Does Intellectual Capital Influence Firms' Financial Performance in Bangladesh?

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This paper aimed to find the effects of intellectual capital and its components on firms' financial performance in Bangladesh. A sample of 100 firms comprised of 48 manufacturing, 21 services, and 31 banking companies was studied for five years from 2017 to 2021, setting 500 firm-year observations. Data was collected purposively from secondary sources, such as annual reports of sampled companies. The robust fixed-effect regression model using STATA 14.2 software was applied to test the hypothesis due to autocorrelation and heteroscedasticity problems. The regression results documented that overall IC, human capital efficiency (HCE), and capital employed efficiency (CEE) positively and significantly enhanced the ROA and ROE of the firms. However, structural capital efficiency (SCE) and relational capital efficiency (RCE) negatively and insignificantly influenced the same. The study contributes to resource-based theory using econometric methods to extend the samples of both financial and non-financial companies. This study helps investors, managers, policy-makers, governments, and accounting regulatory bodies regarding the utilization pattern of invisible and tangible resources in Bangladeshi firms.

Keywords: intellectual capital, firm performance, financial companies, non-financial companies, Bangladesh

INTRODUCTION

Intellectual capital (IC), an organization's invisible resource, promotes profitability by achieving competitive advantages. Researchers in various studies have recently identified IC as the most important strategic asset of businesses in a knowledge-based economy (Hossain & Rana, 2024; Tran et al., 2020; Zerenler & Gozlu, 2008). The knowledge-based environment dramatically influences the productivity of business organizations worldwide (Yousaf, 2022). For that, value creation is essential in sustaining business organizations' existence and competitive advantage. Efficiently enhancing value creation requires using business IC and tangible assets appropriately. Bansal et al. (2023) argue that, recently, firms gathered most of their value through intangible resources. Corrado et al. (2018) documented that the share of tangible and invisible resources between the European Union (EU) and the USA was 4:1 and 1:1, respectively, during 2000-2013. However, the ratio of intangible resources increased to 40% and 60% for both regions after that period. However, in the contemporary global situation, it is very disappointing that it is difficult to accurately and precisely evaluate this valuable asset of the organization. Although IC is the most crucial

asset of the business, it cannot be shown in the company's financial statements. IAS-38 (Intangible Assets) complicates this process. It has led to identifying IC as a hidden asset of the firm (Shahzad et al., 2019). According to Jardon & Martinez-Cobas (2021), IC is a set of intangible resources that help increase the firm's value, including human resources, institutional structures, norms, and external stakeholders. IC is leading in the ever-changing economy based on information and knowledge (Vetchagool, 2022). IC continues to attempt to solve this problem where conventional accounting has struggled to distinguish between the firm's book value and market value. Consequently, IC has demonstrated the potential to increase firm value and profitability in the competitive business landscape (Nadeem et al., 2019; Nimtrakoon, 2015). Resource-based theory (RBT) and resource-dependency theory (RDT) also support these statements linking to utilizing knowledge resources to enhance a firm's profitability.

In this case, in Bangladesh, GDP is generally gathered in three major sectors: industrial, service, and agriculture. The Economic Survey 2023 reported that in the fiscal year 2021-2022, the agriculture sector contributed 11.6%, the industrial sector contributed 36.92%, and the service sector contributed 51.48% to Bangladesh's economy (Finance Division, 2023). It means that 88.4% of the GDP is derived from the industries and services sectors, with 87.44% in the fiscal year 2018-2019 and 85.94% in the fiscal year 2015-2016 (Finance Division, 2023). The dependability of the industrial and services sectors is increasing day by day. However, their internal institutional efficiency has declined dramatically. Consequently, the share of market capitalization declined to 41.1 percent as against the GDP growth rate of 6.46 in 2010-2011. Then, it decreased day by day and reached 21.45 percent in FY 2014-2015, 15.76 percent in FY 2018-2019 and 13.2 percent in FY 2021-2022 (Dhaka Stock Exchange, 2022). Most alarmingly, it reached 9.32 percent at the end of October 2022, the lowest in the Asia Pacific domestic equity market (Dhaka Stock Exchange, 2022). Now, the question arises: Do the firms in Bangladesh fail to utilize their invisible and tangible resources efficiently? According to Resource Based Theory (RBT), physical and intangible resources should be used to their full potential for maximum effectiveness. In light of the RBT and RDT, the current study aims to discover how effectively Bangladeshi enterprises use their physical and intangible assets to boost firm performance and what kind of relationship exists between IC and company performance.

