INTELLECTUAL CAPITAL AND BUSINESS PERFORMANCE: THE CONTINGENT ROLE OF MANAGEMENT ACCOUNTING INFORMATION SYSTEMS

[1]YUDHISTIRA ADWIMURTI, [2]ETTY MURWANINGSARI, [3]SUZYANTY BINTI MOHD SHOKORY

[1,2]Faculty of Economics and Business, Universitas Trisakti, Jakarta, Indonesia
[3]Faculty of Management and Economics, Universiti Pendidikan Sultan Idris, Malaysia
E-mail: etty.murwaningsari@trisakti.ac.id

Abstract - Prior research reports mixed findings on the intellectual capital–performance relationship, suggesting insufficiently addressed boundary conditions. This study examines the direct effects of human capital, structural capital, and relational capital on business performance and tests whether management accounting information system (MAIS) support moderates these relationships. Adopting a quantitative cross-sectional survey approach grounded in the Resource-Based View, Knowledge-Based View, and Contingency Theory, this study collects primary data from corporate officers of Indonesia Stock Exchange-listed firms across twelve industrial sectors. The structural model is estimated using PLS-SEM, with robustness verified through sensitivity analysis. All three intellectual capital components positively affect business performance, with human capital exhibiting the strongest contribution. MAIS support significantly enhances performance directly and strengthens the human capital–performance relationship, functioning as a quasi-moderator. However, MAIS does not moderate the structural or relational capital pathways. The cross-sectional design limits causal inference; future research should employ longitudinal and mixed-methods designs. Theoretically, the findings refine contingency-based intellectual capital theory by demonstrating that information system support selectively amplifies people-dependent resources rather than universally conditioning all intangible assets. The study operationalizes MAIS as a higher-order construct integrating information quality with organizational readiness, managerial commitment, and government support, demonstrating superior explanatory power and providing an emerging market blueprint for aligning intellectual capital strategy with accounting information infrastructure.

Keywords - Intellectual Capital, Business Performance, Management Accounting Information System, Risk Acceptance Trends, Perceived Environmental Uncertainty
JEL Classification: M41, M12, O34, D83

I. INTRODUCTION

In an era of accelerating digital transformation and intensifying global competition, the capacity of firms to generate sustainable value increasingly depends on intangible assets rather than physical or financial resources alone (Ali et al., 2021). Knowledge-driven economies have shifted the locus of competitive advantage toward intellectual capital—the sum of human expertise, organizational systems, and relational networks that underpin innovation and strategic renewal (Aljuboori et al., 2022). In Indonesia, this transition is reinforced by the national economic masterplan and capital market regulations administered through the Indonesia Stock Exchange (IDX), which mandate enhanced corporate disclosure and accountability across all twelve industrial sectors. Consequently, listed firms face mounting pressure to demonstrate not only financial returns but also the strategic deployment of intangible resources that sustain long-term performance.

This shift compels firms to reorient operational and strategic choices, making business performance a visible and continuously monitored outcome by regulators, investors, and stakeholders alike. Business performance serves as the focal dependent variable (Handayani & Ali, 2025). Achieving superior performance requires firms to mobilize and integrate diverse strategic resources. This study highlights three such levers embedded in the intellectual capital framework: human capital, structural capital, and relational capital.

Three intellectual capital components—human capital (workforce knowledge and skills), structural capital (organizational systems and processes), and relational capital (external stakeholder relationships)—serve as the focal independent variables (Aljuboori et al., 2022).

However, possessing intellectual capital does not automatically guarantee superior outcomes. The conversion of intangible resources into realized performance depends critically on the organizational mechanisms that translate knowledge into decisions and actions. Management Accounting Information System support (MAIS)—encompassing information quality, organizational readiness, and managerial commitment—operates as a boundary condition determining when intellectual capital converts into performance(Thuan et al., 2022; Yuliastanti et al., 2022). Without adequate MAIS support—encompassing not only information quality (broadscope, timeliness, aggregation) but also organizational readiness and managerial commitment to system use—intellectual capital assets may remain latent, failing to translate into measurable

performance gains. MAIS therefore operates as a boundary condition that determines when and how effectively intellectual capital converts into business performance.

Prior studies report mixed findings: while human capital generally shows positive effects(Firmansyah et al., 2025; Tran et al., 2022; Xu & Liu, 2020), structural capital yields inconsistent results (Aljuboori et al., 2022; Victoria & Nuryasman, 2020), and relational capital evidence ranges from positive (Firmansyah et al., 2025) to negative (Xu & Liu, 2020). These discrepancies point to unexamined contextual moderators.

Such inconsistencies motivate the inclusion of MAIS support as a moderating variable. When MAIS is strong, the informational infrastructure amplifies the decision usefulness of human capital, activates the productive potential of structural processes, and enables firms to quantify and act upon relational signals from customers and partners. Conversely, weak MAIS may attenuate or nullify the performance returns of intellectual capital. Despite the theoretical plausibility of this moderation, empirical evidence examining MAIS as a contingency factor in the intellectual capital–performance nexus remains scarce, particularly in emerging market contexts.

This study advances the literature along three dimensions. Theoretically, it integrates the Resource-Based View and Knowledge-Based View with Contingency Theory to explain how intellectual capital components interact with MAIS support to shape business performance—an integration that addresses the fragmented treatment of these perspectives in prior work. Methodologically, MAIS is operationalized as a comprehensive higher-order construct that extends beyond traditional information characteristics (broadscope, timeliness, aggregation) to incorporate organizational readiness, owner/manager commitment, and government support dimensions drawn from Thuan et al. (2022), thereby capturing MAIS as an organizational capability rather than merely an information product. Contextually, the study focuses on IDX-listed firms across all twelve sectors, providing cross-industry evidence from an emerging economy that remains underrepresented in the international intellectual capital literature. Three control variables—perceived environmental uncertainty, accounting staff qualification, and risk acceptance trends (Quynh & Mai, 2025)—are included to mitigate omitted variable bias.

Accordingly, this study pursues three objectives: first, to examine the direct effects of human capital, structural capital, and relational capital on business performance among IDX-listed firms; second, to test whether MAIS support moderates the relationships between each intellectual capital component and business performance; and third, to assess the direct contribution of MAIS support to business performance while controlling for environmental uncertainty, staff qualification, and risk acceptance.

II. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1 Theoretical Foundations

This study draws on the Resource-Based View (RBV), the Knowledge-Based View (KBV), and Contingency Theory to explain how human capital, structural capital, and relational capital influence business performance, and how management accounting information system support conditions these relationships. The RBV posits that valuable, rare, inimitable, and non-substitutable resources drive sustained competitive advantage (Aljuboori et al., 2022). Under this lens, human capital constitutes a tacit strategic resource, while the KBV emphasizes that codified organizational knowledge (structural capital) enables scalability and operational efficiency. Relational capital—trust, loyalty, and collaborative networks with external stakeholders—constitutes a boundary-spanning resource enabling co-creation of value (Ramírez-solis et al., 2022).

Contingency Theory argues that resource effectiveness depends on alignment with internal systems. MAIS determines whether intellectual capital assets are activated or remain dormant (Chung & Su, 2012): high MAIS support reduces knowledge loss and enhances coordination, while weak infrastructure attenuates performance returns. The integration of these three perspectives suggests that intellectual capital components are necessary but insufficient—their productive potential is contingent on information system architecture.

2.2 Human Capital and Business Performance

Human capital—the collective knowledge, skills, and creativity in an organization's workforce (Aljuboori et al., 2022)—enhances performance through two mechanisms: talent-driven innovation that improves products and processes, and adaptive decision-making that accelerates organizational responsiveness to market shifts.

Empirical evidence largely supports this association, with positive significant effects reported across diverse contexts (Aljuboori et al., 2022; Firmansyah et al., 2025; Tran et al., 2022; Victoria & Nuryasman, 2020; Xu & Liu, 2020). While magnitude varies across measurement approaches, the directional consensus is robust. Therefore:

H1: Human capital has a positive effect on business performance.

2.3 Structural Capital and Business Performance

Structural capital—the organizational infrastructure enabling knowledge codification and replication

(Aljuboori et al., 2022)—enhances performance through process efficiency and systematic innovation support, reducing operational costs and improving output quality.

The empirical record reveals notable inconsistency: positive significant effects are reported by Firmansyah et al. (2025) and Pangidoan (2022), while Aljuboori et al. (2022), Victoria & Nuryasman (2020), and Xu & Liu (2020) find insignificant direct effects. These mixed results may stem from coordination costs that offset efficiency gains when complementary information infrastructure is lacking. Despite these inconsistencies, the KBV supports a positive expectation. Therefore:
H2: Structural capital has a positive effect on business performance.

2.4 Relational Capital and Business Performance

Relational capital—the value embedded in external relationships including trust, loyalty, and strategic alliances (Aljuboori et al., 2022)—enables firms to retain customers, anticipate demand shifts, and secure collaborative advantages through sustained stakeholder engagement.

Empirical findings are directionally positive yet statistically uneven. Firmansyah et al. (2025) and Tran et al. (2022) report significant positive effects, while Pangidoan (2022) and Aljuboori et al. (2022) find non-significant effects, and Xu & Liu (2020) document a negative association. Ramírez-solis et al (2022)note that relational capital's effect on performance is weaker than on innovation, indicating potential trade-offs. Despite these inconsistencies, the theoretical rationale supports a positive hypothesis. Therefore:

H3: Relational capital has a positive effect on business performance**.**

2.5. The Moderating Role of Management Accounting Information System Support

Within the Contingency Theory framework, MAIS operates as an enabling mechanism determining the efficiency with which intellectual capital converts into performance outcomes (Thuan et al., 2022; Yuliastanti et al., 2022).

MAIS is expected to strengthen the human capital–performance relationship because high MAIS support provides timely data that enhances the decision usefulness of human insights and reduces information loss during knowledge transfer, amplifying the return on human capital investments. Therefore:
H4: MAIS support strengthens the positive effect of human capital on business performance.

MAIS is expected to moderate the structural capital–performance link, as high MAIS support connects operational routines to accurate performance data, enabling process optimization. Without adequate information support, structural assets may operate in isolation from strategic objectives. Therefore:
H5: MAIS support strengthens the positive effect of structural capital on business performance.

MAIS is expected to condition the relational capital–performance pathway by enabling firms to translate external signals into quantified decisions through cost-to-serve analyses and relational performance metrics. Therefore:
H6: MAIS support strengthens the positive effect of relational capital on business performance.

MAIS is also expected to directly enhance business performance by improving managerial planning, reducing uncertainty, and supporting resource allocation (Yuliastanti et al., 2022). Although Chung & Su (2012) caution that this link may operate through mediating mechanisms, Contingency Theory supports a direct positive association at the organizational level. Therefore:
H7: MAIS support has a positive effect on business performance.

2.6 Conceptual Framework

Figure 1 illustrates the conceptual framework, depicting HC, SC, and RC as independent variables predicting BP, with MAIS as both direct predictor and moderator, and PEU, ASQ, and ATR as control variables.

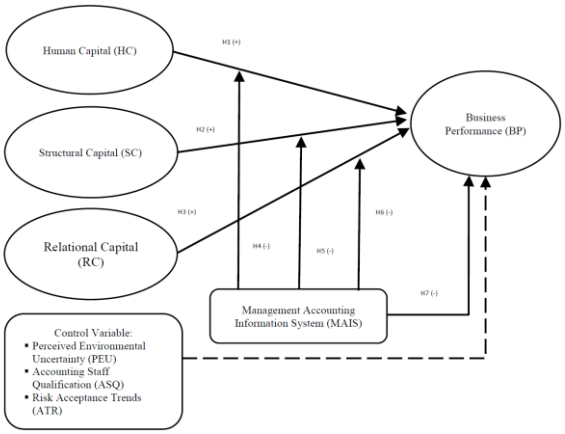


Figure 1 Conceptual Framework

III. RESEARCH METHODOLOGY

3.1 Research Design

This study adopts a quantitative design grounded in the positivist paradigm, utilizing a cross-sectional survey approach to test the proposed hypotheses. The unit of analysis is the firm, specifically publicly listed companies on the Indonesia Stock Exchange (IDX) across all twelve IDX Industrial Classification sectors during the 2024 fiscal year. The unit of observation comprises authorized corporate officers occupying

middle-to-upper managerial positions who possess substantive understanding of organizational strategy, intellectual capital management, accounting information systems, and performance evaluation. The empirical strategy is designed to estimate the direct effects of human capital (HC), structural capital (SC), and relational capital (RC) on business performance (BP), the direct and moderating effects of management accounting information system support (MAIS), while controlling for perceived environmental uncertainty (PEU), accounting staff qualification (ASQ), and risk acceptance trends (ATR). Given the latent nature of all constructs and the complexity of the hypothesized model involving one higher-order construct and multiple interaction terms, Partial Least Squares Structural Equation Modeling (PLS-SEM) is employed using SmartPLS 4.0 software.

