

Modeling and Optimizing Principal Managerial Effectiveness: The Role of Digital Leadership, Data Literacy, Religiosity, and Work Motivation

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Abstract

Keywords:

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The rapid digital transformation of vocational education demands adaptive leadership, yet principal managerial effectiveness often lags behind evolving expectations. Addressing this gap, this study developed and validated an integrative model that examines the direct and indirect influences of digital leadership, data literacy, religiosity, and organizational support on principals' managerial effectiveness, mediated by work motivation. Using a quantitative explanatory design, survey data were gathered from 206 teachers across 19 private vocational high schools (SMK PGRI) in Jakarta, Indonesia. Data were analyzed using Structural Equation Modeling-Partial Least Squares (SEM-PLS) via SmartPLS 4.0 and optimized using the SITOREM method. The structural model explained 88.8% of the variance in managerial effectiveness ($R^2 = 0.888$). Results reveal that digital leadership, data literacy, and religiosity exert significant direct positive effects on managerial effectiveness. Crucially, work motivation emerged as a powerful complementary partial mediator that translates personal competencies and spiritual values into administrative action. Conversely, organizational support showed a non-significant direct effect on managerial effectiveness. SITOREM optimization identified technology utilization, decision-making, and data analysis skills as immediate improvement priorities. This study concludes that enhancing principal effectiveness requires an integrated strategy that blends digital capabilities with values-based spiritual leadership, rooted in intrinsic motivation. Despite cross-sectional and contextual limitations, these results offer a concrete roadmap for evidence-based educational management.

Kata Kunci:

Kepemimpinan Digital, Literasi Data, Religiositas, Motivasi Kerja, Efektivitas Manajerial, Pendidikan Vokasi.

Abstrak.

Akselerasi transformasi digital di sekolah menengah kejuruan (SMK) menuntut kepemimpinan yang adaptif, namun efektivitas manajerial kepala sekolah sering kali tertinggal dari tuntutan zaman. Menjawab kesenjangan ini, penelitian ini mengonstruksi dan memvalidasi model integratif untuk menguji pengaruh langsung dan tidak langsung dari kepemimpinan digital, literasi data, religiusitas, dan dukungan organisasi terhadap efektivitas manajerial kepala sekolah, yang dimediasi oleh motivasi kerja. Menggunakan desain eksplanatori kuantitatif, data survei dikumpulkan dari 206 guru di 19 SMK swasta PGRI di Jakarta, Indonesia. Data dianalisis menggunakan Structural Equation Modeling-Partial Least Squares (SEM-PLS) dengan SmartPLS 4.0 dan dioptimalkan menggunakan metode SITOREM. Model struktural mampu menjelaskan 88,8% varians efektivitas manajerial ($R^2 = 0,888$). Hasil penelitian menunjukkan bahwa kepemimpinan digital, literasi data, dan religiusitas berpengaruh positif dan signifikan secara langsung terhadap efektivitas manajerial. Motivasi kerja terbukti berperan penting sebagai mediator parsial komplementer yang menerjemahkan kompetensi pribadi dan nilai spiritual menjadi tindakan manajerial. Sebaliknya, dukungan organisasi tidak berpengaruh signifikan terhadap efektivitas manajemen. Optimalisasi SITOREM mengidentifikasi pemanfaatan teknologi untuk pengambilan keputusan dan keterampilan analisis

data sebagai prioritas perbaikan utama. Penelitian ini menyimpulkan bahwa peningkatan efektivitas kepala sekolah memerlukan strategi terpadu yang memadukan kapabilitas digital dan kepemimpinan spiritual berbasis nilai, yang dijumpai oleh motivasi kerja. Meskipun memiliki keterbatasan desain cross-sectional dan cakupan kontekstual, temuan ini memberikan panduan konkret bagi manajemen pendidikan berbasis bukti.

