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DO INTANGIBLE ASSETS DRIVE CORPORATE FINANCIAL POLICIES? EVIDENCE FROM PAKISTAN

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Abstract
This study examines how intangible assets, particularly intellectual capital efficiency, influence corporate financial policy, focusing specifically on dividend policy in Pakistani high-tech companies while utilizing the Modified Value Added Intellectual Coefficient to measure intellectual capital efficiency. This research uses two-step System GMM analysis to study the relationship between dividend policy and the ICE measured by MVAIC using firm-level data from 2013 to 2023. The findings from empirical research shows that overall ICE measured by MVAIC establishes an affirmative and statistically substantial relationship with dividend policy. The evidence fits the theoretical framework of Resource-Based View (RBV) together with Signaling Theory which confirms that efficient intellectual capital enables companies to produce lasting earnings and enhance their capacity to distribute dividends. The research findings demonstrate that policy makers together with corporate leaders should invest in human capital and structural assets and employed resources to enhance dividend distribution practices. Future research should conduct sector-wide investigations across diverse geographic regions.

INTRODUCTION

In today's rapidly evolving and intensely competitive global marketplace, businesses must adopt strategic approaches to effectively allocate and develop their resources. This is vital not only for survival but also for achieving sustainable growth and superior performance (Grant, 1991). Among the various organizational resources, intangible assets have emerged as the most critical—and the most difficult to replicate—determinants of long-term success (Winter & Szulanski, 2002). While physical capital can be readily acquired in open markets, the unique attributes of intangible assets, such as employee expertise, customer relationships, organizational culture, brand reputation, and internal structures, are far more complex and elusive for competitors to imitate (Goh & Ryan, 2002 & Sveiby, 1997). Intellectual Capital (IC), increasingly recognized as a strategic asset, plays a pivotal role in sustaining competitive advantage and driving value creation (Clarke et al., 2011). It is embedded within a firm's human resources, organizational architecture, and external relationships, and is instrumental in fostering innovation, creativity, technological advancement, and collaborative synergy (Guthrie, 2001). As such, understanding, identifying, nurturing, and efficiently leveraging IC is essential for modern organizations aiming to outperform competitors in a knowledge-driven economy. Traditionally, the core inputs of production have included land, labor, and financial capital. However, a fourth element—intellectual capital—now stands as a key intangible contributor to value generation (Rupcic, 2019). The majority of experts recognize three fundamental elements in IC framework which include Human Capital (HC), Structural Capital (SC) and Relational Capital (RC) or Customer Capital (CC) (Sumedrea, 2013; Secundo et al., 2018). The knowledge base of employees along with their skills and experience and untapped potential falls under the classification of HC (Stewart, 1997). SC includes systems, processes, patents, databases, and organizational infrastructure that are not typically reflected on financial statements (Bounfour, 2002). RC represents the value derived from a firm's relationships with customers, partners, and other external stakeholders (Festa et al., 2021). Increasingly, scholars and practitioners regard Intellectual Capital Efficiency (ICE) as a crucial determinant of firm performance and strategic growth (Ginesti et al., 2018). Consequently, the IC framework has gained considerable attention across disciplines such as finance, management, and accounting. While early studies focused on defining IC (e.g., Ross et al., 1997), more recent research has developed measurement models to assess its effectiveness and explore its relationship with firm-specific and contextual variables across industries and geographies (Liang et al., 2011).

A substantial body of empirical research has examined the link between IC efficiency and financial performance (Curado et al., 2014). More recently, scholars have investigated IC's broader role in enhancing organizational capabilities and competitive positioning (Nirino et al., 2020b; Vrontis et al., 2020). Intellectual capital enables firms to develop unique competencies that contribute to long-term value creation (Liu et al., 2009) and enhance shareholder wealth (Battisti et al., 2019; Nirino et al., 2021). Moreover, effective IC management has been shown to influence agency conflicts and dividend policy decisions, both of which are vital to corporate governance and value creation (Jensen & Meckling, 1976). Evidence suggests that dividend policy decisions—when made in conjunction with investment strategies—can significantly influence firm valuation, internal processes, and real economic outcomes (Farre-Mensa et al., 2014). Empirical studies affirm that dividend policy is shaped by several factors, including firm size, profitability, governance structure, and lifecycle stage (Chen et al., 2017; Chae et al., 2009). The current research investigates the effect of IC on dividend decisions in Pakistan's fast-developing high-tech sector while adding to existing academic knowledge. While several studies have explored the relationship between IC and firm performance in these countries (Makki et al., 2009; Refa Akter et al., 2021), limited attention has been given to how IC impacts dividend policy, particularly in the high-tech sector. High-tech firms, by nature, possess significant intangible assets and are heavily reliant on research, development, and innovation (Hutson, 2005). These firms operate in volatile environments marked by technological disruption, global competition, and rapid product obsolescence. As such, they require strategic investments in intellectual assets to remain competitive and adaptive (Jafari-Sadeghi et al., 2022; Alzamora-Ruiz et al., 2021). While high levels of investment and innovation are essential for growth, these also bring heightened financial pressures and regulatory scrutiny (Demirel & Kesidou, 2019; Gharbi et al., 2014). Despite these constraints, high-tech firms are often expected to maintain stable dividend policies to meet shareholder expectations (Lee & Lee, 2019). Dividend policy—defined by the decision to pay, the amount, timing, and frequency of dividend distribution—reflects a firm's financial strategy and signals its long-term prospects to investors (Barros et al., 2021a; Ham et al., 2020). In this context, understanding the influence of ICE on dividend policy becomes not only relevant but essential for high-tech firms in South Asia, where knowledge assets are emerging as the cornerstone of competitive advantage.