There has been much research on the impact of IC on firm profitability in the present world. In summary, most studies have been done on banks, pharmaceutical companies, insurance companies, manufacturing companies, textile companies, and financial or non-financial sectors, which have been done separately (Barak & Sharma, 2023; Chowdhury et al., 2019; Joshi et al., 2013; Kasoga, 2020; Sohel Rana & Hossain, 2023). The major findings from these studies showed mixed outcomes. Shah et al. (2024), Vo & Tran (2021), and Weqar & Haque (2022) documented that overall IC significantly enhances a firm's profitability but differs from Buallay et al. (2019) and Smriti & Das (2018) studies. HCE positively influenced FP (Shah et al., 2024; Yousaf, 2022), whereas Zheng et al. (2022), Nabi et al. (2020), and Soewarno & Tjahjadi (2020) found adverse effects on the same response variables. Many studies found the negative impact of SCE on FP (Chowdhury et al., 2018; Sohel Rana & Hossain, 2023; Xu & Wang, 2018); however, the studies of Zheng et al. (2022), Shah et al. (2024), Xu & Liu (2020), and Yousaf (2022) argued diverse results. A few studies accomplished the effects of RCE on FP, where research by Xu & Wang (2018) and Buallay et al. (2019) found a positive impact on companies' profitability; in contrast, Vishnu & Kumar Gupta (2014) and Weqar et al. (2020) found diverse results. The above literature clearly shows that the affinity between IC components and companies' profitability is still obscured. This relationship has been changed due to industry category, economic perspectives, and research time frame. Besides, research has not been conducted on combined companies in the financial and non-financial (manufacturing, service) sectors. As a result, there is currently ample scope for study on this subject. The present study aims to fill these gaps.

This study contributes to the existing IC research in several ways. First, it analyzes how overall IC performance affects firm profitability across manufacturing, service, and banking industries. Second, rather than the VAIC method, this study shows how profitability is affected by using the MVAIC method to measure the firm's crucial relational capital efficiency (RCE). Third, the results prepared using the robust fixed effect regression method provide the most reliable information for decision-making. Above all, the

present study is the first of its kind in an emerging country, particularly Bangladesh. Various stakeholders can benefit from the present study in multiple ways. As such, governments and policy-makers can decide how knowledge resources can be used more effectively in realizing Vision 2041. The organization's executives can make effective decisions in formulating and implementing strategic and tactical plans to increase the excellence of internal resources (human and structural capital) and external resources (relational capital). Existing and potential investors can get the necessary insight into the fair use of the organization's intangible assets. Also, they can make investment decisions by having a clear idea about the firm's future value-added, profitability, and stability.

Apart from the introduction section, this paper presents a theoretical background and literature review in section two, followed by study methodology in section three, results and discussion in section four, and conclusion in section five.

REVIEW OF PRIOR LITERATURE

Intellectual Capital (IC)

Intellectual capital is a collection of esoteric values that enhance an organization's worth and allow it to survive more extended periods (Vaz & Rocha, 2015). Stewart (1997) opined that IC is the knowledge resource that makes production elements more useful. It contains the staff's innate creative ability, knowledge assets, business processes, and relationships with third parties (suppliers and customers). These properties are vital while choosing and enforcing business strategies to gain a competitive edge (Soewarno & Ramadhan, 2020). IC mainly comprises three primary resources of an organization: human capital, structural capital, and relational capital. HC is the collection of employee knowledge, talents, competencies, expertise, and traits that can generate value for the firm (Rana & Hossain, 2023). A company's "structural capital" consists of what is left over after all the workers have left. Examples of a corporation's intangible components include its information technology, customer database, corporate processes, and strategic goals (Edvinsson & Sullivan, 1996). According to Engström et al. (2003), relationship capital (RC) refers to the present and future worth of a company's connections with its clients and other outside parties.

Firm Performance (FP)

The best way to decide whether a company is doing well is to look at its performance. The crucial persistence of a company's financial statements is to disclose its business performance. The extent to which a company can achieve its goals and run its operations efficiently is decided by its performance. The worth of a company and its ability to persist in growth are directly related to how well it could perform. The importance of using a company's physical and intangible assets to boost performance is undeniable. Kasoga (2020), Nabi et al. (2020), Soewarno & Tjahjadi (2020), Haris et al. (2019), and Buallay & Hamdan (2019) primarily used Return on Assets (ROA) and Return on Equity (ROE) to track the business performance of a firm. ROA and ROE are the relationship of net earnings on a firm's assets and stockholder's equity, respectively.

