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Research Article

Systematic Review of the Influence of Intellectual Capital on Firm Value: A Study of Mining Companies Listed on the Indonesia Stock Exchange

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Abstract: This study systematically reviews the influence of intellectual capital (IC) on firm value among mining companies listed on the Indonesia Stock Exchange (IDX) during the 2019–2023 period. The mining industry, typically capital-intensive and asset-heavy, is undergoing transformation as intangible assets such as knowledge, innovation, and organizational capabilities become critical for sustaining competitive advantage. The central research problem concerns how and to what extent IC—measured through human capital efficiency (HCE), structural capital efficiency (SCE), and capital employed efficiency (CEE)—affects firm value, particularly as reflected in Tobin's Q. This paper aims to synthesize findings from recent empirical studies to determine whether IC contributes significantly to market-based valuation in the mining sector. Using a systematic review approach, the study selects peer-reviewed literature applying quantitative methods, especially panel data regression models employing the VAIC™ framework. The results consistently indicate that IC positively impacts firm value, with HCE and CEE emerging as dominant drivers, while SCE shows varied effects. The findings support the Resource-Based View (RBV) theory, suggesting that IC components represent unique, valuable, and hard-to-imitate resources. The synthesis highlights that although mining firms are still adapting to intangible value drivers, those investing in human capital and capital efficiency enjoy higher valuations. The paper concludes that intellectual capital should be an integral part of strategic management in mining firms to sustain growth and investor confidence. Future research should include cross-sectoral and longitudinal analyses for broader generalizability.

Keywords: Firm Value, Human Capital, Intellectual Capital, Mining Companies Indonesia Stock Exchange, Tobin's Q.

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1. Introduction

The evolution of the global economy has transitioned from being predominantly resource- and labor-intensive to one that is driven by knowledge and intangible assets. In this new paradigm, intellectual capital (IC)—comprising human capital, structural capital, and capital employed efficiency—has emerged as a crucial element in determining the competitiveness and valuation of firms [1], [2]. IC, as a strategic asset, is defined as the sum of all knowledge that organizations utilize to create value [3]. Its effective utilization allows companies to innovate, adapt, and gain sustainable competitive advantages.

In Indonesia, the mining sector has historically been characterized by its reliance on physical and natural resources. However, increasing environmental scrutiny, market volatility, and globalization have compelled firms in this sector to explore non-tangible drivers of firm value. While traditional financial indicators such as Return on Assets (ROA), Return on Equity (ROE), and Earnings per Share (EPS) have long been used to assess firm performance, these indicators are no longer sufficient in capturing the full picture of value creation in modern corporations [4]. The integration of intellectual capital into the strategic framework of companies is thus becoming more relevant, even in capital-intensive industries such as mining.

Firm value is a multidimensional concept that reflects the market's perception of a company's future prospects. One widely used proxy is Tobin's Q, which compares the market value of a firm's assets with their replacement cost [5]. A Tobin's Q greater than one indicates that investors believe the firm possesses unique assets or capabilities—often intangible in nature—that enhance its future profitability. In this context, intellectual capital, as a repository of firm-specific knowledge and innovation, becomes a critical driver of firm value [6].

Empirical studies have shown that intellectual capital contributes significantly to firm value in knowledge-intensive sectors such as banking, information technology, and manufacturing [7], [8]. However, evidence from the mining industry remains limited and inconsistent. While some scholars have demonstrated a positive and significant relationship between IC and firm value in mining companies [9], others argue that the capital-intensive nature of the sector may diminish the observable impact of intangible assets on valuation metrics [10]. This incongruity highlights the need for a focused investigation into the role of intellectual capital within mining firms, particularly in emerging markets like Indonesia.

The Indonesian mining sector, a major contributor to national GDP and exports, faces distinct challenges. These include fluctuating commodity prices, evolving environmental regulations, and increasing expectations from stakeholders. In such a turbulent environment, the ability of mining firms to harness and develop their intellectual capital can serve as a buffer against external shocks and a mechanism for enhancing firm value [11]. Human capital efficiency (HCE), for instance, reflects the productivity and innovation potential of the workforce; structural capital efficiency (SCE) represents the internal systems and knowledge infrastructure that support operational performance; and capital employed efficiency (CEE) captures how effectively physical and financial capital are utilized to generate value [12].

Despite these insights, few studies have systematically reviewed the influence of IC on firm value in the Indonesian mining sector. Existing literature tends to either generalize across sectors or focus on financial or service industries. This lack of specificity limits the applicability of findings to industries like mining, which possess unique structural characteristics.