INTRODUCTION

The global push towards a digital and sustainable economy has placed vocational education and training (TVET) at the forefront of education reform (UNESCO, 2022). In Indonesia, Vocational High Schools (SMK) are under immense pressure to produce graduates relevant to an increasingly complex and technology-driven job market (Kemendikbudristek, 2023). In this transformational context, the role of the school principal is crucial. The digital transformation sweeping through educational institutions is not merely about adopting new software, but involves shifting paradigms in how schools are led and managed to drive sustained educational quality (Area-Moreira et al., 2023; Sheninger, 2019). Consequently, the quality of school transformation is fundamentally linked to the quality of leadership and managerial effectiveness of the principal, which extends beyond routine administration to strategic change management (Mergoni et al., 2026). The demands on the role of the school principal in the era of digital transformation are no longer merely administrative; rather, they position the principal as an agent of change and a catalyst for modern educational transformation.

Successful school leadership is consistently associated with positive school outcomes, including improved student achievement and teacher commitment (Leithwood et al., 2020). Recent literature has emphasized the need for school principals to lead the digital transformation of the education sector (Alshammari & Alshammari, 2024; Ananto & Supardi, 2025) and to develop specific digital leadership roles and technological capabilities (Sulistiyani et al., 2021). Effective digital leadership goes hand-in-hand with managerial effectiveness, as principals must empower teachers to integrate technology in increasingly demanding and innovative instructional ways (Schmitz et al., 2023). However, there is often a significant gap between expected high performance and actual managerial capabilities in the field. A meta-analysis of data-driven school leaders confirmed that while data use is crucial for school effectiveness, the translation of data into leadership practices remains inconsistent (C. Lee & Kim, 2024).

Data-driven decision-making for school improvement requires not only access to data but also the capacity to interpret and act on it (Schildkamp, 2019). Furthermore, the transformation of principal leadership in the digital era requires not only technical system infrastructure but also high information quality, adaptive, and value-based strategies (Azzukhrufi et al., 2026; Murtiningsih et al., 2025; Rahmi & Putri, 2025). Focusing on ethical values, clear vision, teamwork, and effective communication is critical to building a culture of high productivity and psychological safety within educational organizations (Mercader et al., 2021). Existing literature has explored factors influencing managerial effectiveness, but mostly in isolation. Studies confirm the positive role of digital leadership in driving technology integration and school transformation (AlAjmi, 2022; Navaridas-Nalda et al., 2020), while school technology leadership directly influences teacher technology use (Anderson & Dexter, 2005; Dexter, 2011).

Similarly, data literacy is essential for evidence-based decision-making and educator preparation (Aksu & Demir, 2022; Mandinach, 2022). Organizational support and spiritual leadership, aligned with religiosity, foster positive work attitudes, team innovation, and psychological safety (Fry, 2003; Fry & Kriger, 2018). In educational organizations, religiosity reflects the internalization of religious values in leadership behavior rather than formal symbolism

(Malik et al., 2023). However, these factors are rarely integrated into a cohesive model. Current literature lacks explanation of how these resources translate into effective managerial behavior, creating a critical theoretical and practical gap.

This study's primary aim is to address this gap by developing and testing an integrated model for strengthening principals' managerial effectiveness. The novelty lies in its conceptual integration of digital leadership, data literacy, religiosity (conceptualized as a form of spiritual leadership), and organizational support, with work motivation as a central mediator. Unlike previous studies that examined partial relationships, this research proposes a holistic framework where these four exogenous variables influence managerial effectiveness both directly and indirectly through the energizing force of work motivation. This approach is particularly relevant in the Indonesian context, where cultural and religious values interplay with technological imperatives in school management, as highlighted by recent studies on short-cycle school improvement planning (Rahman & Hakim, 2023) and adaptive leadership practices (Wahyuni & Kurniawan, 2024).

