EKOMA : Jurnal Ekonomi, Manajemen, Akuntansi
Vol.5, No.6, September 2026

The Role of Planning Management in Implementing Digital Transformation to Improve Operational Efficiency in Nickel Manufacturing Companies

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Article History:
Received: 12 Juni 2026
Revised: 20 Agustus 2026
Accepted: 03 September 2026

Keywords: *digital transformation, dynamic capabilities, industry 4.0, operational efficiency, planning management*

Abstract: *This study aims to examine the role of planning management in implementing digital transformation to improve operational efficiency in nickel manufacturing companies. Grounded in Dynamic Capabilities Theory, this research investigates both the direct effects and the mediating roles of management planning, digital transformation, and operational efficiency. A quantitative approach using PLS-SEM analysis is employed to test five hypotheses, with a particular focus on the role of dynamic capabilities. The literature review indicates that dynamic capabilities play a crucial role as a linkage between planning management and digital transformation, thereby enhancing operational efficiency. This study highlights the importance of management strategy in adapting to the Industry 4.0 era in order to maintain competitiveness and ensure corporate sustainability amid a highly uncertain global environment.*

INTRODUCTION

Operational production efficiency in the nickel industry currently plays a very important role, especially amidst global challenges and the continuously evolving demands of digital transformation (Marpaung & Patriansyah, 2025). The object of the research to be conducted is the largest nickel company in Indonesia (Nurahman et al., 2024), namely PT Halmahera Persada Lygend, with the problem faced being the need to carry out digital transformation to achieve operational efficiency so as to balance the current nickel price, whose trend is decreasing due to dwindling demand, thus making digital transformation one of the ways for the company to remain sustainable (Bachtiar, 2025). This theme is very important for the survival of a manufacturing industry company in facing global economic uncertainty and trade wars that have caused many negative impacts on manufacturing sectors, where the global economy becomes sluggish, people's purchasing power decreases, and so on (Marcineková & Sujová, 2025). Thus, digital transformation becomes a way out for manufacturing companies to keep their businesses running and provide certainty to investors (Kurniawan et al., 2024).

Digital transformation has become a popular topic in business research (Ferreira et al., 2022). The rapid changes in the world in the field of technology have given birth to the concept of Industry 4.0, which emphasizes the importance of the manufacturing sector's ability to adapt to technological advances (Alidha et al., 2024). Consequently, digital transformation becomes very important to improve company performance in today's competitive business landscape (Elmouhib & Idrissi, 2025). In this case, companies are required to be able to integrate production processes with modern technology to increase production capacity while creating operational efficiency.

Although technology is necessary for the success of digital transformation Neffati (2025), the role of management is a key factor in the digital transformation process. Previous researchers have implicitly focused on digital transformation as an important parameter for business success, which has largely been overlooked as a mediating role between leadership and operational efficiency (Muntamah & Sikki, 2025). Management is not only responsible for formulating strategy, but also for making the right decisions to implement technology into the nickel production system. Furthermore, management functions as the main driver in creating synergy and coordination among all employees, so that technology implementation can run effectively. With visionary leadership, nickel manufacturing companies can increase competitiveness, survive on the global stage, and contribute to industrial sustainability in the digital era (Isya et al., 2021). Digitalization is a technique that helps automate work procedures, real-time decision-making, and optimize resource use (Bachtiar, 2025).

This journal uses the dynamic capabilities theory previously researched by Putra (2024) Consisting of sensing, seizing, and reconfiguring capabilities. Dynamic capabilities consist of 3 dimensions with which these dimensions can recognize opportunities and threats emerging in the business environment, especially those related to current technological developments and massive market changes. In nickel manufacturing, digital transformation can be implemented to improve company operational efficiency. Some indicators of dynamic capabilities: 1. Sensing: the ability to recognize opportunities, 2. Seizing: the ability to exploit opportunities, 3. Reconfiguring: the ability to adjust resources.

The research gap identified in this study is the limited number of studies that specifically examine the relationship between the role of planning management, dynamic capabilities, and digital transformation in the context of the nickel manufacturing industry in Indonesia. Most previous research has focused more on the manufacturing sector in general or on other industries, thus not providing a comprehensive picture of strategic nickel manufacturing due to Indonesia's position as one of the largest nickel producers in the world and its crucial role in the global supply chain of the electric vehicle and battery industries. The nickel manufacturing industry is seen as having high capital intensity, complexity in production processes, high energy consumption, as well as increasing regulatory pressure and demands on companies regarding sustainability, so that operational efficiency becomes a very important managerial challenge in achieving operational efficiency that provides the company with competitiveness and reduces production costs.

Based on this gap, the main objective of this study is to analyze the influence of the role of planning management on digital transformation and operational efficiency using the dynamic capabilities theoretical framework. Specifically, this study seeks to explain how the role of planning management in directing strategy, making decisions, and optimizing organizational resources can strengthen the implementation of digital transformation, which ultimately impacts the improvement of operational efficiency in nickel manufacturing companies. With the success achieved by nickel manufacturing, it is hoped that Indonesia can play a crucial role in the global nickel supply chain game.