This article aims to fill this gap by conducting a systematic review of empirical research from 2019 to 2023, specifically examining the impact of intellectual capital on firm value in mining companies listed on the Indonesia Stock Exchange (IDX). The objectives of this study are threefold: (1) to analyze the extent to which intellectual capital affects firm value in the mining sector; (2) to identify which components of IC—HCE, SCE, or CEE—exert the greatest influence on firm valuation; and (3) to contextualize these findings within a strategic management framework, particularly the Resource-Based View (RBV), which argues that firms achieve competitive advantage through resources that are valuable, rare, inimitable, and non-substitutable [13].

In doing so, this study contributes to both academic discourse and managerial practice by providing evidence-based insights into how mining firms can leverage intellectual capital to enhance firm value. The findings are also expected to inform investment strategies, policy development, and future research on intangible asset management in resource-based industries.

2. Literature Review

2.1 Theoretical Framework of Intellectual Capital

Intellectual capital (IC) encompasses intangible resources and knowledge-based assets that contribute to a firm's competitive advantage and long-term performance. The components of IC are commonly categorized into Human Capital Efficiency (HCE), Structural Capital Efficiency (SCE), and Capital Employed Efficiency (CEE). Pulic's Value Added Intellectual Coefficient (VAIC™) model is widely used to quantify these components, reflecting the efficiency of intellectual capital in value creation [1]. HCE refers to the value generated from

employee competencies and productivity; SCE reflects institutional knowledge, procedures, patents, and databases; and CEE represents the efficiency with which a company uses its capital to generate profits [2].

Stewart [3] and Edvinsson and Malone [4] were among the first to conceptualize IC as the new source of wealth in knowledge-based economies. Their foundational work positioned IC as a key element in explaining discrepancies between book and market value. This is particularly relevant in the context of modern firms where intangibles—such as innovation capability, employee expertise, and process efficiency—are not always visible in financial statements.

2.2 Resource-Based View (RBV) and the Role of IC

The Resource-Based View (RBV) theory offers a strategic lens for understanding the impact of IC on firm performance. According to Barney [5], firms can achieve sustained competitive advantage by possessing resources that are valuable, rare, inimitable, and non-substitutable. Intellectual capital meets these criteria, especially in industries that require innovation, operational excellence, and market adaptability. In the mining sector, effective use of HCE and CEE can differentiate firms in terms of efficiency, resilience, and profitability [6].

2.3 Measuring Firm Value

Firm value reflects the market's perception of a company's future earning potential. Tobin's Q, defined as the ratio of the market value of a firm's assets to their replacement cost, is a frequently used proxy in empirical studies [7]. A Tobin's Q value greater than one suggests that investors expect the firm to outperform its book value, often due to superior intangible assets or strategic positioning. Intellectual capital enhances Tobin's Q by improving investor confidence through innovation and efficient use of resources [8].

2.4 Empirical Studies on IC and Firm Value

A large body of empirical literature supports the positive impact of intellectual capital on firm performance and valuation. Studies by Bontis et al. [9], Firer and Williams [10], and Ghosh and Mondal [11] found that higher levels of HCE and CEE significantly correlate with improved stock returns, ROE, and Tobin's Q across various industries.

In the Indonesian context, Nuryaman [12] found that VAIC significantly influences firm value in manufacturing firms. Theodora et al. [13] extended these findings to mining firms, reporting that companies with higher intellectual capital scores exhibit better market valuations. Similarly, Mukaro et al. [14] and Githaiga et al. [15] provided regional evidence from Africa, affirming the robustness of the IC–firm value link even in resource-intensive sectors.

2.5 Sector-Specific Perspectives: Mining vs. Other Industries

Although much of the literature on IC centers around service and high-tech industries, research focusing on capital-intensive sectors like mining has gained momentum. Bala et al. [16] argue that mining companies, despite their dependence on physical infrastructure, increasingly rely on IC to navigate environmental risks, regulatory changes, and operational complexity. However, the role of SCE remains mixed in mining, possibly due to underdeveloped internal systems or limited knowledge integration [17].

Comparative studies by Choudhury [18] and Seleim et al. [19] suggest that while IC is the backbone of service firms, its strategic importance in manufacturing and extractive industries is growing. The mining industry stands at an inflection point where leveraging IC can lead to enhanced innovation, risk management, and sustainable growth.

2.6 Research Gap and Justification

Despite the growing evidence of IC's significance, systematic reviews specifically addressing Indonesian mining firms remain scarce. Most existing research either aggregates multiple sectors or overlooks the structural uniqueness of mining companies. This study addresses this gap by synthesizing findings from 2019 to 2023 and focusing exclusively on mining firms listed on the Indonesia Stock Exchange (IDX), thereby offering a more targeted and contextual analysis.

3. Proposed Method

This study employs a systematic review methodology to synthesize empirical evidence regarding the relationship between intellectual capital (IC) and firm value, specifically within the context of mining companies listed on the Indonesia Stock Exchange (IDX) during the period of 2019–2023. The aim is to identify, evaluate, and integrate findings from peer-reviewed research to draw comprehensive insights on the extent and mechanism of IC's influence in capital-intensive industries.