3.2 Population and Sampling

The target population comprises all publicly listed companies on the Indonesia Stock Exchange in 2024, selected for their standardized governance structures, mandatory regulatory reporting, and operational exposure to knowledge-driven competitive pressures across diverse industries. Respondents are corporate officers directly responsible for or knowledgeable about strategic decision-making, including finance managers, accounting managers, operations managers, and directors. Purposive sampling with a key informant method is applied based on five inclusion criteria: (1) employed at an IDX-listed company; (2) middle-to-upper managerial position; (3) minimum bachelor's degree; (4) minimum 21 years of age; and (5) minimum one-to-two years of tenure. Incomplete and patterned responses are excluded. The minimum sample size is determined following the ten-times rule for PLS-SEM, calculated based on the construct with the highest number of structural paths or indicators. MAIS, as the construct with the most indicators (24 items across six dimensions), serves as the basis for this calculation.

3.3 Data Collection Procedures

Primary data were collected via a structured online questionnaire using a six-point Likert scale (1 = Strongly Disagree to 6 = Strongly Agree), excluding a neutral midpoint to mitigate central tendency bias.
The questionnaire comprised demographics (Section A) and measurement items for all research variables (Section B). Content validity was assessed through expert judgment; reliability via Cronbach's Alpha and Composite Reliability (≥ 0.70); and construct validity through AVE (≥ 0.50), HTMT (< 0.90), and the Fornell-Larcker criterion.

3.4 Variable Definition and Measurement

All focal constructs are measured using multi-item indicators adopted from validated instruments. MAIS is operationalized as a higher-order construct (HOC) comprising six dimensions with reflective relationships at the item level, reflecting its composite nature as a capability assembled from distinct information characteristics and organizational support subsystems. Human capital, structural capital, relational capital, business performance, and the three control variables are specified as first-order reflective constructs. Table 1 summarizes the operationalization of all variables.

Variable	Definition	Dimensions / Indicators	Items	Scale / Source
Human Capital (HC)	The knowledge, skills, creativity, and problem-solving capabilities residing in an organization's workforce.	Human Capital	HC1–HC5 (5)	Likert 1–6; Aljuboori et al. (2022)
Structural Capital (SC)	The organizational infrastructure of knowledge: systems, processes, routines, and cultural mechanisms enabling knowledge replication.	Structural Capital	SC1–SC7 (7)	Likert 1–6; Aljuboori et al. (2022))
Relational Capital (RC)	The value embedded in external relationships with customers, suppliers, and strategic partners.	Relational Capital	RC1–RC5 (5)	Likert 1–6; Aljuboori et al. (2022)
Management Accounting Information System (MAIS)	The degree to which the accounting information system provides timely, relevant, and strategically useful information, underpinned by organizational readiness and managerial commitment.	Broadscope (5); Timeliness (3); Aggregation (5); Organizational Readiness (3); Owner/Managers Commitment (6); Government Support (3)	Z1–Z24 (24)	Likert 1–6; Yuliastanti et al. (2022); Thuan et al. (2022)
Business	Multi-dimensional managerial	Business Performance	Y1–	Likert 1–6;

Performance (BP)	perception of financial and non-financial organizational outcomes.		Y16 (16)	Handayani & Ali (2025)
Perceived Environmental Uncertainty (PEU)	The difficulty firms face in predicting changes in the legal, economic, and competitive environment.	Perceived Environmental Uncertainty	PEU1–PEU6 (6)	Likert 1–6; Quynh & Mai (2025)
Accounting Staff Qualification (ASQ)	The educational background and strategic competence of accounting personnel.	Accounting Staff Qualification	ASQ1–ASQ4 (4)	Likert 1–6; Quynh & Mai (2025)
Risk Acceptance Trends (ATR)	The organization's willingness to embrace uncertainty when implementing modern MA techniques.	Risk Acceptance Trends	ATR1–ATR3 (3)	Likert 1–6; Quynh & Mai (2025)

Table 1. Variable Operationalization
Source: compiled from various references

3.5 Model Specification

3.5.1 Main Structural Equation Model

The primary structural model evaluates both the direct and moderating effects specified in H1 through H7:

$$BP = \beta_0 + \beta_1 HC + \beta_2 SC + \beta_3 RC + \beta_4 MAIS + \beta_5 (HC \times MAIS) + \beta_6 (SC \times MAIS) + \beta_7 (RC \times MAIS) + \beta_8 PEU + \beta_9 ASQ + \beta_{10} ATR + \varepsilon$$

Where BP represents Business Performance; HC, SC, and RC denote the three intellectual capital components; MAIS denotes Management Accounting Information System Support measured as a higher-order construct integrating all six dimensions—Broadscope, Timeliness, and Aggregation from Yuliastanti et al. (2022) together with the novelty dimensions of Organizational Readiness, Owner/Managers Commitment, and Government Support from Thuan et al. (2022).

The interaction terms (HC × MAIS), (SC × MAIS), and (RC × MAIS) capture the moderating effects hypothesized in H5, H6, and H7 respectively. PEU, ASQ, and ATR serve as control variables. Interaction terms are computed using the product-indicator approach with standardized latent variable scores to minimize multicollinearity.