This study contributes to the existing literature in several important ways. First, it extends the discourse on intellectual capital by examining its influence on dividend policy—an area that has received limited attention, particularly within high-tech firms in emerging economy i.e., Pakistan, utilizing a dynamic panel data approach through the System Generalized Method of Moments (System GMM). While prior research has predominantly focused on the relationship between intellectual capital and financial performance, this study uniquely explores how intellectual capital efficiency (ICE) affects dividend payout decisions in knowledge-intensive sectors across Pakistan. Second, this research is among the first to empirically test the interaction between ICE and dividend policy in high-tech firms operating in volatile, innovation-driven environments, where traditional financial assets often fall short in sustaining competitive advantage. Finally, by contextualizing the findings within emerging markets, the study offers insights that are both theoretically enriching and practically relevant for corporate decision-makers, policymakers, and investors seeking to navigate the complexiti

Literature Review

A firm's competitive advantage depends heavily on Intellectual Capital (IC) within today's knowledge-based economy according to Barney's (1991) research. IC remains a widely recognized framework of integrative knowledge-based resources which effectively enhance organizational value generation (Ginesti et al., 2018). The academic field groups IC into three major parts which include Human Capital (HC), Structural Capital (SC) and Relational Capital (RC) according to Bamel et al. (2020). Economic value generation alongside long-term competitive advantage depends on HC which represents employee capabilities through work experience and specialized knowledge. The successful administration of Human Capital depends primarily human resource strategies to extract the maximum value from this resource (Delery and Roumpi 2017; Pereira and Malik 2015). Strategic resource status in the Resource-Based View (RBV) considers HC as it leads to innovative practices while improving operational efficiency while drawing essential business elements (Coff & Kryscynski, 2011). SC, often described as "what remains in the company when employees go home" (Roos et al., 1997), includes internal processes, organizational culture, and knowledge systems that enable employees to fully utilize their capabilities (Chen et al., 2004). RC refers to the firm's external relationships with customers, suppliers, governments, and other stakeholders, which are essential for developing long-term strategic value (Liu et al., 2010). The value-creating potential of IC is well established in the literature, particularly in its contribution to long-term shareholder value (Peppard & Rylander, 2001). Firms that successfully manage their human and organizational assets are better positioned to create economic value (Liu et al., 2009). As emphasized by Cabrita and Vaz (2006), IC facilitates the development and coordination of knowledge, skills, and talents both within and outside the firm, thereby enhancing value creation. Although the concept of value creation encompasses various dimensions, financial scholars often define it through the lens of shareholder wealth maximization, reinforcing it as the primary objective of the firm (Battisti et al., 2019; Damodaran, 2006; Miglietta et al., 2018b).

According to (Batthacharya, 1979; Karpavicius, 2014) that in reality, stockholders who anticipate a decline in future profits alongside a decline in investor value would perceive a probable dividend cut adversely. The importance of dividends extends beyond value generation and plays a key part in the argument over agency theory. It is generally accepted that distributing free cash flow back to shareholders will reduce agency costs. According to agency theory, outside investors favour dividends over retained earnings when moral hazard or asymmetric knowledge are present because the latter could be plundered by management for their own use or to expand their empires (Atanassov, J., & Mandell, A. J. (2018). According to agency theory, it is best to keep shareholders' interests and managers' interests separate (Jensen, 1976). Due to a natural knowledge asymmetry that gives them an advantage in decision-making, managers actually work to maximise their personal gain at the cost of stockholders (Manos, 2003). In contrast to the natural principle, the company's primary goal should be to maximize value for its owners. Instruments are required to realign internal corporate interests. In fact, dividend policy is an important aspect of the alignment of managers' and shareholders' interests. (La Porta et al., 2000). As managers and shareholders commonly have conflicting interests, the ownership-management separation often leads to an increase in the so-called agency costs (Jensen and Meckling, 1976). The impact of such charges tends to reduce the value of the company for stockholders. But according to La Porta et al. (2000), dividend distribution lower agency costs through defending interests, particularly those of small stockholders who have little influence on management choices. This eventually increases the value for shareholders. Particularly, the company's capacity to disclose intangibles' characteristics in its financial statements enhances IC efficiency and reduces the interest misalignment by minimising the costs linked with them (Giacosa et al., 2017). In one of their research studies, Battisti et al. (2021) looked at how IC affected a company's dividend policy in a developing nation. Understanding these possible connections has important theoretical and managerial implications because dividend and internal control decisions are crucial. The results indicate a favorable correlation between intellectual capital and the company's dividend policy. This finding shows that when IC efficiency increases inside the organization, more cash flow is delivered to shareholders, increasing the value of those stockholders (Karpavicius and Yu, 2018).