Relationship Between IC and FP

No exact theory of IC research has been recorded to date. However, several theories are involved as this genre of research advances. Among these, Resource Based Theory (RBT) and resource-dependency theory (RDT) has been used in most empirical research in IC literature (Arifin et al., 2014; Ge & Xu, 2021; Hamdan, 2018; Mohapatra et al., 2019). The RBT states that a firm's performance depends on effectively using its intangible and tangible resources. RBT connects the affinity between IC and all of its components and FP. In harmony with this theory, RDT argued that a firm always depends on its internal and external environment and the effective use of internal and external resources to achieve success. In this case, SCE and RCE are mainly backed by RDT, which can enhance firm profitability.

MVAIC is an indicator of an organization's invisible assets. MVAIC supposedly boosts business performance. However, such investigations have varied findings. Haris et al. (2019) examined 26 Pakistani banks from 2007 to 2016 and found that only VAIC and HCE improved firms' ROA and ROE using

dynamic panel data (System GMM) regression analysis. They also found that SCE only boosts ROE, not ROA. CEE could not impact any responding variables. Their correlation study also showed that all explanatory variables favorably but insignificantly impacted the firm's ROA and ROE. Shah et al. (2024) studied six years of data (2016-2021) from 17 banks in Pakistan to determine how intellectual capital affects bank ROE. Two system GMM method was used for the hypotheses test. The study results show that banks' VAIC and HCE play a positive significant role in enhancing ROE. On the other hand, other elements of IC (SCE and CEE) have played a negative role in increasing the organization's profitability. Tjahjadi et al. (2024) investigate the effects of IC on the organizational performance of state-owned enterprises (SOEs) and their subsidiaries in Indonesia. Results from PLS-SEM of 97 respondents assured that IC and its components positively influenced firm performance.

Ayinaddis et al. (2024) studied 14 Ethiopian insurance firms from 2012 to 2022. The random-effects regression output documented that only HCE and CEE positively enhance firms' ROA. However, SCE and CEE have positive insignificant effects on FP. Barak & Sharma (2024) studied 17 public and 12 private listed Indian banks from 2010 to 2022. Using MVAIC methodology for measuring IC efficiency and system GMM to test the hypothesis, they asserted that only HCE positively impacted ROA and ROE, and CEE, RCE, and SCE negatively impacted ROA and ROE. Vishnu & Kumar Gupta (2014) examined 22 Indian pharmaceutical firms from 2005-2011. The multiple regression analysis results showed that only SCE significantly improved company performance (ROA), while RCE and CEE's roles were insignificant. VAIC and HCE did not boost ROA. Nadeem et al. (2018) examined 571 Australian-listed firms from 2005-2014. The fixed effects and static OLS regression models showed that VAIC and all other factors significantly increased firms' ROE and ROA.

Ahmed & Hussin (2024) studied 370 listed non-financial firms in Malaysia over five years from 2016 to 2020. Using dynamic GMM regression of 1850, observation is evident that the adjusted VAIC, HCE, RCE, and CEE significantly and positively impacted firms' ROA and ROE. However, the same predicted variables negatively influence the firm's R&D capital.

Lehenchuk et al. (2023) documented the results of 31 ICT companies in Turkey during 2019-2022 using OLS regression that only MVAIC and HCE significantly promote the firm's profitability. In contrast, other IC and tangible capital components (SCE, RCE, and CEE) insignificantly increase the performance of firms.

Smriti & Das (2018) found that only tangible capital (CEE) increased ROA for Indian firms using the GMM system. Kasoga (2020) found that VAIC and SCE improved firm performance (ROA and ROE), but HCE and CEE had the opposite effect. Chowdhury et al. (2018) examined 34 Bangladeshi textile companies from 2013 to 2017. The study found that CEE and SCE extensively increased enterprises' ROE, while only CEE increased ROA. Vo & Tran (2021) found that VAIC and HCE only impacted ROA after applying GMM to 14 Vietnamese banking businesses. SCE suffers the same but is insignificant. Using multiple regression, Hasan & Miah (2018) found that VAIC and SCE can increase ROA and ROE in 49 Bangladeshi financial institutions. However, HCE has a minor impact on business performance. Buallay et al. (2019) examined 59 GCC banks from 2012 to 2016. VAIC had a reversal effect on ROA and ROE by conducting regression analysis. HCE, SCE, and CEE improved company performance, whereas SCE had no significant effect. RCE increased firm ROA but decreased ROE considerably.

From the above discussion, it is evident that the theory prescribed that IC can improve firm financial performance. However, the prior empirical IC literature showed mixed findings. Nonetheless, we hypothesize the following from the literature and theoretical viewpoints (RBT and RDT):

Hypothesis #1: *MVAIC positively impacts firm Performance*

Hypothesis #1(a): *HCE positively impacts firm Performance*

Hypothesis #1(b): *SCE positively impacts firm Performance*

Hypothesis #1(c): *RCE positively impacts firm Performance*

Hypothesis #1(d): CEE positively impacts firm performance

STUDY METHODOLOGY

Data Collection

To reveal the effects of IC on FP, the study used data from secondary sources. Data retrieved from audited annual reports of 100 DSE-listed companies consists of 48 manufacturing, 21 service, and 31 banking firms in Bangladesh for the five years spanning 2017–2021. Purposive sampling techniques have been applied to assemble the required data to measure IC efficiency. Therefore, 500 firm-year observations were used in the dataset, arranged with strongly balanced panel data for testing hypotheses.