This SITOREM test is used to measure the strength of the relationship or influence, analyze indicator weights, and analyze indicator values. The final result of the SITOREM analysis is a priority order of indicators that need improvement and indicators that should be maintained or developed (Hardhienata, 2017). Based on self-determination theory, autonomy, competence, and relatedness drive intrinsic motivation (Eyal & Roth, 2011; Jesus & Lens, 2005). This means that principals who experience digital leadership support, possess data literacy, and internalize religious values will demonstrate higher work motivation, which in turn increases their managerial effectiveness. The main argument to be tested is that strengthening digital leadership, data literacy, and religiosity among principals will not only directly improve their managerial skills but also significantly enhance their work motivation, thereby serving as a powerful bridge to sustainable and effective managerial action.

METHOD

A quantitative explanatory design was adopted to examine statistical associations, predictive relationships, and mediating mechanisms among leadership, organizational, and psychological constructs rather than temporal causality (Riyanto, 2001). The study was conducted from October 2025 to June 2026 and focused on private vocational high schools (SMK PGRI) across the Special Capital Region of Jakarta, Indonesia. The target population comprised 421 active teachers distributed across 19 private vocational high schools (Ishtiaq, 2019). Given the stratified structure of the population across distinct institutional sites, the sample size was calculated using Cochran's 1977 stratified random sampling formula. With a 5% margin of error and a conservative proportion assumption ($p = 0.5$), the initial minimum sample requirement was determined to be 188 respondents. To safeguard against incomplete responses and nonresponse bias, the target sample size was increased by 10%, resulting in a final sample of 206 teachers (Saldana, 2011).

Data were gathered using a structured questionnaire on a 5-point Likert scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The instrument operationalized six primary constructs: Managerial Effectiveness (Y), Digital Leadership (X1), Data Literacy (X2), Religiosity (X3), Organizational Support (X4), and Work Motivation (X5). Measurement items were adapted from established literature and validated scales (Aksu & Demir, 2022; Sulistiyan et al., 2021). The instrument underwent a pilot test with 30 non-sample teachers. Item validity was confirmed using Pearson item-to-total correlations ($r \geq 0.361$, $\alpha = 0.05$), while internal consistency was established

across all constructs with Cronbach's alpha values exceeding the standard reliability threshold of 0.70 (Hair et al., 2022). Table 1 summarizes the operational conceptualization, measurement scales, and underlying literature for all research variables.

Table 1. Operationalization of Research Variables

Variable	Role	Operational Definition	Measurement Scale
Managerial Effectiveness (Y)	Dependent Variable (Endogenous)	The degree to which school principals achieve organizational goals, execute strategic change, maintain administrative efficiency, and foster instructional quality.	5-Point Likert Scale (1 = Strongly Disagree to 5 = Strongly Agree)
Digital Leadership (X1)	Independent Variable (Exogenous)	The principal's capability to lead digital transformation, foster an innovative tech culture, and empower educators in utilizing educational technology.	5-Point Likert Scale (1–5)
Data Literacy (X2)	Independent Variable (Exogenous)	The capability of principals to collect, analyze, interpret, and translate educational data into actionable, evidence-based decisions.	5-Point Likert Scale (1–5)
Religiosity (X3)	Independent Variable (Exogenous)	The degree of internalization of religious and ethical values reflected in leadership practices, workplace behavior, and decision-making.	5-Point Likert Scale (1–5)
Organizational Support (X4)	Independent Variable (Exogenous)	The extent to which principals perceive that the foundation or educational institution values their contributions and supports their professional well-being.	5-Point Likert Scale (1–5)
Work Motivation (X5)	Mediating Variable (Intervening)	The intrinsic psychological drive that energizes, directs, and sustains principals' managerial behavior, grounded in Self-Determination Theory.	5-Point Likert Scale (1–5)

Source: Synthesized from Literature Review (2026)

Data analysis followed a structured two-stage analytical strategy. In the first stage, Structural Equation Modeling–Partial Least Squares (SEM-PLS), implemented in SmartPLS version 4.0, was employed to evaluate both the measurement (*outer*) and structural (*inner*) models (Indrati et al., 2025). Measurement evaluation included testing convergent validity (item loadings, average variance extracted), discriminant validity (*Fornell-Larcker criterion*, *HTMT*), and composite reliability, while the structural model assessed path coefficients, coefficient of determination (R^2), effect sizes (f^2), and hypothesis significance for direct and mediating effects (Hair et al., 2022). In the second stage, the Scientific Identification Theory to Conduct Operation Research in Education Management (SITOREM) method was implemented to synthesize empirical findings into actionable managerial interventions (Hardhienata, 2017).