3.1 Research Design

The research follows a descriptive and qualitative design using systematic literature review principles as outlined by Kitchenham [1] and Tranfield et al. [2]. This approach ensures replicability, transparency, and comprehensiveness in collecting and analyzing existing studies. The inclusion and exclusion criteria were clearly defined to ensure objectivity.

3.2 Data Sources and Collection

The literature search was conducted using multiple academic databases, including Google Scholar, Scopus, ScienceDirect, and national repositories such as Garuda and Neliti. Search terms included combinations of keywords: "intellectual capital," "firm value," "VAIC," "mining sector," and "Indonesia." The time frame was limited to studies published between 2019 and 2023. The inclusion criteria were:

- Studies must focus on IC as the independent variable
- Firm value must be the dependent variable, measured using Tobin's Q or equivalent
- Sample must consist of companies in the mining sector listed on IDX
- Methodology must involve panel data regression or other quantitative models

3.3 Variable Operationalization

The primary variables used across the reviewed studies are defined as follows:

- Intellectual Capital (IC): Measured using the VAIC™ model, which includes:
  - HCE (Human Capital Efficiency): VA / HC
  - SCE (Structural Capital Efficiency): SC / VA
  - CEE (Capital Employed Efficiency): VA / CE
- Firm Value (FV): Measured by Tobin's Q

4. Results and Discussion

4.1 Descriptive Statistics

A review of empirical studies examining intellectual capital (IC) and firm value in Indonesia's mining sector reveals consistent findings regarding the relevance of IC as a determinant of market valuation. Across most studies reviewed between 2019 and 2023, the average value of Tobin's Q among mining companies ranged from 0.95 to 1.45, indicating moderate to high investor confidence in firms' future profitability beyond their tangible assets [1], [2]. Companies that scored higher in VAIC (Value Added Intellectual Coefficient) tended to have above-average market valuations, affirming the hypothesis that IC enhances perceived firm value [3].

4.2 Direct Effect of IC on Firm Value

The majority of the studies reviewed suggest a statistically significant and positive effect of intellectual capital on firm value. Chugh and Mohammadi [4] found that a one-unit increase in VAIC is associated with a 0.08 unit increase in Tobin's Q. This finding was supported by studies focusing on mining and manufacturing firms in Indonesia, such as those by Nuryaman [5] and Theodora et al. [6], both of which reported that firms with strong IC indicators outperformed peers in terms of stock performance and investor valuation.

Moreover, Mukaro et al. [7] emphasized the importance of IC in enhancing firm adaptability and value during periods of economic uncertainty, which is particularly relevant for the mining sector subject to fluctuating commodity prices and regulatory pressure. Their findings reinforce the strategic value of intangible resources in resource-based industries.

4.3 Component-Level Analysis

A more granular analysis of IC components—HCE, SCE, and CEE—shows varying levels of influence on firm value:

- Human Capital Efficiency (HCE): This was consistently found to be the most influential component of IC. Firms that invested in employee development, training, and knowledge retention tended to exhibit higher innovation output and operational efficiency, leading to improved market valuation [4], [6], [8]. HCE reflects the organization's ability to leverage employee competencies, a critical factor in industries where skilled labor is needed to optimize resource extraction and operational planning.
- Structural Capital Efficiency (SCE): The influence of SCE on firm value was found to be mixed. While some firms demonstrated a strong correlation between SCE and market performance, others showed weak or statistically insignificant relationships. This inconsistency suggests that many mining firms have yet to fully develop or leverage internal systems such as databases, operational procedures, or organizational culture to enhance value [9]. In some cases, inadequate technological infrastructure and fragmented knowledge systems may explain the limited impact of SCE.
- Capital Employed Efficiency (CEE): This component showed a strong and consistent effect on firm value, especially in asset-heavy industries such as mining. High CEE values indicate effective utilization of financial and physical capital to generate added value. As stated by Bala et al. [10], capital-intensive firms must maximize returns on employed capital to meet investor expectations. Consequently, improvements in capital allocation and efficiency can significantly raise firm valuation.

4.4 Interpretation

The empirical evidence aligns closely with the Resource-Based View (RBV), which asserts that unique, valuable, and non-substitutable resources—such as intellectual capital—confer competitive advantage and drive superior firm performance [11]. Intellectual capital fits this framework, particularly in sectors where innovation, efficient resource management, and adaptability are essential for long-term success.

Furthermore, the findings suggest that even in industries historically dominated by tangible assets, such as mining, the strategic use of IC can offer pathways to enhanced firm value. Firms that excel in managing their human and capital resources are better positioned to generate sustainable value, attract investment, and withstand market volatility [12].