3.5.2 Sensitivity (Robustness) Analysis

A sensitivity analysis re-measures MAIS using only the traditional three dimensions from Yuliastanti et al. (2022)—Broadscope, Timeliness, and Aggregation (13 items)—excluding the novelty dimensions from Thuan et al. (2022), to validate whether effects persist under a narrower operationalization.. The robustness model is specified as:

$$BP = \beta_0 + \beta_1 HC + \beta_2 SC + \beta_3 RC + \beta_4 MAIS_alt + \beta_5 (HC \times MAIS_alt) + \beta_6 (SC \times MAIS_alt) + \beta_7 (RC \times MAIS_alt) + \beta_8 PEU + \beta_9 ASQ + \beta_{10} ATR + \varepsilon$$

In this specification, MAIS_alt represents MAIS measured using existing dimensions only (13 items from Yuliastanti et al. (2022), while all other parameters remain consistent with the main model. This analytical approach ensures that inferences about the determinants of business performance are statistically robust and not artifacts of any single operationalization of the MAIS construct.

IV. RESULTS

4.1 Sample Characteristics

A total of 860 questionnaires were distributed to corporate of 860 distributed questionnaires, 760 were returned (88.4%). After excluding 50 incomplete or patterned responses, 710 valid responses (82.6%) were analyzed, substantially exceeding the PLS-SEM ten-times rule minimum (Hair et al., 2019a).

Description	Total	Percentage
Questionnaires Distributed	860	100.0%
Questionnaires Returned	760	88.4%
Less:		
(1) Incomplete responses	(32)	(3.7%)
(2) Patterned responses	(18)	(2.1%)
Total Analyzed Questionnaires	710	82.6%

Table 1. Distribution of Questionnaire Return
Source: Primary data processed (2025).

The sample comprises qualified corporate informants: predominantly male (60.8%), aged 31–50 (81.7%), holding bachelor's (52.4%) or master's degrees (40.0%), serving as managers (43.2%) or supervisors (40.1%), primarily in Finance/Accounting (28.3%) and Strategy (22.5%), with 3–10 years of tenure (62.1%) across all twelve IDX sectors.

4.2 Descriptive Statistics

Table 2 presents descriptive statistics for all research variables, measured on a six-point Likert scale (1 = Strongly Disagree to 6 = Strongly Agree). The analysis reveals meaningful variation across constructs, confirming the dataset's suitability for structural equation modeling.

Variable	N	Mean	Std. Dev.	Min	Max
BP	710	3.904	1.082	1.00	6.00
HC	710	4.110	1.071	1.00	6.00
SC	710	3.799	1.112	1.00	6.00
RC	710	4.164	1.038	1.00	6.00
MAIS	710	3.777	1.119	1.00	6.00
PEU	710	4.277	1.045	1.00	6.00
ASQ	710	3.688	1.133	1.00	6.00
ATR	710	3.581	1.160	1.00	6.00

Table 2. Descriptive Statistics

Note: BP = Business Performance; HC = Human Capital; SC = Structural Capital; RC = Relational Capital; MAIS = Management Accounting Information System Support; PEU = Perceived Environmental Uncertainty; ASQ = Accounting Staff Qualification; ATR = Risk Acceptance Trends. All variables measured on 6-point Likert scale (1 = Strongly Disagree; 6 = Strongly Agree). Source: Primary data processed (SmartPLS 4.0, 2025).

All standard deviations are smaller than corresponding means, indicating homogeneous distributions. Among intellectual capital components, RC records the highest mean (4.164), followed by HC (4.110) and SC (3.799). MAIS support (M = 3.777) reflects moderate implementation levels, with Owner/Managers Commitment highest (4.018) and Government Support lowest (3.517) among sub-dimensions.

4.3 Correlation Analysis

Table 3 presents the correlation matrix using the Fornell-Larcker criterion (Fornell & Larcker, 1981), with the square roots of Average Variance Extracted (AVE) displayed on the diagonal.

	ASQ	ATR	BP	HC	MAIS	PEU	RC	SC
ASQ	**0.811**							
ATR	0.145	**0.855**						
BP	0.322	0.245	**0.776**					
HC	0.214	0.171	0.608	**0.795**				
MAIS	0.225	0.160	0.509	0.274	**0.650**			
PEU	−0.079	0.035	−0.281	−0.091	−0.094	**0.788**		
RC	0.124	0.087	0.283	0.146	0.191	−0.081	**0.837**	
SC	0.122	0.090	0.299	0.286	0.247	0.001	0.286	**0.774**

Table 3. Correlation Matrix (Fornell-Larcker Criterion)

Note: Diagonal elements (bold) represent the square root of AVE; off-diagonal elements represent inter-construct correlations. BP = Business Performance; HC = Human Capital; SC = Structural Capital; RC = Relational Capital; MAIS = Management Accounting Information System Support; PEU = Perceived Environmental Uncertainty; ASQ = Accounting Staff Qualification; ATR = Risk Acceptance Trends. Source: Primary data processed (SmartPLS 4.0, 2025).

BP exhibits the strongest correlation with HC (r = 0.608), followed by MAIS (r = 0.509), SC (r = 0.299), and RC (r = 0.283). PEU shows the expected negative correlation (r = −0.281). All inter-predictor correlations remain below 0.80, and each construct's √AVE exceeds its correlations with all others, confirming discriminant validity.

4.4 Diagnostics

Table 4 presents the construct reliability, convergent validity, and discriminant validity assessment results.

Construct	Cronbach's Alpha (α)	rho_a	Composite Reliability (ρc)	AVE
ASQ	0.827	0.829	0.885	0.658
ATR	0.816	0.817	0.891	0.731
BP	0.956	0.957	0.960	0.603
HC	0.854	0.856	0.895	0.632
MAIS	0.943	0.944	0.948	0.422
PEU	0.879	0.885	0.908	0.622
RC	0.893	0.896	0.921	0.700
SC	0.866	0.872	0.900	0.599

Table 4.Measurement Model Evaluation

Note: BP = Business Performance; HC = Human Capital; SC = Structural Capital; RC = Relational Capital; MAIS = Management Accounting Information System Support; PEU = Perceived Environmental Uncertainty; ASQ = Accounting Staff Qualification; ATR = Risk Acceptance Trends. Source: Primary data processed (SmartPLS 4.0, 2025).

The measurement model evaluation confirms robust psychometric properties across all constructs. Internal consistency reliability is established, with Cronbach's Alpha values ranging from 0.816 (ATR) to 0.956

(BP), and Composite Reliability (ρc) values ranging from 0.885 to 0.960. All values substantially exceed the recommended threshold of 0.700 (Hair et al., 2019a), confirming that the measurement items consistently represent their underlying constructs. Convergent validity is confirmed for seven of the eight constructs, as AVE values exceed the 0.500 threshold, ranging from 0.599 (SC) to 0.731 (ATR). MAIS registers an AVE of 0.422, below the 0.500 benchmark but expected given its higher-order nature integrating 25 indicators across six dimensions. With composite reliability of 0.948 and all outer loadings between 0.587–0.697 (above the 0.400 minimum; (Hair et al., 2019), the construct is retained as psychometrically acceptable.