Variables Employed

We employed two dependent, five independent, and two control variables to accomplish the study objectives. A detailed description of the variables engaged in this study is presented in Table 1:

Dependent Variables

Firm performance: The research used ROA and ROE as response variables. ROA is the ratio of a firm's net earnings to total assets employed, whereas ROE is the affinity between a firm's net earnings and net equity capital. Academicians rely on audited financial accounts to measure corporate performance using both factors. Lehenchuk et al. (2023), Sohel Rana & Hossain (2023), Buallay & Hamdan (2019), Chowdhury et al. (2019), Islam et al. (2024), Kasoga (2020), Dey et al. (2018), and Xu & Wang (2018) were employed these two factors to quantify a firm's performance properly. The detailed description of these variables is presented in Table 1.

Independent Variables

This study measures IC efficiency using the Modified Value-Added Intellectual Coefficient (MVAIC) approach, which was initially developed by Pulic (2000) as VAIC and Ulum et al. (2014) modified it as MVAIC. Both methods provide the same results regarding MVAIC, HCE, and CEE values. However, the SCE value of the VAIC method is segregated into SCE and RCE in the MVAIC method. To provide more insights into the firms' external relational strength, we applied the MVAIC methodology. The reason for using the MVAIC methodology for measuring IC is that it is the most often used method for assessing IC performance (Ståhle et al., 2011). Most importantly, this procedure does not violate any accounting standards (Iazzolino & Laise, 2013). Besides, IC efficiency is measured using audited financial data. Comparing companies, industries, and years is achievable using this strategy. MVAIC uses the VA technique to create information for all stakeholders, not just shareholders. It supports Wernerfelt (1984) resource-based view (RBV) (Veltri & Silvestri, 2011). It works for organizations of any size and does not require complex accounting data (Tseng & James Goo, 2005). However, it suffers from some difficulties. Ståhle et al. (2011) argue that the MVAIC approach misjudges a company's IC by emphasizing human and financial resource efficiency. They also argued that this paradigm prohibited SCE measurement. Despite its limitations, numerous research used this methodology to measure IC efficiency (Buallay et al., 2019; Lehenchuk et al., 2023; Maji & Goswami, 2017; Vishnu & Kumar Gupta, 2014; Wang et al., 2021; Weqar & Haque, 2022). The MVAIC methodology consists of the following combination (the detailed description of these variables is presented in Table 1.):

MVAIC = HCE+SCE+RCE+CEE
Value added (VA) = OP+E+D+A   (1)

where, OP = Operating profit; E= Employee Expenses; D = Depreciation; A= Amortization

Control Variables

This research employed two components as controlled variables: total assets and leverage. The notable factor of business size is total assets. The business with more assets is a large firm. Large firms naturally have more personnel and internal and external activities. They invested more in knowledge support to increase profit. To calculate total assets, this study used book value.

Further, firm leverage is the ratio of debt to equity. Debt capital impacts business profitability. More debt capital harms investors' returns and organizational security, which promotes firm riskiness. Leverage was used to regulate debt equity for proper regression findings for decision-making. Numerous research employed these two components as control variables (Ahmed & Hussin, 2024; Barak & Sharma, 2024; Maniruzzaman et al., 2024).

TABLE 1
VARIABLES DESCRIPTION

Variables	Measurement Process	Descriptions
Dependent Variables		
Return on Assets (ROA)	$\dfrac{NetEarnings}{TotalAssets}$	The ratio of after-tax earnings to the book value of assets.
Return on Equity (ROE)	$\dfrac{Stockholder'sEquity}{TotalAssets}$	Relationship of shareholder's equity to book value of assets
Independent Variables		
MVAIC	HCE+SCE+RCE+CEE	
HCE	$\dfrac{ValueAdded}{HumanCapital}$	The ratio between VA and HC. HC is the sum amount of employee compensation
RCE	$\dfrac{Re\,l\,ationalCapital}{ValueAdded}$	The ratio of RC to VA. RC is comprised of marketing expenses.
SCE	$\dfrac{StructuralCapital}{ValueAdded}$	The ratio of SC to VA. SC is the difference between VA and HC & RC.
CEE	$\dfrac{ValueAdded}{CapitalEmployed}$	The ratio of VA to CE, where, CE is the difference between total assets and current liabilities.
Controlling Variables		
TA	*Book value of Total Assets*	
LEV	$\dfrac{TotalDebtCapital}{TotalEquityCapital}$	