5. Comparison

Comparison with Other Sectors

To better understand the contextual significance of intellectual capital (IC) in the mining sector, it is instructive to compare findings from this study with those from other industries such as banking, manufacturing, and services. Each of these sectors possesses varying degrees of reliance on intangible assets, which affects how IC influences firm value.

5.1 Banking Sector

The banking sector has long been recognized as a knowledge-intensive industry where intellectual capital is the primary driver of firm value. Empirical studies consistently demonstrate a strong positive relationship between IC—particularly human capital efficiency (HCE)—and firm performance metrics such as Tobin's Q, return on equity, and stock price appreciation [1]. According to Bontis et al. [2], banks that heavily invest in employee development and internal processes show superior financial outcomes. Choudhury [3] further emphasized that human and structural capital significantly impact value creation in the financial sector due to the reliance on intellectual services rather than physical products.

5.2 Manufacturing Sector

In manufacturing, the influence of IC is moderate and often mediated by other operational factors such as production technology, supply chain efficiency, and asset utilization. Although capital employed efficiency (CEE) plays a critical role in improving productivity, the contribution of HCE and SCE is relatively limited unless firms are actively pursuing innovation or automation strategies [4]. Studies by Firer and Williams [5] suggest that manufacturing firms need to better integrate IC into their value-creation frameworks to remain competitive, particularly in high-tech sub-sectors.

5.3 Service Sector

Service industries, including consulting, education, and information technology, demonstrate the strongest linkage between IC and firm value. These sectors rely almost entirely on knowledge, expertise, and client relationships to drive revenue. Ghosh and Mondal [6] argue that in service firms, IC constitutes nearly all of the value-generating assets, making it central to both operational effectiveness and strategic positioning. As a result, Tobin's Q and other valuation metrics are highly sensitive to changes in IC indicators.

5.4 Mining Sector Context

In contrast, the mining industry is traditionally capital-intensive and asset-heavy. However, findings from this review indicate that IC—especially HCE and CEE—plays an increasingly important role in shaping firm value. Structural capital efficiency (SCE), while less influential, still offers potential through improvements in knowledge systems, digital integration, and operational optimization [7]. These trends reflect the growing need for innovation, sustainable practices, and human capital development in extractive industries.

5.5 Synthesis

Table 1 below summarizes the comparative influence of intellectual capital components across selected sectors:

Sector	HCE Impact	SCE Impact	CEE Impact	Overall IC Influence
Banking	Strong	Strong	Moderate	High
Manufacturing	Moderate	Moderate	Strong	Moderate
Services	Strong	Strong	Weak	Very High
Mining	Strong	Weak–Mod	Strong	Moderate–High

The comparison highlights that while IC is universally relevant, its relative impact on firm value differs based on industry characteristics. For mining firms, strengthening human capital and optimizing capital deployment appear to be the most effective strategies for leveraging IC.

6. Conclusions

This study has provided a comprehensive systematic review of the influence of intellectual capital (IC) on firm value in the context of mining companies listed on the Indonesia Stock Exchange (IDX). In an industry traditionally dominated by tangible assets, the findings underscore the growing strategic relevance of intangible resources such as knowledge, expertise, and organizational capabilities.

The analysis of empirical literature from 2019 to 2023 reveals that intellectual capital—particularly human capital efficiency (HCE) and capital employed efficiency (CEE)—exerts a significant and positive influence on firm value, commonly measured using Tobin's Q. These findings affirm that mining firms with greater investment in employee development, knowledge retention, and optimal capital utilization are more likely to command higher market valuations. Although structural capital efficiency (SCE) showed less consistent impact, it remains a potential area for value enhancement through improved internal systems, digital innovation, and institutional learning.

These results align with the principles of the Resource-Based View (RBV), which positions intellectual capital as a valuable, rare, inimitable, and non-substitutable asset capable of generating sustainable competitive advantage. In the volatile and competitive landscape of the mining sector, the ability to manage and leverage IC effectively can differentiate high-performing firms from their peers.

Furthermore, comparative analysis with other industries demonstrates that while IC is most influential in service and financial sectors, it also plays a critical but often underutilized role in asset-heavy sectors like mining. Therefore, there is a pressing need for mining companies to shift their strategic orientation toward the integration and optimization of intangible assets.

For practitioners, the findings highlight the importance of embedding IC considerations into strategic planning, human resource policies, and capital investment decisions. For scholars, the review suggests avenues for future research, including longitudinal studies, multi-sectoral comparisons, and the incorporation of digital transformation variables into IC models.

In conclusion, intellectual capital should no longer be viewed as a supplementary asset but as a core driver of firm value—even in traditional, capital-intensive sectors. Mining companies that proactively develop their human and intellectual resources will not only improve their valuation but also enhance their resilience in the face of global challenges and market uncertainties.

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