RESULTS AND DISCUSSION

Results

Evaluation of the Measurement Model

The assessment of the measurement model involved evaluating convergent validity, internal consistency reliability, and discriminant validity. Convergent validity was confirmed, as all item factor loadings exceeded the recommended threshold of 0.70 (ranging from 0.742 to 0.915).

Internal consistency was demonstrated through Cronbach's alpha (α) and Composite Reliability (CR), where all constructs surpassed the 0.70 benchmark, indicating high reliability. Furthermore, the Average Variance Extracted (AVE) for each construct exceeded 0.50, indicating that each construct explained more than half of the variance in its indicators (*Table 2*).

Table 2. Measurement Model Quality Assessment

Construct	Loading Range	Cronbach's Alpha (α)	Composite Reliability (CR)	Average Variance Extracted (AVE)	Status
Digital Leadership (X1)	0.768 – 0.885	0.865	0.908	0.712	Valid & Reliable
Data Literacy (X2)	0.742 – 0.860	0.832	0.888	0.665	Valid & Reliable
Religiosity (X3)	0.795 – 0.912	0.891	0.925	0.754	Valid & Reliable
Organizational Support (X4)	0.780 – 0.894	0.874	0.914	0.726	Valid & Reliable
Work Motivation (X5)	0.801 – 0.905	0.887	0.922	0.747	Valid & Reliable
Managerial Effectiveness (Y)	0.755 – 0.915	0.912	0.935	0.741	Valid & Reliable

Source: Primary data processed, 2026

Discriminant validity was assessed using both the Fornell-Larcker criterion and the Heterotrait-Monotrait ratio of correlations (HTMT). As presented in *Table 3*, the square root of the AVE for each construct (diagonal values in bold) was greater than its highest correlation with any other construct. Additionally, all HTMT values remained well below the conservative threshold of 0.85 (ranging from 0.412 to 0.812), thereby rigorously establishing discriminant validity across all constructs.

Table 3. Discriminant Validity Matrix (Fornell-Larcker and HTMT Ratio)

Construct	X1	X2	X3	X4	X5	Y
Digital Leadership (X1)	0.844	0.512	0.618	0.702	0.754	0.782
Data Literacy (X2)	0.445	0.815	0.412	0.485	0.589	0.612
Religiosity (X3)	0.552	0.368	0.868	0.812	0.724	0.765
Organizational Support (X4)	0.628	0.421	0.742	0.852	0.698	0.710
Work Motivation (X5)	0.685	0.518	0.654	0.621	0.864	0.798
Managerial Effectiveness (Y)	0.710	0.542	0.692	0.635	0.725	0.861

Source: Primary data processed, 2026

Evaluation of the Structural Model

The structural model was evaluated after establishing measurement validity. Model fit diagnostics indicated a good fit, with a Standardized Root Mean Square Residual (SRMR) of 0.034, which is well below the standard 0.08 cutoff. Predictive relevance was assessed via R^2 and Stone-Geisser's Q^2 values obtained from PLS Predict.