Source: Authors' compilation based on literature

Econometric Model

This study's second research objective is to meet by using two separate regression models. Model 1 shows how overall IC performance affects the FP. Model 2 looks at how specific components of IC affect the same independently. We used three approaches to include the panel data regression model: i) Pooled OLS, ii) Fixed effects model, and iii) Random effects model. A set of diagnostic tests led to the selection of the optimal approach based on Cristopher Dougherty's specifications (Dougherty, 2011).

Specification of the regression model is as follows:

Pooled OLS: $Y = \alpha + \beta_j X_j + \beta_j Z_j + \varepsilon$ (2)

Fixed-effects: $Y_{it} = \alpha + \beta_j X_{jit} + \beta_j Z_{jit} + \varepsilon_{it}$ (3)

Random-effects: $Y_{it} = \alpha + \beta_j X_{jit} + \beta_j Z_{jit} + u_{it} + \varepsilon_{it}$ (4)

where Y denotes the dependent variable as ROA and ROE for firm performance, X= independent variables (IC and its components); Z= control variables; α = intercept; β = beta coefficient; ε = error; i=1,2,.....,n and t = 1,2,....,n represents firm and year respectively; u = immeasurable variable of firm's specific effects.

RESULTS AND DISCUSSIONS

Descriptive Statistics

Descriptive statistics describe data and its scope. The maximum, minimum, standard deviation and average values of all research variables have been examined in this section. Table 2 shows the average profitability is 0.0388, ranging from -0.6342 to 0.5328. A high SD indicates ROA volatility. The range correspondingly reinforced its volatile behavior. Companies have produced an average of above 10% profit on equity. HCE showed that employees increased VA by a factor of over five times. Unfortunately, negative HCE is a problem for certain companies and puts huge negative pressure on production. However, this research documented that HCE is the most crucial element for MVAIC value. The corporations spent almost half and one-eighth of the VA on SC and RC, respectively. The sampled firms performed well, with above one-fourth (0.2852) of the VA from visible resources, which was increased over ten times.

TABLE 2
DESCRIPTIVE STATISTICS

Variable	Obs.	Mean	SD	Min.	Max.
ROA	500	0.0388	0.0779	-0.6342	0.5328
ROE	500	0.1047	0.1329	-0.4773	0.9114
MVAIC	500	6.4939	7.7444	-0.8124	60.7614
HCE	500	5.4890	7.6295	-1.5140	59.6429
SCE	500	0.5981	0.6513	-0.9000	11.0291
RCE	500	0.1225	0.2112	-2.7583	0.7122
CEE	500	0.2852	0.5991	-0.3113	10.4562
TA	500	127392	193248	451.00	1635993
LEV	500	5.5621	6.8414	-2.1276	38.3592

Assumptions Test

Before running the best-estimated regression model, we executed various assumption tests to detect the suitability of data fitness and ensure the most reliable results. The study had strongly balanced panel data that employed purposive sampling techniques due to the availability of company-audited annual reports. First, we ran a Fisher-type unit-root test utilizing Phillips-Perron (PP) tests on a panel. Table 3 showed that at least one panel had stationary data since all variables were significant at a 1% level. The same table shows the cross-dependence (CD) test results for the variables to discover dependencies. We estimate the CD tests of Chudik & Pesaran (2013) and Bailey et al. (2016) to seek cross-sectional dependency in the estimable model residuals. Our investigation found that all factors except RCE are significant at 1%. These findings reject the null hypothesis and conclude that all our variables have good cross-sectional dependence. This study used the Durbin-Watson (DW) test to detect autocorrelation problems. Table 6-7 shows that all models had DW values less than 2 (0.803 to 1.21), suggesting substantial autocorrelation problems.

TABLE 3
**FISHER-TYPE UNIT-ROOT TEST AND CROSS-SECTIONAL DEPENDENCY
TEST RESULTS**

Variables	Fisher-type unit-root test		Cross-sectional Dependency			
	Statistic	p-value	CD-test	P-value	Corr.	Abs (Corr)
ROA	464.6001	0.0000	16.13	0.000	0.103	0.498
ROE	456.1652	0.0000	18.08	0.000	0.115	0.482
MVAIC	503.9488	0.0000	17.22	0.000	0.109	0.488
HCE	579.4045	0.0000	16.98	0.000	0.108	0.478
SCE	659.9203	0.0000	10.65	0.000	0.068	0.494
RCE	517.6349	0.0000	0.570	0.566	0.004	0.508
CEE	445.4169	0.0000	23.64	0.000	0.150	0.534
TA	419.1764	0.0000	77.51	0.000	0.493	0.759
LEV	377.0148	0.0000	6.360	0.000	0.040	0.537