	ASQ	ATR	BP	HC	MAIS	PEU	RC	SC
ASQ								
ATR	0.176							
BP	0.359	0.277						
HC	0.250	0.204	0.672					
MAIS	0.252	0.181	0.533	0.303				
PEU	0.098	0.058	0.303	0.103	0.103			
RC	0.143	0.101	0.304	0.169	0.207	0.090		
SC	0.142	0.111	0.326	0.332	0.273	0.046	0.325	

Table 5. Discriminant Validity (HTMT Ratio)

Note: BP = Business Performance; HC = Human Capital; SC = Structural Capital; RC = Relational Capital; MAIS = Management Accounting Information System Support; PEU = Perceived Environmental Uncertainty; ASQ = Accounting Staff Qualification; ATR = Risk Acceptance Trends. Source: Primary data processed (SmartPLS 4.0, 2025).

All outer loadings exceed 0.700 (range: 0.710–0.868), VIF values range from 1.030 to 1.213 (below 3.300), and all HTMT ratios remain below 0.850 (highest: HC-BP at 0.672). The SRMR of 0.041 is well below the 0.080 threshold, confirming acceptable model fit.

4.5 Structural Model and Hypothesis Testing

The structural model demonstrates substantial explanatory power. The coefficient of determination (R^2) for BP is 0.596 (adjusted $R^2 = 0.590$), indicating that the model explains 59.6% of the variance in Business Performance. The Stone-Geisser Q^2predict value of 0.580 substantially exceeds zero, confirming the model's predictive relevance. Table 6 presents the structural model results, comparing Model 1 (full MAIS with novelty dimensions) with Model 2 (sensitivity analysis using traditional MAIS dimensions only) for robustness verification.

Path	Predicted Direction	Model 1: Novelty (MAIS - 6 Dimensions)			Model 2: Sensitivity (MAIS - 3 Dimensions)			Result
		Coef.	t-stat	p-value	Coef.	t-stat	p-value	
HC → BP	(+) Positive	0.452	18.870	0.000***	0.455	18.870	0.000***	H1 Supported
SC → BP	(+) Positive	0.048	1.820	0.034**	0.055	1.820	0.034**	H2 Supported
RC → BP	(+) Positive	0.108	4.390	0.000***	0.107	4.390	0.000***	H3 Supported
MAIS → BP	(+) Positive	0.291	10.868	0.000***	0.277	10.868	0.000***	H4 Supported
MAIS × HC → BP	(+) Strengthens	0.118	4.849	0.000***	0.123	4.849	0.000***	H5 Supported
MAIS × SC → BP	(+) Strengthens	0.039	1.458	0.072*	0.038	1.458	0.072*	H6 Not Supported
MAIS × RC → BP	(+) Strengthens	−0.007	0.304	0.381	−0.019	0.304	0.381	H7 Not Supported
PEU → BP	Control	−0.197	7.906	0.000***	−0.201	7.906	0.000***	Significant
ASQ → BP	Control	0.113	4.602	0.000***	0.120	4.602	0.000***	Significant
ATR → BP	Control	0.102	4.127	0.000***	0.099	4.127	0.000***	Significant
R^2		0.596			0.588			
R^2 Adjusted		0.590			0.582			
Q^2predict		0.580			0.571			
SRMR		0.041			0.039			
BIC		−572.743			−558.031			

Table 6. Structural Model Results and Robustness Check

Model 1: $BP = \beta_0 + \beta_1 HC + \beta_2 SC + \beta_3 RC + \beta_4 MAIS + \beta_5 (HC \times MAIS) + \beta_6 (SC \times MAIS) + \beta_7 (RC \times MAIS) + \beta_8 PEU + \beta_9 ASQ + \beta_{10} ATR + \varepsilon$

Model 2: $BP = \beta_0 + \beta_1 HC + \beta_2 SC + \beta_3 RC + \beta_4 MAIS_Alt + \beta_5 (HC \times MAIS_Alt) + \beta_6 (SC \times MAIS_Alt) + \beta_7 (RC \times MAIS_Alt) + \beta_8 PEU + \beta_9 ASQ + \beta_{10} ATR + \varepsilon$

*Note: ***p ≤ 0.01; **p ≤ 0.05; *p ≤ 0.10; Bootstrap samples = 5,000. BP = Business Performance; HC = Human Capital; SC = Structural Capital; RC = Relational Capital; MAIS = Management Accounting Information System Support; PEU = Perceived Environmental Uncertainty; ASQ = Accounting Staff Qualification; ATR = Risk Acceptance Trends. Model 1 operationalizes MAIS with 6 dimensions (25 items, including novelty dimensions Organizational Readiness, Owner/Managers Commitment, and Government Support from Thuan et al., 2022). Model 2 operationalizes MAIS with 3 traditional dimensions only (13 items: Broadscope, Timeliness, Aggregation from Yuliastanti et al., 2022). N = 710. Source: Authors' calculations (SmartPLS 4.0).*

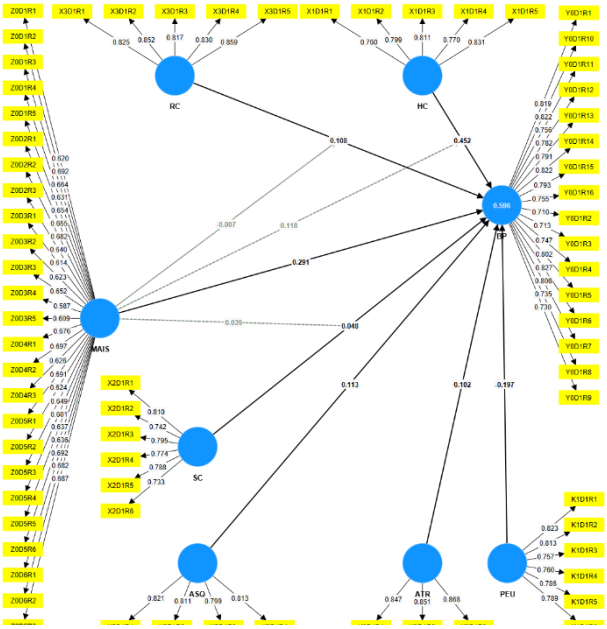


Figure 1. Path Coefficients Model 1 (Novelty)