Table 4. Structural Model Predictive Power (R^2 and Q^2)

Endogenous Variable	R^2	Adjusted R^2	Q^2 ($Q_{\text{predict}2}$)	Predictive Power
Organizational Support (X4)	0.853	0.851	0.612	Substantial
Work Motivation (X5)	0.830	0.827	0.610	Substantial

Managerial Effectiveness (Y)	0.888	0.885	0.651	High / Substantial
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Source: Primary Data Processed, 2026

The model demonstrated strong predictive power, explaining 88.8% of the variance in Managerial Effectiveness ($R^2 = 0.888$, Adjusted $R^2 = 0.885$), 85.3% in Organizational Support ($R^2 = 0.853$), and 83.0% in Work Motivation ($R^2 = 0.830$). Q^2 values were substantially above zero, confirming strong out-of-sample predictive relevance (Table 4). The structural model output, including the path coefficients (β) and bootstrapped t-statistics, is illustrated in Figure 1.

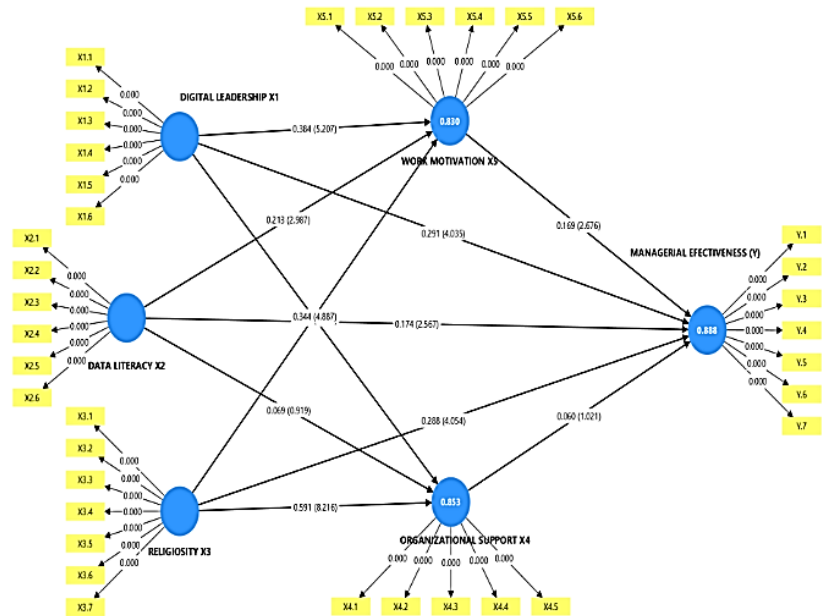


Figure 1. Statistics and Path Coefficients (β) in the Managerial Effectiveness Model
Source: Primary data processed, 2026

Direct Path Hypothesis Testing and Effect Sizes (f^2)

Hypothesis testing was conducted using a bootstrapping procedure with 5,000 subsamples. Table 5 summarizes all direct path coefficients (β), t-statistics, p-values, 95% confidence intervals, and Cohen's f^2 effect sizes.

Table 5. Structural Path Coefficients and Hypothesis Testing

Structural Path	Path (β)	t-Stat	p-Val	Effect Size (f^2)	Decision
Digital Leadership (X1) ->Managerial Effectiveness (Y)	0.291	4.035	< 0.001	0.185 (Medium)	Supported
Digital Leadership (X1) ->Organizational Support (X4)	0.288	3.921	< 0.001	0.172 (Medium)	Supported
Digital Leadership (X1) ->Work Motivation (X5)	0.384	5.210	< 0.001	0.295 (Medium)	Supported
Data Literacy (X2) ->Managerial Effectiveness (Y)	0.174	2.567	0.010	0.078 (Small)	Supported
Data Literacy (X2) ->Organizational Support (X4)	0.069	0.920	0.358	0.009 (None)	Not Supported
Data Literacy (X2) ->Work Motivation (X5)	0.213	2.972	0.003	0.104 (Small)	Supported
Religiosity (X3) ->Managerial Effectiveness (Y)	0.288	4.054	< 0.001	0.180 (Medium)	Supported