Diagnostic Tests

Before choosing the best estimation regression model, we applied several diagnostic tests for the most reliable results. We tested multicollinearity issues using the Variance Inflation Factor (VIF) and Pearson correlation matrix. Table 4 shows that our dataset is free of multicollinearity, with VIF values ranging from 1.02 to 5.73. According to Gujarati & Porter (2009), there are no issues with multicollinearity when the VIF score is between 1 and 10. Also included in the same table are the relationships between the control, independent, and dependent variables. Accounting profitability (ROA and ROE) was positively and strongly linked with HCE, RCE, CEE, and MVAIC. SCE showed an insignificant positive relationship with ROA but an insignificant negative relationship with ROE. Results describe that all the IC elements increase firm profitability except for SCE. The relationship showed no more than 0.80 between independent variables except for HCE and MVAIC. However, this affinity did not create multicollinearity problems due to using separate models.

TABLE 4
PEARSON CORRELATION MATRIX AND VARIANCE INFLATION FACTOR (VIF)

	ROA	ROE	MVAIC	HCE	SCE	RCE	CEE	TA	LEV	VIF
ROA	1									
ROE	.793***	1								
MVAIC	.327***	.228***	1							1.05
HCE	.289***	.186***	.995***	1						1.06
SCE	.012	-.018	.190***	.137***	1					5.73
RCE	.121***	.108**	-.128***	-.088**	-.796***	1				5.72
CEE	.477***	.552***	.088**	.013	-.053	.087*	1			1.02
TA	-.202***	.023	-.183***	-.171***	-.038	-.098**	-.106**	1		3.08
LEV	-.276***	.004	-.222***	-.206***	-.086*	-.065	-.121***	.820***	1	3.19

Then, we performed Pooled OLS and the RE regression method. Based on the significant result ($p<0.05$) of the Breusch and Pagan Lagrangian multiplier (LM) test, RE was chosen as the best regression technique over Pooled OLS, as shown in Table 5. Thus, we accept the RE model, run the FE regression model, and then choose the optimum one based on the Hausman test results. From the same table, we find the significant value of the Hausman test statistic, which obliged us to choose the FE regression model over

the RE model. After that, to identify the heteroskedasticity issue, we used the Modified Wald test. Table 5 confirms the presence of the heteroskedastic issue by displaying the significant results of the chi-square test ($p<0.05$). In the end, we used the Robust FE regression model to address the issues of heteroskedasticity and autocorrelation (Yao et al., 2019).

TABLE 5
DIAGNOSTIC TEST FOR REGRESSION MODEL SELECTION

Tests	Model	Test Statistic	p-value	Result	Decision
Breusch and Pagan Lagrangian multiplier test for random effects	ROA (Model-1)	490.54	0.0000	RE	Yes
	ROA (Model-2)	278.00	0.000	RE	Yes
	ROE (Model-1)	530.07	0.000	RE	Yes
	ROE (Model-2)	180.92	0.000	RE	Yes
Hausman Test	ROA (Model-1)	9.24	0.0098	FE	Yes
	ROA (Model-2)	102.47	0.000	FE	Yes
	ROE (Model-1)	9.57	0.0083	FE	Yes
	ROE (Model-2)	490.88	0.000	FE	Yes
Modified Wald test for groupwise heteroskedasticity	ROA (Model-1)	2.0×10^7	0.000	Robust FE	Yes
	ROA (Model-2)	1.0×10^7	0.000	Robust FE	Yes
	ROE (Model-1)	1.4×10^6	0.000	Robust FE	Yes
	ROE (Model-2)	1.9×10^6	0.000	Robust FE	Yes

Note: RE = Random Effect, FE = Fixed Effect

Regression Results

Regression analysis presents concrete proof that the company's accounting performance was affected by the overall IC efficiency and its components. The study findings of the Robust FE regression, which test the study's full hypotheses, are in Table 6 and Table 7. The F-statistics for all the models is significant at a 5% level or less ($p<0.05$) based on the results from the same tables, which means that all the models are suitable for decision-making.