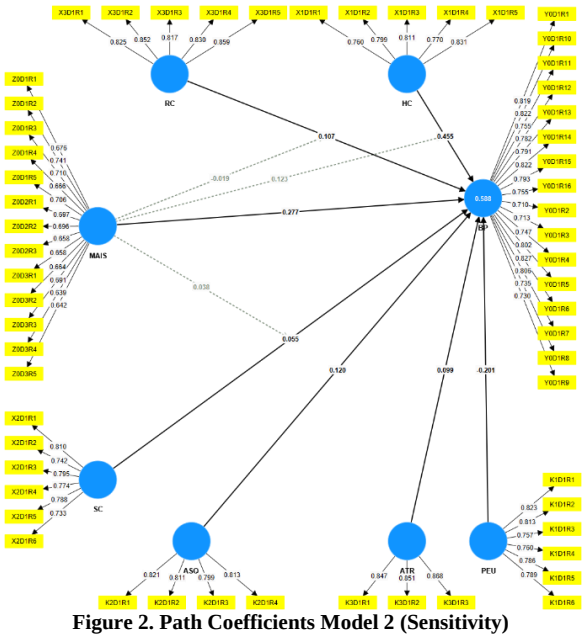


Figure 2. Path Coefficients Model 2 (Sensitivity)

The results indicate that Human Capital has a positive and significant effect on Business Performance (β = 0.452, t = 18.870, p < 0.01), supporting H1. This finding confirms that firms whose employees possess higher levels of knowledge, skills, creativity, and problem-solving capability achieve superior multi-dimensional performance outcomes. The effect size is substantial (f^2 = 0.419), representing the largest

individual contribution among all predictors and indicating a large practical significance. Structural Capital also exerts a positive effect on BP ($\beta = 0.048$, $t = 1.820$, $p = 0.034$), supporting H2 at the 5% significance level. However, the effect size is negligible ($f^2 = 0.005$), suggesting that while the direction aligns with theoretical expectations, the incremental contribution of organizational systems and processes to performance is marginal after controlling for other intellectual capital components. Relational Capital demonstrates a positive and significant effect on BP ($\beta = 0.108$, $t = 4.390$, $p < 0.01$), supporting H3, with a small effect size ($f^2 = 0.026$). This confirms that external relationships with customers, suppliers, and strategic partners contribute meaningfully to organizational performance.

MAIS support exerts a positive and significant direct effect on BP ($\beta = 0.291$, $t = 10.868$, $p < 0.01$), supporting H4, with a medium effect size ($f^2 = 0.178$). This finding establishes that management accounting information systems providing timely, broad-scope, and aggregated information—underpinned by organizational readiness and managerial commitment—independently enhance business performance.

Regarding the moderation hypotheses, the interaction term MAIS × HC is positive and significant ($\beta = 0.118$, $t = 4.849$, $p < 0.01$), indicating that MAIS support strengthens the positive effect of Human Capital on Business Performance; H5 is supported. The corresponding effect size ($f^2 = 0.031$) indicates a small but meaningful moderating influence. This confirms the contingency argument: the return on human capital investments increases when the informational architecture enables employees' knowledge and creativity to be translated into better-informed strategic decisions. The interaction term MAIS × SC is positive but statistically insignificant at the conventional 5% level ($\beta = 0.039$, $t = 1.458$, $p = 0.072$), although marginally significant at the 10% level; H6 is not supported. The effect size is negligible ($f^2 = 0.003$). The interaction term MAIS × RC is negative and statistically insignificant ($\beta = -0.007$, $t = 0.304$, $p = 0.381$), indicating that MAIS support does not significantly moderate the effect of Relational Capital on Business Performance; H7 is not supported. The effect size is essentially zero ($f^2 = 0.000$).

All three control variables are statistically significant. Perceived Environmental Uncertainty exerts a negative effect on BP ($\beta = -0.197$, $t = 7.906$, $p < 0.01$), confirming that uncertainty in the legal, economic, and competitive environment constrains firm performance. Accounting Staff Qualification exhibits a positive effect ($\beta = 0.113$, $t = 4.602$, $p < 0.01$), as does Risk Acceptance Trends ($\beta = 0.102$, $t = 4.127$, $p < 0.01$). The significance of these controls affirms that the core independent variables operate after accounting for the influence of environmental conditions, staff competence, and organizational risk orientation.

4.6 Robustness Analysis

The sensitivity analysis comparing Model 1 (full MAIS measurement incorporating all six dimensions including the novelty Organizational Readiness, Owner/Managers Commitment, and Government Support from Thuan et al., 2022) with Model 2 (traditional MAIS measurement using only Broadscope, Timeliness, and Aggregation from Yuliastanti et al., 2022) confirms the stability of the results. Path coefficients remain highly consistent across both specifications: HC ranges from 0.452 to 0.455, SC from 0.048 to 0.055, RC from 0.107 to 0.108, and MAIS from 0.277 to 0.291. The significance patterns are identical, with the same five of seven hypotheses supported and the same two hypotheses (H6 and H7) rejected in both models.

Model 1 achieves marginally superior explanatory power ($R^2 = 0.596$ vs. 0.588; adjusted $R^2 = 0.590$ vs. 0.582), higher predictive relevance ($Q^2predict = 0.580$ vs. 0.571), and a lower BIC value (−572.743 vs. −558.031), indicating better parsimony-adjusted model fit. The improvement in MAIS's direct path coefficient under Model 1 (0.291 vs. 0.277) suggests that the novelty dimensions—Organizational Readiness, Owner/Managers Commitment, and Government Support—contribute meaningful explanatory power beyond the traditional information characteristic dimensions. The AVE for MAIS improves from 0.422 in Model 1 to 0.464 in Model 2, reflecting the expected trade-off: fewer heterogeneous dimensions produce marginally higher convergent validity per indicator, yet the broader operationalization in Model 1 captures a more comprehensive picture of MAIS as an organizational capability rather than merely an information product. The stability of the moderation results across both models—with MAIS × HC remaining significant and MAIS × SC and MAIS × RC remaining insignificant—validates that the identified interaction effects are methodologically robust and not artifacts of any single operationalization of the MAIS construct.