Battisti et al. (2021) conducted an initial empirical research to study how intellectual capital (IC) influences financial dividend choices of firms operating in China's emerging market economy. The study findings manifest that IC efficient companies tend to distribute greater cash amounts through dividends to their shareholders. According to value creation theory the dividend distribution serves as a financial indicator of future profitability potential for shareholders (Bhattacharya 1979). Previous research had only examined how well IC may boost performance from the perspective of value generation (Ginesti et al., 2018). The ability of the company to continue generating positive cash flows from its operations in the future serves as a signal to investors (Batthacharya, 1979). A drop in agency costs and a surge in investor satisfaction as a result of the dividend distribution can also result from using these two tools concurrently, even when taking into account the potential conflict of interest between ownership and management (La Porta et al., 2000 and Goebel, 2019). Investors may see a dividend policy associated with a great degree of IC efficiency, in particular, in the Chinese setting, as an indication of increased protection of investors' interests (Cao et al., 2016). When evaluating the safeguard of investors' interests other than China, the considerable political possibility of future interventions becomes a risk element due to the government's substantial influence on corporate actions. Another study by Gamayuni (2015) looked at the connection between intangible assets and financial policies and came to the conclusion that this happens because businesses use retained earnings to finance intangible asset investments while paying down debt because intangible assets are riskier and therefore have higher debt costs. The influence of intangible assets on dividend policy is significant and huge. Because it is argued that businesses want to send investors positive signals, dividends are said to be paid in direct proportion to the value of intangible assets. These findings confirm earlier studies that indicated that a company's ability to return assets to shareholders increased with the amount of intangible assets it possessed. While Alves and Martins (2014) provided insight into how intangible assets impact a company's financial policy.

Numerous authors have demonstrated that intangible asset investments have an effect on a firm's debt and dividend policy. The literature refers to two theoretical ideas that express opposing views on the dividend policy. One school of thought adheres to Miller and Modigliani's (1961) viewpoint that dividends shouldn't affect the value of a company. Gordon (1963), in contrast, thought that dividend policy was important and had an influence on the value of the firm. Mohanlingam, S., et al. (2021) examined the relationship between payment rules and intangible assets in one of their research done in Thailand. Intangible assets, such brands, client lists, copyrights, and goodwill, did not significantly affect financial policies (dividend payout) according to the study. Thai technology firms use their accumulated reserves to buy assets while developing their businesses and reducing their debt rather than distributing dividends to shareholders. Qureshi et al. (2020) examined the relationship between intangible assets and financial performance as well as financial policies and market value assessment in technology companies. Analysis showed that intangible assets produce significant positive effects on financial policies at technology-based businesses as evidenced through dividend distributions. It is believed that entities having superior intangible asset values will distribute higher dividend payments to their shareholders. This study will examine whether investing in intangibles is the best course of action for increasing the profitability, efficiency, capital structure, dividend policy, and market value of technology companies when compared to other aspects. R. Döttling et al. (2018) looked into the relationship between intangible assets and payout policies and found that there was little correlation between the two. To test the effect of intangible investment on corporate payout policy, we provide a straightforward extension. A second internal conflict arises in the company because of dividend policy. The value of the employee's unvested ownership is lowered by dividends because they are only paid to vested shareholders. There is a general consensus that higher demand for internal financing and hedging results from lower asset tangibility (e.g., Almeida and Campello, 2007), however, a brief realization provides some further context. Since intangible investment is more dependent on long-term human capital investment, it requires less initial upfront capital than the building of tangible assets. It is common knowledge that a significant reliance on intangibles necessitates a careful financial strategy. Because their assets are less pledgeable, lowering their debt capacity, businesses with a high ratio of intangible to total capital (henceforth HINT companies) are naturally concerned about becoming financially limited (Holmstrom and Tirole, 1998 and Bates et al., 2009). In addition to the traditional precautionary motive, the analysis of Döttling, R., et al. (2018) offers a second motivation for prudent financial policy. Due to the requirement for skilled labor's collaboration in intangible investments, businesses must compensate human capital through delayed remuneration (in the form of career prospects, bonuses and share grants).

Research Methodology

Sample selection

The panel data sample for this study comprises 32 high-tech companies listed on the Pakistan Stock Exchange (PSX), covering the period from 2013 to 2023. The selected industries include information technology, communication, pharmaceuticals, and automobiles—sectors that are recognized for their strong reliance on intellectual capital and relevance to dividend policy research. All firms included in the Pakistani sample were consistently listed throughout the 11-year period and had complete data available, thereby enabling the use of a balanced panel dataset for the empirical analysis. Research analyses how intellectual capital affects dividend policy decisions across the high-tech sector of Pakistan through an examination of human capital, structural capital and relational capital. This study did not include financial institutions as research subjects because they possess unique financial structure requirements as well as regulatory constraints for dividend distribution. Data for the analysis was obtained from two main sources. Company data and financial indicators regarding intellectual capital elements and firm dimensions as well as leverage and net profit margin and dividend payout ratio (DPR) and dividend yield (DY) were obtained from DataStream. The research analyses high-tech corporate operations within Pakistan through a detailed country-based approach to better understand dividend patterns and intellectual capital efficiency dynamics.