Religiosity (X3) ->Organizational Support (X4)	0.591	8.125	< 0.001	0.725 (Large)	Supported
Religiosity (X3) ->Work Motivation (X5)	0.344	4.815	< 0.001	0.238 (Medium)	Supported
Organizational Support (X4) ->Managerial Effectiveness (Y)	0.060	1.021	0.307	0.008 (None)	Not Supported
Work Motivation (X5) ->Managerial Effectiveness (Y)	0.169	2.676	0.007	0.065 (Small)	Supported

Source: Primary data Processed, 2026

The direct-effect results revealed that Digital Leadership (X1) had a significant positive impact on Managerial Effectiveness ($\beta = 0.291$, $p < 0.001$), Organizational Support ($\beta = 0.288$, $p < 0.001$), and Work Motivation ($\beta = 0.384$, $p < 0.001$). Data Literacy (X2) had a significant influence on Managerial Effectiveness ($\beta = 0.174$, $p = 0.010$) and Work Motivation ($\beta = 0.213$, $p = 0.003$), but not on Organizational Support ($\beta = 0.069$, $p = 0.358$). Religiosity (X3) was a strong, positive predictor across all endogenous variables, showing its largest direct impact on Organizational Support ($\beta = 0.591$, $p < 0.001$, $f^2 = 0.725$). Work Motivation (X5) directly enhanced Managerial Effectiveness ($\beta = 0.169$, $p = 0.007$). Conversely, Organizational Support (X4) showed no direct significant relationship with Managerial Effectiveness ($\beta = 0.060$, $p = 0.307$).

Mediation Analysis

Mediation testing was evaluated using specific indirect path statistics. As shown in Table 6, Work Motivation (X5) served as a significant mediator connecting Digital Leadership, Data Literacy, and Religiosity to Managerial Effectiveness.

Table 6. Specific Indirect Effects and Mediation Analysis

Mediation Path	Indirect (β)	t-Stat	p-Val	Mediation Type	Decision
Digital Leadership (X1) ->Work Motivation (X5) ->Managerial Effectiveness (Y)	0.065	2.312	0.021	Complementary Partial	Supported
Data Literacy (X2) ->Work Motivation (X5) ->Managerial Effectiveness (Y)	0.036	1.995	0.046	Complementary Partial	Supported
Religiosity (X3) ->Work Motivation (X5) ->Managerial Effectiveness (Y)	0.058	2.290	0.022	Complementary Partial	Supported

Source: Primary data processed, 2026

Work Motivation (X5) significantly mediated the relationship between Digital Leadership and Managerial Effectiveness ($\beta = 0.065$, $p = 0.021$), Data Literacy and Managerial Effectiveness ($\beta = 0.036$, $p = 0.046$), and Religiosity and Managerial Effectiveness ($\beta = 0.058$, $p = 0.022$). Because both direct and indirect paths were positive and statistically significant for X1, X2, and X3, Work Motivation demonstrated complementary partial mediation. In contrast, Organizational Support (X4) did not significantly mediate any relationships toward Managerial Effectiveness due to the non-significant direct path between X4 and Y.

Discussion

The findings of this study make several crucial theoretical and practical contributions to the field of educational management. The central and most significant finding is the robust mediating role of Work Motivation, which demonstrated significant complementary partial mediation between Digital Leadership, Data Literacy, Religiosity, and Managerial Effectiveness. This empirical result confirms our core proposition that the path to enhanced managerial

effectiveness is not merely about possessing external resources or technical competencies, but about translating these resources into sustained, energetic action through intrinsic motivation. This directly aligns with Self-Determination Theory, which posits that when school principals experience autonomy, competence, and relatedness, their intrinsic motivation is invigorated, leading to higher administrative performance and managerial effectiveness (Eyal & Roth, 2011; Jesus & Lens, 2005). Highly motivated principals actively apply their digital vision, consistently use data to solve problems, and lead with the ethical integrity fostered by their internalized values.