V. DISCUSSION

5.1 Human Capital Has a Positive Effect on Business Performance

The results confirm that human capital exerts a positive and significant effect on business performance, thereby supporting this hypothesis. This finding is consistent with the Resource-Based View, which posits that the knowledge, skills, creativity, and problem-solving abilities embedded in an organization's workforce constitute valuable, rare,

and inimitable resources that drive competitive advantage and superior outcomes. When employees possess high levels of expertise and experience, they generate innovative solutions, accelerate decision-making, and enable the firm to respond adaptively to market shifts—mechanisms that collectively strengthen both financial returns and non-financial performance dimensions such as customer satisfaction and operational responsiveness.

This finding aligns with prior studies across diverse contexts (Aljuboori et al., 2022; Firmansyah et al., 2025; Tran et al., 2022; Victoria & Nuryasman, 2020; Xu & Liu, 2020), reinforcing the generalizability of the human capital–performance link.

The strong effect observed in this study—the largest among all predictors—suggests that among Indonesian listed firms, workforce capability represents the most critical intangible asset for driving performance. This may reflect the labour-intensive nature of many IDX sectors, where the quality of human judgment and expertise directly shapes operational efficiency, customer engagement, and strategic adaptation. From a practical standpoint, firms seeking to enhance business performance should prioritize sustained investments in talent acquisition, skill development, and knowledge retention rather than treating human capital as a residual factor.

5.2 Structural Capital Has a Positive Effect on Business Performance

The test results show that structural capital has a positive effect on business performance, so this hypothesis is accepted. However, the effect is notably weak relative to human capital and relational capital, indicating that while organizational systems, processes, routines, and cultural infrastructure contribute positively to performance, their incremental impact is marginal after accounting for other intellectual capital components. This finding is consistent with the Knowledge-Based View, which argues that codified organizational knowledge—when embedded in systems and procedures—enables scalability and operational consistency. Yet the modest magnitude suggests that the mere existence of structural infrastructure does not automatically yield strong performance gains without complementary resources to activate it.

This weak effect is consistent with the mixed evidence: positive effects reported by Firmansyah et al. (2025) and Pangidoan (2022), but insignificant effects found by Aljuboori et al. (2022), Victoria & Nuryasman (2020), and Xu & Liu (2020).

The weak effect may reflect implementation complexity: maintaining organizational systems entails coordination costs that offset efficiency gains, particularly across heterogeneous sectors. Structural capital operates more as a necessary condition than a sufficient driver, requiring human agency to become productive.

5.3 Relational Capital Has a Positive Effect on Business Performance

The results show that relational capital has a positive and significant effect on business performance, so this hypothesis is accepted. This finding is in line with the Resource-Based View, which frames trust, loyalty, long-term customer relationships, supplier partnerships, and strategic alliances as socially complex resources that accumulate over time and are costly for competitors to replicate. Through sustained stakeholder engagement and collaborative network maintenance, relational capital enables firms to retain customers, anticipate market demands, and secure preferential access to external resources—all of which translate into enhanced performance. The moderate effect is consistent with the mixed literature: positive effects (Firmansyah et al., 2025; Tran et al., 2022) coexist with insignificant (Aljuboori et al., 2022; Pangidoan, 2022) and negative findings (Xu & Liu, 2020), suggesting that relational investments do not automatically translate into financial gains.

Indonesian listed firms derive tangible value from external relationships, but conversion into performance requires ongoing management effort. Firms investing in relational assets for symbolic purposes without translating them into operational advantages may experience diminishing returns.

5.4 MAIS Support Strengthens the Positive Effect of Human Capital on Business Performance

The interaction between MAIS support and human capital is positive and significant, confirming that MAIS strengthens the effect of human capital on business performance. This hypothesis is accepted. Following the moderation typology proposed by Sharma et al. (1981), MAIS functions as a quasi-moderator in this relationship because it both interacts significantly with human capital and exerts a significant direct effect on business performance. A quasi moderator simultaneously operates as an independent predictor and a contingency factor, meaning that MAIS not only amplifies the performance returns of human capital but also contributes independently to organizational outcomes.

Consistent with Contingency Theory, high MAIS support provides the decisional architecture enabling managers to translate employee insights into effective actions, reducing knowledge loss and accelerating coordination, thereby amplifying human capital returns.

The significant moderating effect confirms the theoretical proposition advanced in this study:

intellectual capital requires an enabling information infrastructure to realize its full potential. Human capital, as the most potent direct predictor of performance, benefits disproportionately from strong MAIS support because creative and knowledgeable employees can only drive superior outcomes when their insights are channelled through systematic, information-rich decision processes rather than ad hoc or poorly informed managerial judgment.

5.5 MAIS Support Does Not Strengthen the Positive Effect of Structural Capital on Business Performance

The interaction between MAIS support and structural capital is positive but statistically insignificant at the conventional significance level, so this hypothesis is rejected. Following Sharma et al. (1981), MAIS operates as a predictor moderator in the structural capital–performance relationship. Because MAIS has a significant direct effect on performance but fails to interact significantly with structural capital, it functions purely as an independent predictor rather than a boundary condition in this specific pathway.

This non-significance reflects conceptual overlap: structural capital and MAIS share organizational infrastructure characteristics, potentially representing substitutable rather than complementary resources where enhancing one yields diminishing returns when the other is well-developed.

This interpretation is consistent with the weak direct effect of structural capital itself (H2). If structural capital's contribution to performance is already marginal, then even a well-functioning MAIS would have limited scope to amplify an inherently modest relationship. Chung & Su (2012)demonstrate that broad-scope management accounting information does not directly enhance managerial performance, operating instead through mediating mechanisms such as role clarity—a finding that underscores the conditional and indirect nature of information system effects. The result suggests that for structural capital specifically, the pathway to enhanced performance may require mediating mechanisms (such as innovation capability or process optimization) rather than the amplifying function that moderation implies.