Methodology

Under assumptions of spherical error generation the Ordinary Least Squares (OLS) estimator performs as the most efficient linear unbiased estimator for data based on panels. OLS requires two operational conditions: homoscedasticity and error independence to work effectively. Error processes need constant variance and must also be unrelated and not demonstrate serial correlation. The errors in panel data models tend to display heteroscedasticity because their variances change between different units. Because our dependent variables (DPR and DY) may scale differently throughout the chosen high-tech companies, panel heteroscedasticity may present challenges in our situation. Errors for unit I at time t may be associated with errors for unit j at the same time, indicating that contemporaneous correlation can provide challenges in our models. The standard errors of the conventional OLS estimator are skewed and estimates become inefficient when these issues are present (see Reed & Ye, 2011).

The research implements the two-way System Generalized Method of Moments (Sys-GMM) dynamic methodology which was developed by Blundell and Bond (1998) and Arellano and Bover (1995) for dealing with endogeneity-related bias in dynamic panel data models. The Sys-GMM approach surpasses the first-differenced GMM since it works most effectively with small sample sizes according to Levine, Loayza, & Beck (2000). The Sys-GMM method resolves endogeneity may be caused by reverse causality problems and independent variable-error term correlations through the addition of lagged dependent variables and control factors. The empirical models are based on two regression equations, with the first equation applied when endogeneity is not detected. For the country-specific analysis, balanced panel data for Pakistan, India, and Bangladesh from 2013 to 2023 is utilized. Initial endogeneity tests for each of the three countries confirmed the presence of endogeneity, indicating that conventional panel OLS models (such as fixed or random effects) would be inappropriate due to their failure to address endogeneity (Chatterjee and Nag, 2022). The dynamic nature of the model necessitates the use of the Sys-GMM approach, as endogeneity in this context arises from reverse causality and the strong association between the regressors and the error term. Additionally, heteroskedasticity is a concern due to the diverse characteristics of the firms, further justifying the use of Sys-GMM. The Generalized Method of Moments (GMM) provides an appropriate method to handle endogeneity problems in panel data according to Ullah et al. (2018) and Tzouvanas et al. (2020) because it uses lagged dependent variables and endogenous variables as instruments to minimize bias. Endogeneity in panel data can stem from omitted variable bias, simultaneity, or reverse causality, which GMM effectively corrects (Tzouvanas et al., 2020). GMM is available in two variations: Difference GMM, which only analyzes differenced equations, and System GMM, which integrates both differenced and level equations. Given the short time span of the data and the persistence of the dependent variable, System GMM is deemed more appropriate as it accommodates the autoregressive nature of the data (Blundell and Bond, 1998).

The Sys-GMM estimator passes both tests of validity by checking for serial correlation absence in residuals and over-identifying restriction correctness. The study evaluates serial correlation using the AR (1) and AR (2) tests, where the results indicate no significant serial correlation at lag-2 (p-value > 0.05), confirming that the model is appropriately specified. The Sargan test is employed to assess the validity of the over-identifying restrictions, with results showing a p-value exceeding 0.05, thus confirming the validity of the instrument set. To further ensure the robustness of the results, multicollinearity among the independent variables is checked using the correlation matrix and variance inflation factors (VIF). Additionally, heteroskedasticity, which is a common issue in panel data regression models, is tested using the Breusch-Pagan test. Autocorrelation is addressed by adjusting for error components that may be correlated over time. Finally, cross-sectional dependence is assessed using Pesaran's test, which ensures that error terms are not correlated across firms. This comprehensive approach to addressing econometric issues such as endogeneity, multicollinearity, heteroskedasticity, and autocorrelation ensures the robustness and reliability of the empirical findings.

Variables

Dependent Variable

Dividend policy is the dependent variable, and two measures of dividend policy have been employed in the study in accordance with Wu et al. (2020). A dividend yield proxy (DY) and a dividend payout ratio proxy (DPR) are two examples of measurements. In order to simulate dividend policy, we use two different criteria. We evaluate the dependability of the proxy for the dividend payout variable by analysing two separate criteria. The primary statistic is the Dividend Payout Ratio (DPR), determined by dividing the dividend per share by net income before extraordinary items (Boubakri et al., 2016; Sawicki, 2009). The dividend yield (DY) can be determined by dividing price per share by dividend per share (Al-Najjar & Kilincarslan, 2016; Byoun, 2016). Our study uses the dividend payout ratio as the research variable because it evaluates cash distributions to shareholders compared to net income (Barros et al., 2020; Wu et al., 2020). This can be measured as follows:

$$DPR = \frac{\text{Total cas dividends}}{\text{Net Income}}$$

$$DY = \frac{\text{Dividend per share}}{\text{Market Price per share}}$$

Independent variable

There are several measurement methods of intellectual capital (IC). The most frequently used method for measuring intellectual capital efficiency (ICE) is Value-Added Intellectual Coefficient (VAIC™) created by Pulic (1998) according to researcher recommendations (Al-Musali & Ismail, 2016). VAIC™ utilizes audited financial statement data that can be easily obtained thus making it straightforward, simple, objective, verifiable and comparable (Nimtrakoon, 2015). RC serves as a component that Ulum et al. (2014) incorporated to establish Modified VAIC (MVAIC™) which this study adopts. The MVAIC™ represents a structured method which enables every stakeholder including management teams and investors to analyse and track intellectual capital efficiency throughout organizations to evaluate resource-based value creation. The MVAIC calculation follows this method:

VA = OUTPUT – INPUT

Thus, VA = OUTPUT – INPUT

The calculation of value addition combines operating profit before interest and tax with added depreciation costs and amortization expenses and employee costs following Pulic (1998) and Puntillo (2009):

VA = P + C + D + A

Where:

P = Operating profits;

C = Employee costs;

D = Depreciation; and

A = Amortisation

The MVAIC emerges from the combination of its four elements which consist of CEE, HCE, SCE and RCE.

The following method allows their extraction:

CEE = VA/CE

HCE = VA/HC

SCE = (VA - HC) =VA

RCE = RC/VA

MVAIC = CEE + HCE + SCE + RCE

Where Capital Employed Efficiency (CEE) represents the efficiency with which a firm utilizes its physical and financial capital to generate value. It is computed as the ratio of Value Added (VA) to Capital Employed (CE), where Capital Employed (CE) is defined as the difference between total assets and total liabilities, representing the net assets attributable to shareholders. Human Capital Efficiency (HCE) captures the contribution of a firm's human resources to its value creation processes. It is calculated by dividing VA by Human Capital (HC), where HC is proxied by the total expenditures on employees, including salaries, wages, and related benefits incurred during the fiscal year. Structural Capital Efficiency (SCE) measures the value generated from a firm's internal processes, systems, and organizational infrastructure. It is derived by subtracting HC from VA (i.e., VA – HC) and dividing the result by VA. Relational Capital Efficiency (RCE) reflects the firm's ability to leverage its external relationships—such as those with customers, suppliers, and other stakeholders—for value creation. Relational Capital (RC) is measured as the total marketing, selling, and advertising expenses incurred during the fiscal year. The Modified Value Added Intellectual Coefficient (MVAIC) is an extended version of the traditional VAIC model. It incorporates relational capital efficiency in addition to the three core components—CEE, HCE, and SCE.

Table 1 Variables Operationalization

Variable		Type	Measurement Technique
DPR	Dividend Payout Ratio	DV	DPR = Total Dividends/ Outstanding Shares
DY	Dividend Yield	DV	DY= Dividend per Share/Market price per share
ICE	Intellectual Capital Efficiency	IV	ICE=HCE + CEE + SCE MVAIC= HCE + SCE+ CEE +RCE MVAIC = ICE+CEE

LEV	Leverage	CV	Leverage equals the sum of long-term and short-term obligations divided by total assets.
PRT	Profitability	CV	Return on equity
FS	Firm size	CV	Natural log of total assets
NPM	Net Profit Margin	CV	Net profit margin is calculated as net income divided by total revenue for year t.
BS	Board size	CV	Natural log of number of directors on board

Specification of the model

The research examines ICE effects on dividend policy through Models 1 and 2 While to test the impact of intellectual capital efficiency which is measured by MVAIC on dividend policy using two proxies i.e., DRP and DY. Model 1 and 2 are employed in the equations to summarize the overall effect of intellectual capital efficiency (MVAIC) on dividend policy.

$$DPR_{it} = \beta_0 + \beta_1 MVAIC_{it} + \beta_2 FS_{it} + \beta_3 NPM_{it} + \beta_4 BS_{it} + \beta_5 ROE_{it} + \beta_6 LEV_{it} + \mu_{it} \ldots (1)$$

$$DY_{it} = \beta_0 + \beta_1 MVAIC_{it} + \beta_2 FS_{it} + \beta_3 NPM_{it} + \beta_4 BS_{it} + \beta_5 ROE_{it} + \beta_6 LEV_{it} + \mu_{it} \ldots\ldots (2)$$

In the aforementioned equations, the DPR and DY serve as the two proxies used for dependent variable i.e., dividend policy. In the aforementioned equations, the variable dividend payout ratio is represented by DPR, while DY signifies the dividend yield; both are the dependent variables utilized in the study. Intellectual capital efficiency is quantified by MVAIC, an independent variable representing the modified value added intellectual coefficient, utilized to enhance the dividend policy. Additionally, Control variables have their significance as they mitigate the results' biasedness (Garc´ıa-S´anchez, 2020). Controlling for any omitted variable biases is the main reason for incorporating the control variables (Nguyen et al., 2015). In the study, the dependent variables (DPR and DY) are also controlled by variables to minimize the biases of the results. Further, among the control variables, FS stands for Firm Size and NPM, or Net Profit Margin. BS refers to Board Size, which reflects the number of directors responsible for overseeing the firm's governance. ROE, or Return on Equity, indicates the firm's ability to generate profit from shareholders' equity, and LEV, or Leverage. The error term μ_it in the model deals with unobserved differences both across firms (i) and time periods (t) that influence performance.