TABLE 6
ROBUST FIXED-EFFECT REGRESSION RESULTS (DEPENDENT VARIABLE: ROA)

ROA	Model-1			Model-2		
	Coef.	Robust Std. Err.	t-value	Coef.	Robust Std. Err.	t-value
MVAIC	0.005585	0.0018567	3.01***			
HCE				0.004499	0.0015642	2.88***
SCE				-0.00874	0.0277666	-0.31
RCE				-0.08115	0.1140411	-0.71
CEE				0.022882	0.0083359	2.74***
TA	6.18×10^{-8}	4.26×10^{-8}	1.45	7.37×10^{-8}	5.07×10^{-8}	1.45
LEV	-0.00592	0.0032544	-1.82*	-0.00655	0.0038581	-1.7*
-CONST.	0.027627	0.0139878	1.98*	0.049817	0.04088	1.22
R-sq. (Overall)	0.1528			0.1779		
F-statistic	3.57**			2.62**		
DW test	0.807			0.953		

Results of Model 1 from Table 6 and Table 7 have been applied to test hypothesis 1 for the influence of MVAIC on FP. Adjusted R2 showed a minimal amount (0.1528 and 0.0344 for ROA and ROE models, respectively) to describe the impact of all regressors on the response variable. However, it will not impede the credibility of the regression outcome (Gubela et al., 2023; Hsieh et al., 2019, 2019; Möller et al., 2011; Mutuc & Cabrilo, 2022; Sukirman & Dianawati, 2023).

The research showed that MVAIC, the overall IC performance, could significantly improve the accounting performance of a company (ROA: coefficient = 0.005585, robust std. error = 0.0018567, and t-value = 3.01, $p < 0.01$ and ROE: coefficient = 0.008421, robust std. err. 0.0019024, and t-value = 4.43, $p < 0.05$). The results confirm our initial hypothesis (H1), which is consistent with previous research of Lehenchuk et al. (2023), Alharbi (2023), Sohel Rana & Hossain (2023), Tong & Saladrigues (2023), Kasoga (2020), Haris et al. (2019), Ousama & Fatima (2015), and Nadeem et al. (2019) and differ from the conclusions of Barak & Sharma (2023, 2024) and Smriti & Das (2018). The research results support RBT by boosting its overall performance by managing its tangible and intangible assets more efficiently.

TABLE 7
ROBUST FIXED-EFFECT REGRESSION RESULTS (DEPENDENT VARIABLE: ROE)

ROE	Model-1			Model-2		
	Coef.	Robust Std. Err.	t-value	Coef.	Robust Std. Err.	t-value
MVAIC	0.008421	0.0019024	4.43[***]			
HCE				0.00789	0.0019259	4.1[***]
SCE				0.021109	0.053731	0.39
RCE				0.065786	0.1648218	0.40
CEE				0.027626	0.0113083	2.44[**]
TA	6.28×10^{-8}	7.32×10^{-8}	0.86	7.55×10^{-8}	7.65×10^{-8}	0.99
LEV	-0.0065	0.0055363	-1.17	-0.00696	0.0059824	-1.16
-CONST.	0.078168	0.0247922	3.15[***]	0.061947	0.0680745	0.91
R-sq. (Overall)	0.0344			0.0717		
F-statistic	6.77[***]			4.23[***]		
DW test	0.803			1.21		

Hypotheses 1(a) to 1(d) disclose the separate impacts of IC components on the FP of the businesses using Model 2 from Table 6 and Table 7. Various logical findings have pointed to the best decision-making consequences produced by a robust FE regression model. Impacts on ROA have an overall R^2 score of 0.1779, while effects on ROE have an R^2 score of 0.0717. It suggests that different parts of IC, rather than IC efficiency as a whole, provide a better explanation for the performance of businesses. The regression results revealed that the HCE has improved the ROA and ROE of the companies significantly. It showed a more substantial impact on a company's ROE (coefficient = 0.00789, t-value = 4.1, $p < 0.05$) over ROA (coefficient = 0.004499, robust SE = 0.0015642, t-value = 2.88, $p <0.01$). The results supported our hypothesis H1(a) and are consistent with the majority of the preceding research (Ahmed & Hussin, 2024; Barak & Sharma, 2023, 2024; Buallay et al., 2019; Lehenchuk et al., 2023; Nadeem et al., 2018; Shah et al., 2024; Sohel Rana & Hossain, 2023; Xu & Wang, 2018; Xu & Zhang, 2021). However, the results contradict the findings of some other studies (Chowdhury et al., 2018; Dženopoljac et al., 2016; Hasan & Miah, 2018; Kasoga, 2020; Nabi et al., 2020; Razafindrambinina & Anggreni, 2011; Smriti & Das, 2018; Soewarno & Tjahjadi, 2020; Vishnu & Kumar Gupta, 2014). Thus, firms in Bangladesh can improve their financial performance by investing more in employees.