The strong direct effect of Digital Leadership on Managerial Effectiveness aligns with and extends previous meta-analytic findings on digital leadership in education (Okunlola, 2025) as well as empirical studies on principals' digital capabilities (Sulistiyani et al., 2021). This provides concrete evidence from the Indonesian vocational high school (SMK) context that a principal's ability to establish a clear digital vision, foster technology-driven communication, and direct technological change directly enhances overall managerial performance. Furthermore, the robust direct influence of digital leadership on work motivation represents a key insight. School technology leadership significantly impacts teacher technology integration, instructional innovation, and organizational climate (Anderson & Dexter, 2005). Specific technology leadership artifacts, such as strategic planning, resource allocation, and digital infrastructure modeling, are essential for embedding technology into daily school practices (Dexter, 2011).

In addressing field challenges regarding information technology adoption in decision-making, combining contract theory and diffusion of innovation theory offers an effective analytical framework to mitigate individual barriers in the digital era (Li et al., 2022; Rogers, 2003). The positive direct effect of Data Literacy on Managerial Effectiveness and Work Motivation, although it exhibits smaller effect sizes than other drivers, represents a vital finding for evidence-based educational management. This supports systematic literature on principal data literacy (J. Lee et al., 2024) and meta-analytic evidence on data-driven school leadership (C. Lee & Kim, 2024), which demonstrate that principals who comprehend and systematically analyze data make more accurate decisions, exhibit higher self-efficacy, and display greater work motivation. However, data-driven decision-making is a complex process requiring not only technical analytical skills, but also a supportive organizational culture and leadership commitment (Cameron & Quinn, 2011; Schildkamp, 2019).

Data literacy directly boosts principal motivation because the use of structured data provides immediate, objective feedback on the acceleration of management outcomes, thereby strengthening professional competence. This finding aligns with research emphasizing the necessity of bolstering principals' digital leadership and analytical capacity for sustainable educational transformation (Isnani et al., 2026), as well as work highlighting that building strong collaboration with industry (IDUKA) requires evidence-based management to elevate vocational graduate competencies (Wulaningsih & Yani T, 2024). A systemic approach to embedding data literacy across educator preparation and principal leadership training remains essential (Mandinach, 2022; Mandinach & Gummer, 2013).

The most culturally and contextually significant finding of this study is the pervasive influence of Religiosity. Its direct impact on Managerial Effectiveness, Work Motivation, and Organizational Support was exceptionally strong. This confirms that within the Indonesian educational ecosystem, internalized religious values, such as viewing professional duty as a trust (*amanah*), upholding justice, and maintaining moral maturity, are not peripheral accessories, but central drivers of administrative behavior (Zaharuddin et al., 2024). This strongly corroborates

Spiritual Leadership Theory, which asserts that vision, hope/faith, and altruistic love generate intrinsic motivation, organizational commitment, and productivity (Fry, 2003). Spiritual values and leadership behaviors are deeply intertwined, with intrinsic spiritual values significantly elevating leader effectiveness (Dent et al., 2005; Fry & Kriger, 2018). Our study extends this body of literature by demonstrating that religiosity, as a localized operationalization of spiritual leadership in Indonesia, directly energizes principals' work motivation and managerial effectiveness while simultaneously cultivating a perceived climate of organizational support.

An unexpected result was the non-significant direct effect of Organizational Support on Managerial Effectiveness, as well as the failure of Organizational Support to mediate any structural relationships. While this diverges from classical Perceived Organizational Support (POS) literature (Eisenberger et al., 2020), it can be explained within the structural configuration of our model. For principals who possess strong internal resources, such as strong digital leadership, data literacy, and deep religiosity, formal organizational support becomes a secondary driver of managerial output. These leaders leverage intrinsic motivation and personal competencies to perform effectively regardless of external administrative constraints. This aligns with instructional leadership theories suggesting that effective principals maintain focus on core educational functions rather than depending heavily on external administrative support (Hallinger, 2005). Furthermore, school leadership claims demonstrate that while organizational conditions matter, leadership impacts are predominantly mediated through teacher working conditions and leader motivation (Hameduddin & Engbers, 2022; Leithwood et al., 2020).