Data Estimation

Descriptive Statistics

Table 1: Descriptive Statistics

	Mean	Std. Deviation	Minimum	Maximum
DY	0.061	0.049	0.009	0.620
DPR	0.203	0.221	0.023	0.921
MVIAC	6.387	7.174	-12.987	57.740
Lev	0.501	0.251	0.010	0.984
FS	8.605	1.552	4.000	11.98
NPM	0.003	0.449	-4.850	0.880
ROE	0.147	0.051	0.041	0.283
BS	7.712	1.028	6.000	13.00

Note: DPR=Dividend payout ratio, DY=Dividend yield, MVAIC= Modified Value Added Intellectual Capital, Control variables: FS=Firm Size, BS=Board size, NPM=Net profit margin, Lev=Leverage.

Table 1 presents the descriptive statistics for Pakistan during the entire time period. The mean and standard deviation were analyzed annually to detect outliers and discern general patterns for future examination, while the maximum, minimum, mean, and standard deviation statistics offer essential data insights. For Pakistan, the descriptive statistics reveal that the DPR is 0.2034, which means that the average DPR is 20.34%, with a standard deviation of 0.2217. The standard deviation tells us that the average value of the dividend payout ratio can vary up to 0.2217 from one year to another and from one company to another. The mean dividend yield of the firms in the sample is 6.12%, as per the mean value of the dividend yield, which is approximately 0.0612. This provides the central trend of the dividend yields for all the firms. The standard deviation of 0.0493 indicates the level of dispersion or variation of the dividend yield (DY) from the mean. A standard deviation close to the mean value of 6.12% indicates a moderate level of dispersion. This is in line with earlier studies (Mehralian et al. 2012). Table indicates that Modified Value Added Intellectual Coefficient measures (MVAIC) as a proxy for ICE presents an average value of 6.387 and a significant standard deviation measured at 7.174. The diverse MVAIC readings reveal extensive differences in intellectual capital use between Pakistani high-tech companies. Intellectual capital stands as an important value driver for firms according to the mean score yet the diverse dispersion of data shows that organizations utilize their human and structural and relational capital through different means. A high standard deviation shows both outstanding intellectual capital utilization among organizations but also reveals inconsistency between firms regarding their intellectual asset management. As per conventional studies, high-tech companies, such as pharma companies, obtain more value from intellectual assets as compared to physical and financial assets (Chowdhury, Rana, and Azim 2019).

Table 2 Correlation Matrix

	DY	MVAIC	LEV	FS	BS	NPM	ROE
DY	1.00						
MVAIC	0.04	1.00					
LEV	0.05	0.04	1.00				
FS	-0.08	0.20	0.06	1.00			
BS	0.02	0.08	0.27	0.27	1.00		
NPM	0.04	-0.13	-0.09	-0.02	-0.01	1.00	
ROE	0.07	-0.05	0.03	0.22	-0.08	0.08	1.00

Table 2 provides a summary of Pearson's correlation coefficients among the moderating, dependent, independent, and control variables utilized in the study. The primary purpose of conducting cross-variable correlation analysis is to explore the interrelationships among variables and to detect any potential multicollinearity issues, particularly among the independent variables. According to Hooper et al. (2008), multicollinearity becomes a concern when the Pearson correlation coefficient exceeds 0.80. While both Pearson and Spearman correlation matrices are commonly applied in empirical research, Pearson's correlation method has been employed in this study, as it is better suited for parametric data. Correlation results in Table 2 show that all independent variable associations remain within 0.80 levels which indicates no occurrence of multicollinearity. These correlation values show the degree of linear relationship between variables together with their directional linkages yet they do not indicate causal effects. Hence, the dataset satisfies the assumption of low interdependence among predictors, affirming the suitability of the variables for further regression analysis.

Table 3 Diagnostic tests

Test	Model	Test Statistic	p-value	Conclusion
Heteroskedasticity Test	**DY**	chi2(1) = 390.34	0.000	Heteroskedasticity present
	DPR	chi2(1) = 14.66	0.000	Heteroskedasticity present
Cross-section Dependence Test	**DY**	z = 0.181	0.856	No cross-sectional dependence
	DPR	z = -0.223	0.823	No cross-sectional

				dependence
Autocorrelation Test	**DY**	F = 39.255	0.000	Autocorrelation present
	DPR	F = 29.305	0.000	Autocorrelation present

Table 4 Test for Endogeneity

Dependent variable	t-value	P-value
DPR	249.01	0.000
DY	413.05	0.000

Note: DPR=Dividend pay-out ratio, DY= Dividend yield ***P¡0.01, **P¡0.05, *P¡0.1 Parenthesis= (P value, significance)