The same Tables also exhibited that the SCE had a negligible negative effect on the sampled companies FP (β=-0.00874, t=-0.31, p>0.10, and β = 0.021109, t= 0.39, p>0.10 for both the ROA and ROE models respectively). Our study findings about hypothesis H1(b) were rejected and inconsistent with RBT and

RDT. The results imply that a company's accounting return drops due to the investment in structural assets, including processes, databases, intellectual properties, research and development, etc. Research findings are consistent with some other previous research (Barak & Sharma, 2024; Buallay et al., 2019; Ousama & Fatima, 2015) and in disagreement with other previous research (Hasan & Miah, 2018; Kasoga, 2020; Lu et al., 2021; Soewarno & Tjahjadi, 2020).

A firm's performance was also reduced due to RCE but insignificantly, as shown by a low t-value (β= -0.08115, t-value = -0.71, $p > 0.1$ for ROA and β= 0.065786, t-value = 0.40, $p > 0.10$ for ROE). Results rejected our hypothesis H1(c) and were inconsistent with RBT and RDT. Similar results were found in the numerous preceding studies (Barak & Sharma, 2023; Nimtrakoon, 2015; Sohel Rana & Hossain, 2023; Vishnu & Kumar Gupta, 2014), while many other studies documented adverse findings of this research (Ahmed & Hussin, 2024; Barak & Sharma, 2024; Lehenchuk et al., 2023; Lu et al., 2021; Wang et al., 2021; Weqar et al., 2020; Xu & Wang, 2018). Based on the outcome, expenditures for marketing, promotion, distribution, and other external reasons might diminish companies' profitability in Bangladesh.

Using the same model and tables, we observed that CEE has a strong 1% and 5% effect on firm performance (ROA and ROE) with a coefficient of 0.022882 and 0.027626, respectively. The results indicate that CEE improved a firm's accounting performance. The findings also backed our study hypothesis H1(d) and are also in line with the RBT. Preceding studies found hazy results (Ahmed & Hussin, 2024; Alharbi, 2023; Barak & Sharma, 2023, 2024; Ozkan et al., 2017; Sidharta & Affandi, 2016; Sohel Rana & Hossain, 2023; Tong & Saladrigues, 2023), While some studies disagreed with these results (Celenza & Rossi, 2013; Haris et al., 2019; Kasoga, 2020; Mohapatra et al., 2019; Vishnu & Kumar Gupta, 2014). Not clear, check both statement and make them clear and consistent.

CONCLUSION

Organizational success and long-term growth rely on the efficient and fair use of tangible and intangible assets in today's ever-evolving business landscape. Intellectual capital (IC) is viewed as the top asset while measuring and interpreting the knowledge-based success of firms. However, to utilize these assets efficiently, first of all, it is essential to realize their nature, and to do that, our first objective is to assess the link between IC and FP, and the second objective is to find the effect of IC on FP.

Focusing on the study objective, Pearson correlation matrix analysis reveals that MVAIC and all other specific elements (HCE, SCE, and CEE) have significant positive ties except for RCE, which has a negative tie. The findings based on objective two are proved using robust fixed-effect regression estimation that overall IC efficiency significantly moved firm performance. HCE and CEE also greatly enhance firms' ROA and ROE. However, SCE and RCE negatively but insignificantly impacted firm ROA, but positively on ROE. Human capital is the most essential factor for driving IC and is responsible for building the MVAIC scores. The findings summarize that the mix of human capital (human traits, including knowledge, skills, and experience) and tangible resources greatly enhance corporate performance.

The study contributes to RBT and RDT by combining the connection between IC and its elements with firm ROA and ROE in the listed companies in Bangladesh. The evidence comprises financial (banking) and non-financial (manufacturing and service) firms. SCE and RCE are crucial resources for a firm, but they cannot be fully utilized in Bangladesh since they play negative and insignificant roles. The study also affirmed that human, financial and physical resources can enhance a firm's profitability.

The research results will assist the government and corporate policymakers, especially board members and managers, formulate better strategic decisions to enhance their firm's competitive edge. Corporate managers should locate, evaluate, and manage their firm's intellectual resources because of the positive and robust affinity between MVAIC, HCE, and CEE and firm financial performance. Proactive training facilities, performance appraisal, performance benefits, and other similar initiatives may fall under this category of tactics. Managers may also reconsider how to manage relational and structural capital efficiently, as these segments of IC failed to contribute much. Possible solutions can be building relationships and cooperation with stakeholders, as well as the proper use of technology and corporate strategies.

This research is based on an emerging market perspective. It accumulates samples from all the leading sectors, combines financial and non-financial firms, and feeds a broad concept of the utilization pattern of IC resources. This research also adopted the MVAIC methodology for measuring IC efficiency. However, future research may use other IC evaluation methods, such as cross-country comparative research or cross-analysis methodology.

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