5.6 MAIS Support Does Not Strengthen the Positive Effect of Relational Capital on Business Performance

The interaction between MAIS support and relational capital is negative and statistically insignificant, indicating that MAIS does not moderate the relational capital–performance relationship. This hypothesis is rejected. Applying the Sharma et al. (1981) typology, MAIS operates as a predictor moderator in this relationship—significant as a direct predictor of performance but failing to interact meaningfully with relational capital. MAIS therefore does not serve as a boundary condition for the conversion of relational assets into performance gains.

The non-significant result reflects a misalignment: relational capital operates through qualitative, trust-based mechanisms with external stakeholders, while MAIS is internally oriented. Formalizing relational processes through accounting metrics may not align with—and could potentially undermine—the informal trust characterizing productive external relationships.

This finding resonates with the broader empirical pattern in the relational capital literature. Ramírez-solis et al. (2022)note that relational capital's effect on firm performance is weaker than its effect on innovation, suggesting that relational assets generate value through qualitative mechanisms that are not easily captured or amplified by formal information systems. The result implies that for relational capital, alternative moderating mechanisms—such as organizational absorptive capacity, strategic networking practices, or customer relationship management systems specifically designed for external engagement—may be more relevant boundary conditions than internally focused accounting information systems.

5.7 MAIS Support Has a Positive Effect on Business Performance

The results confirm that MAIS support exerts a positive and significant direct effect on business performance, representing the second-largest individual contribution after human capital. This hypothesis is accepted. The finding is consistent with Contingency Theory, which argues that organizations achieving alignment between their information systems and strategic decision needs realize superior outcomes. Management accounting information systems that provide timely, broad-scope, and appropriately aggregated information reduce decision uncertainty, improve resource allocation, and enhance managerial planning and control—all of which contribute directly to both financial and non-financial performance dimensions.

While Chung & Su (2012) find no direct MAIS–managerial performance link, the present study documents a robust association at the organizational level, likely attributable to the comprehensive higher-order operationalization capturing system capability beyond narrow information quality measures.

The robustness analysis confirms that the six-dimension operationalization achieves superior explanatory power, suggesting that viewing MAIS purely as an information product underestimates its role. Complementary investments in workforce readiness, leadership engagement, and regulatory frameworks are necessary to realize full system potential.

VI. CONCLUSION AND IMPLICATIONS

6.1 Conclusion

This study examined the effects of human capital, structural capital, and relational capital on business performance among IDX-listed firms, testing the moderating role of MAIS support using PLS-SEM.

The findings reveal that all three intellectual capital components positively affect business performance, with human capital emerging as the most potent driver, followed by relational capital and then structural capital. MAIS support exerts a substantial direct positive effect on performance, confirming its independent strategic value. Regarding the contingency function, MAIS significantly strengthens the human capital–performance relationship, validating the theoretical proposition that an enabling information infrastructure amplifies the returns on workforce knowledge and creativity. However, MAIS does not significantly moderate the structural capital–performance or relational capital–performance pathways, suggesting that the contingent role of accounting information systems is selective rather than universal across intellectual capital dimensions. A sensitivity analysis comparing the comprehensive six-dimension MAIS operationalization against the traditional three-dimension measure confirms the robustness of all structural relationships across both specifications.

6.2 Theoretical Implications

This study advances intellectual capital theory by demonstrating that the relationship between intangible assets and firm performance is not uniformly direct but selectively contingent on the management accounting information architecture. The integration of the Resource-Based View and Knowledge-Based View with Contingency Theory provides a more nuanced theoretical lens than prior studies that treat intellectual capital components as independently sufficient predictors. The finding that MAIS moderates the human capital–performance link but not the structural or relational capital pathways refines the contingency argument: information systems amplify people-dependent resources whose value hinges on decision quality, but they do not meaningfully enhance infrastructure-based or relationship-based assets that operate through different causal mechanisms.

Methodologically, the higher-order MAIS operationalization integrating traditional information characteristics with implementation-oriented dimensions captures MAIS as an organizational capability, validated by superior explanatory power over traditional specifications.

6.3 Practical Implications

Firms should prioritize coordinated investments in workforce development and accounting information infrastructure, as investing in talent without complementary information systems—or vice versa—yields suboptimal returns.

Second, the significant direct effect of MAIS underscores that management accounting systems are not merely support functions but independent contributors to organizational performance. Corporate leaders should treat MAIS development as a strategic priority, investing not only in information technology but also in organizational readiness (financial and technological preparedness), leadership commitment to system adoption, and alignment with government regulatory expectations. The finding that managerial commitment records the highest mean among MAIS sub-dimensions while government support records the lowest suggests an opportunity for policymakers to strengthen regulatory frameworks and incentive structures that encourage AIS adoption among listed firms.

Third, the non-significant moderation of MAIS on the structural and relational capital pathways signals that different intellectual capital components require distinct managerial approaches. Structural capital may benefit more from process optimization and innovation management interventions than from enhanced accounting information, while relational capital may require dedicated customer relationship management tools and partnership governance mechanisms rather than internally focused accounting systems.

6.4 Limitations and Future Research Directions

Several limitations warrant acknowledgment. First, the cross-sectional design captures associations at a single point in time and cannot establish temporal causality. Future research should adopt longitudinal or panel designs to track how changes in intellectual capital and MAIS support affect performance trajectories over multiple periods. Second, the reliance on self-reported perceptual measures introduces the possibility of common method bias, despite procedural safeguards. Subsequent studies could triangulate survey data with archival financial indicators through mixed-methods approaches to strengthen causal inference.

Third, this study tests MAIS exclusively as a moderator. The non-significant moderation on two pathways raises the possibility that MAIS may operate as a mediator rather than a moderator for structural and relational capital—transmitting their effects through enhanced information quality rather than amplifying direct relationships. Future research should compare mediating and moderating specifications to clarify the precise mechanism through which MAIS interacts with different intellectual capital dimensions. Fourth, the study focuses exclusively on Indonesian listed firms, which

limits cross-national generalizability. Comparative studies across emerging and developed economies with varying institutional environments, accounting standards maturity, and digital infrastructure levels would help establish the boundary conditions of the observed relationships.

Finally, future research should explore non-linear specifications that may reveal diminishing returns at extreme investment levels, and investigate additional moderators such as firm size, digital maturity, or corporate governance quality.

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