The diagnostic tests reveal important issues in the models for both Dividend Yield (DY) and Dividend Payout Ratio (DPR). Firstly, heteroskedasticity is present in both models, as indicated by the significant Breusch-Pagan test results: for DY, chi2 (1) = 390.34 with a p-value of 0.0000, and for DPR, chi2 (1) = 14.66 with a p-value of 0.0000. These results suggest non-constant error variance, which may require the use of heteroskedasticity-robust standard errors. Secondly, the Cross-section Dependence Test shows no evidence of cross-sectional dependence in either model, with the test statistic for DY being z = 0.181 and a p-value of 0.8563, and for DPR, z = -0.223 with a p-value of 0.8239, indicating that the error terms across firms are independent. Lastly, autocorrelation is detected in both models, with significant Wooldridge test results: for DY, F = 39.255 with a p-value of 0.0000, and for DPR, F = 29.305 with a p-value of 0.0000, suggesting that the residuals are correlated over time. This implies that adjustments for autocorrelation, such as using robust standard errors or generalized least squares methods, are necessary. Overall, while cross-sectional dependence is not a concern, the presence of heteroskedasticity and autocorrelation warrants model adjustments to improve the reliability of the estimates.

Table 5 Impact of Intellectual Capital Efficiency (ICE) on Dividend Policy

	DPR				**DY**			
Variable	Coefficient	Std. err.	z	P>|z|	Coefficient	Std. err.	z	P>|z|
DPR (-1)/ DY (-1)	0.054	0.023	2.29	0.022	0.038	0.016	2.40	0.016
MVAIC	0.048	0.012	4.03	0.000	0.310	0.062	5.01	0.000
LEV	-0.035	0.018	-1.95	0.051	-0.030	0.011	-2.54	0.011
NPM	0.136	0.016	8.39	0.000	0.003	0.006	0.57	0.568
FS	0.103	0.019	5.26	0.000	0.052	0.012	4.18	0.000
BS	-0.044	0.011	-4.07	0.000	-0.025	0.005	-5.02	0.000
ROE	0.036	0.140	0.26	0.793	0.276	0.041	6.72	0.000
Constant	0.315	0.218	1.44	0.149	0.187	0.021	8.82	0.000
AR1			-2.08	0.038			-4.20	0.000
AR2			-0.77	0.441			-0.90	0.369
Hansen J-Stat P-Value			21.39	0.940			17.50	0.805

Note: DPR=Dividend payout ratio, DY=Dividend yield, MVAIC= Modified Value-Added Intellectual Coefficient, FS=Firm Size, BS=Board size, ROE= Return on equity, NPM=Net profit margin, Lev=Leverage. ***P < 0.01,**P < 0.05,*P < 0.1 Parenthesis= (P-value, significance) OR * significant at 10%, ** significant at 5%, and *** significant at 1%. AR1 and AR2 refer to the Arellano-Bond test for first- and second-order autocorrelation, respectively. Hansen J-Stat P-Value assesses the validity of the instruments used in the model, with a higher p-value suggesting no misspecification of the model's instruments.

The estimation results in Table 5 show how MVAIC affects dividend policy through DPR and DY measurements. The auto-correlation issue received attention through inclusion of two autoregressive terms named AR (1) and AR (2) in each model structure. Autocorrelation problems in Pakistan were resolved using the AR (2) term which demonstrated a p-value higher than 0.05 thereby indicating no substantial autocorrelation at that order of lag. The Hansen J-statistic for over-identifying restrictions also showed an insignificant result ($p > 0.05$), validating the use of instrumental variables and confirming that the model's instruments are valid. The statistical analysis shows that both DPR and DY coefficients measure positive correlations with a statistical significance at 0.022 for DPR and 0.016 for DY. The results support Lintner's dividend model due to companies using past dividend values as a basis for their present dividend adjustments. The analyses establish that MVAIC demonstrates a strong positive relationship with both dividend policy models while keeping significant results. When MVAIC increases by one unit both DPR and DY rise by 0.048 ($p = 0.000$) and 0.310 ($p = 0.000$) respectively showing efficient intellectual capital enables firms to offer dividends. These results support the idea that intellectual assets contribute to firm performance, enabling sustainable shareholder returns. The study also reveals that leverage (LEV) negatively affects dividend policy, with coefficients of -0.035 ($p = 0.051$) for DPR and -0.030 ($p = 0.011$) for DY, showing that higher leverage reduces dividend payouts. The net profit margin has a significant and positive relationship with DPR (0.136, $p = 0.000$) but does not significantly affect DY (0.003, $p = 0.568$), suggesting that profitability is more influential on dividend payout ratios than on dividend yields. Larger firms, as indicated by firm size (FS), show a positive and significant correlation with both DPR (0.103, $p = 0.000$) and DY (0.052, $p = 0.000$), demonstrating that bigger firms are more capable of sustaining higher dividend distributions. In contrast, board size (BS) is negatively correlated with both DPR (-0.044, $p = 0.000$) and DY (-0.025, $p = 0.000$), possibly due to inefficiencies in decision-making in larger boards. Lastly, return on equity (ROE) is statistically insignificant in DPR analysis (0.036, $p = 0.793$), but shows a strong positive relationship with DY (0.276, $p = 0.000$), suggesting that market-based dividend metrics are more influenced by equity returns than accounting-based metrics like DPR. The research establishes firm evidence backing the Resource-Based View (RBV) by showing that corporations with higher efficiency in intellectual capital perform better in paying dividends. Factors such as firm size and profitability further enhance dividend distribution, while higher leverage and larger board sizes tend to limit dividend payouts.