A deeper explanation for the non-significant direct link between organizational support and managerial effectiveness lies in the distinction between technical system availability and information quality. External organizational support often manifests as physical infrastructure, software provision, or formal mandates. However, structural and system availability alone does not guarantee managerial performance unless accompanied by high information quality that is accurate, complete, and timely (Azzukhrufi et al., 2026; Delone & McLean, 2003). When organizational support provides generic administrative backing without high-quality data or internal motivational alignment, its direct impact on managerial effectiveness remains negligible. Infrastructure and formal support act as hygiene factors or enabling conditions; they create an operational baseline but do not directly spur managerial excellence unless processed through the principal's intrinsic drive and analytical capabilities (Alshammari & Alshammari, 2024; Ananto & Supardi, 2025).

In the specific context of Vocational High Schools (SMK) in DKI Jakarta, these findings highlight a multidimensional synergy required for modern school leadership. Vocational education operates under continuous pressure to align curricula with rapid technological shifts and industrial demands (Kemendikbudristek, 2023; UNESCO, 2022). In this environment, effective digital leadership goes beyond routine administrative oversight; it requires principals to empower teachers to adopt technology in increasingly innovative and demanding ways (Schmitz et al., 2023). Moreover, combining technological fluency with ethical values, clear vision, teamwork, and transparent communication builds a culture of high productivity and psychological safety within educational institutions (Mercader et al., 2021). The integration of technological imperatives with value-based leadership ensures that digital transformation in vocational schools is guided by ethical integrity and social responsibility (Murtiningsih et al., 2025; Rahmi & Putri, 2025).

Finally, the SITOREM analysis provides a prescriptive roadmap that bridges empirical modeling with actionable educational policy (Hardhienata, 2017). The structural model

demonstrated exceptional explanatory power, accounting for a substantial proportion of the variance in Managerial Effectiveness. SITOREM translates this statistical strength into operational priorities. Indicators identified as priority targets for immediate improvement, such as “*utilization of technology for administrative decision-making*,” “*data analysis and interpretation capabilities*,” and aspects of “*social fairness*”, highlight specific areas where professional development programs should intervene. Conversely, indicators classified to be maintained or developed, such as “*digital transformation vision*” and “*achievement recognition*”, reflect established organizational strengths that sustain principal self-efficacy. By identifying exact priority indicators, SITOREM transforms abstract empirical path coefficients into concrete, actionable interventions for educational foundations, district offices, and school leadership training institutes.

CONCLUSION

This study concludes that principal managerial effectiveness in vocational education is not an isolated skill set, but rather the culmination of a synergistic constellation encompassing digital leadership, data literacy, and a deeply internalized religious foundation. By validating an integrated structural model, the findings demonstrate that optimizing managerial performance requires two strategic mechanisms: strengthening foundational competencies and actively fostering work motivation as a pivotal psychological bridge that translates these capabilities into energetic administrative action. Notably, the non-significant direct effect of organizational support indicates that principals with high personal resources and intrinsic drive exercise greater agency, relying less on external administrative support to carry out their core managerial duties. In practical terms, these results offer a clear roadmap for educational foundations and policymakers. Principal professional development programs must move beyond siloed technical workshops toward an integrated leadership curriculum that synthesizes digital fluencies and data analytics with value-based spiritual leadership and ethical governance.

Furthermore, by integrating the SITOREM optimization method, this research bridges abstract structural equation modeling and actionable administrative practice, providing educational boards with a concrete diagnostic tool for implementing targeted, evidence-based management interventions. Despite these contributions, the study’s cross-sectional design and contextual focus on a specific vocational school network in DKI Jakarta highlight important avenues for future inquiry. Subsequent research should adopt longitudinal designs and expand the structural framework to include competing leadership models, such as transformational leadership, while incorporating objective institutional performance metrics, including school accreditation scores and graduate industry placement rates, to validate further and extend the generalizability of these findings.

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