Discussion

The study investigates how ICE measured by MVAIC affects dividend decisions of Pakistani high-tech companies. The relationship indicates that firms within the technology sector using efficient intellectual capital management methods achieve enduring profits and cash flows. High profits generated by the firm allow distribution of dividends that demonstrate stability and grow potential to shareholders. The appropriate handling of intellectual capital enables firms to reach higher profit levels which they can either reinstate back into their operations or distribute as dividends to shareholders. High-tech firms using effective intellectual resource management unlock both innovation and business growth and decide to share their operational success with shareholders through dividends (Bontis, 1999; Edvinsson & Malone, 1997). The results present theoretical along with empirical contributions from the Resource-Based View (RBV) coupled with Agency Theory because they emphasize intangible resources' critical role in shaping financial decisions of knowledge-intensive industries. The empirical results point towards a strong positive relationship between high levels of ICE and the tendency of a firm to pay dividends. This implies that in the high-tech industry of Pakistan, intellectual capital is not only an enhancer of operations but also a strategic driver that allows for sustainable value creation. The RBV model (Barney, 1991; Wernerfelt, 1984) emphasizes the importance of inimitable, valuable, and distinctive resources in gaining competitive advantage, and the results confirm that intellectual capital—made up of human, structural, relational, and capital utilized components—acts as such a resource.

From the perspective of Signaling Theory (Spence, 1973), firms with higher ICE are better positioned to distribute dividends as a signal of strong performance, future prospects, and financial stability. In environments where information asymmetry between management and investors persists, especially in emerging markets like Pakistan, dividends serve as credible signals of firm quality. Thus, ICE not only enhances internal value generation but also functions as a strategic communication tool to build investor confidence. The positive linkage observed in this study aligns with prior literature, including the works of Vrontis et al. (2021), Fatimo Imike et al. (2023), and Nielsen and Farooq (2015), who similarly documented the affirmative role of intellectual capital in shaping dividend policy. Furthermore, Karpavičius and Yu (2018) emphasized that enhanced ICE contributes to improved cash flow management, enabling firms to consistently meet dividend obligations.

Conclusion

This study investigates the impact of Intellectual Capital Efficiency (ICE) on dividend policy in high-tech firms in Pakistan, using the Modified Value Added Intellectual Coefficient (MVAIC) to measure ICE. The Modified Value Added Intellectual Coefficient (MVAIC) applied for calculating Intellectual Capital Efficiency amounts to important positive factors impacting dividend choices in Pakistani high-tech organizations. The results validate Resource-Based View principles (Barney, 1991; Wernerfelt, 1984) because they show intangible and inimitable assets like intellectual capital create sustainable competitive advantages which drive firm value creation. The important relationship between ICE and dividend payout ratio and dividend yield proves Signaling Theory (Spence, 1973). It shows that higher intellectual capital firms use dividend distributions for signaling strong financial performance to investors in emerging markets where information asymmetry remains high. Research conducted by Vrontis et al. (2021) and Fatimo Imike and team (2023) and Nielsen & Farooq (2015) confirms that intellectual capital leads to beneficial impacts on corporate financial policies. The results from this study bear critical implications which influence high-tech corporate strategic decisions while affecting Pakistani regulators and investors. First, firms should prioritize investments in intellectual capital—particularly in human, structural, and capital employed components—as these directly enhance the firm's ability to sustain dividend payments and signal financial health. Policymakers and boards should adopt strategies that foster talent development, innovation, knowledge management systems, and efficient resource utilization, as these elements not only improve firm performance but also positively influence shareholder returns. Second, regulatory bodies such as the SECP may consider encouraging greater transparency in intellectual capital reporting to reduce information asymmetry and help investors make informed decisions. Furthermore, given the non-significant role of relational capital in dividend policy, firms should be cautious in over-relying on external partnerships and instead focus on strengthening internal capabilities. Lastly, investor education programs may benefit from highlighting the value of intellectual capital indicators—such as MVAIC—as part of financial analysis, thus enabling more accurate assessments of a firm's long-term value and dividend sustainability. Collectively, these policies can strengthen corporate governance, improve investor confidence, and promote a more innovation-driven and resilient financial environment in emerging markets like Pakistan.

The research examines high-tech companies in Pakistan while doing so might compromise universal applicability to different national or sectoral settings. The research depends on secondary data for its assessments of intellectual capital's nuanced and qualitative aspects especially regarding relational capital. Future research in this area requires investigation of the effects that corporate governance have on the relationship between dividend policy and intellectual capital efficiency. Analysing intellectual capital utilization through governance mechanisms in multiple industries or countries would provide enhanced knowledge about financial decision-making processes.

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