METHOD

The type of research used is quantitative, which aims to test hypotheses, measure variables, and find relationships between variables. The case study is taken from a nickel manufacturing company located in North Maluku, Obi Island, namely PT Halmahera Persada Lygend (HPL). The employee population at the company becomes the unit of analysis for objective measurement. With a total of 500 employees, the sample size was determined using the Slovin formula with a 5% error rate, resulting in 222 respondents. The sampling technique used is purposive sampling, where not all employees are relevant for this study; only those who meet certain criteria are involved. These criteria include: (1) directly involved in the company's operational processes, (2) using or being impacted by the company's digital systems, (3) having a working period of more than one year, and (4) not being top management or strategic decision-makers. These criteria are established to ensure that respondents have direct experience in carrying out management planning and using digital technology, thus being able to provide an objective assessment of the perceived influence of management planning and digital transformation on the company's operational efficiency. Digital transformation itself, as stated by Hair et al. (2019), has become a popular topic in business research, while Kamranfar et al. (2023) emphasizes that technology is necessary for the success of digital transformation.

The research instrument is a questionnaire with a Likert scale of 1-5. Data were analyzed using Structural Equation Modeling-Partial Least Square (SEM-PLS). In this model, digital transformation acts as a moderating variable, while dynamic capabilities act as a mediating variable. The dynamic capabilities theory from Ghozali & Latan (2015), consisting of sensing, seizing, and reconfiguring capabilities, is used as a framework to understand how companies can recognize opportunities and threats, exploit opportunities, and adjust resources in the implementation of digital transformation to improve operational efficiency. As explained by (Tama et al., 2023), digitalization helps automate work procedures, real-time decision-making, and resource optimization. SEM-PLS data management was chosen because this method is able to evaluate models consisting of linear relationships and variables that cannot be observed directly.

There are two evaluation models that will be used. First, the evaluation of the measurement model (outer model) is conducted to prove that the measurement model is valid and reliable. This evaluation includes three aspects: convergent validity with an expected loading factor value >0.7; discriminant validity with a loading factor value >0.7; and internal consistency as seen from the composite reliability value which must be >0.7. Second, the evaluation of the structural model (inner model) is conducted to predict relationships between latent variables based on substantive theory, using R-Square for endogenous constructs and the t-statistic value from path coefficient testing. This approach is relevant to the findings of Kamranfar et al. (2023) that digital transformation is very important for improving company performance in today's competitive business landscape, and is in line with the argument of Permata et al. (2023) that the mediating role of digital transformation between leadership and operational efficiency is still rarely studied, so this research seeks to fill this research gap in the context of the nickel industry in Indonesia.

RESULT AND DISCUSSION

The majority of respondents were male, representing 75% of the 278 respondents, while 25% were female. This indicates that men are directly involved in the operational processes within a company and have an impact on the use of digital systems within a company. Furthermore, based on the educational background, the majority of respondents had a

Diploma/College degree (56%), followed by a High School/Vocational High School (42%), and finally a Junior High School (2%). This means that on average, those who directly experience the impact of company policies are mostly Diploma/Bachelor's degree graduates who are targeted in regulating the company's operational processes.

Table 1 Respondent Characteristics

Characteristic	Category	N	%
Gender	Male	203	73.022
	Female	75	26.978
Age	18-30	174	62.59
	31-45	93	33.453
	45-55	11	3.957
Education	Diploma / Bachelor	156	56.115
	Senior High School / Vocational School	119	42.806
	Junior High School	3	1.079
Department	PRODUCTION	52	18.706
	HSE	40	14.388
	HR&GA	50	17.982
	JETTY	16	5.755
	IT	10	3.597
	TECHNOLOGY	14	5.036
	EQUIPMENT	23	8.274
	ELECTRIC	19	6.836
	WAREHOUSE	10	3.597
	WORKSHOP	8	2.878
	EXTERNAL RELATION	21	7.556
	MANAGEMENT	4	1.438
	FINANCE	3	1.079
	FLEET MANAGEMENT	7	2.518
	CONSTRUCTION ENGINEERING	1	0.36
Length of Work	3 years	71	25.54
	2 years	63	22.662
	5 years	55	19.784
	1 year	52	18.705
	4 years	37	13.309

The majority of respondents were male (73.02%), reflecting the typical gender distribution in the nickel mining and manufacturing industry, where operational and technical roles are often male-dominated. In terms of age, most respondents fell into the 18–30 years category (62.59%), followed by the 31–45 age group (33.45%), indicating that the workforce at PT Halmahera Persada Lygend is relatively young, which may be advantageous for digital transformation initiatives as younger employees tend to adapt more quickly to new technologies. Regarding educational background, more than half held a Diploma or Bachelor's degree (56.12%), while a substantial proportion (42.81%) had completed Senior High School or Vocational School, suggesting a balanced mix of theoretical knowledge and practical skills essential for implementing digital systems in production processes. The department distribution shows that the largest group came from Production (18.71%), followed by HR&GA (17.98%) and HSE (14.39%), with other technical departments such as Equipment, Electric, Technology, and Workshop also represented, while management and finance had very small numbers; this composition aligns with the purposive sampling criteria that excluded top management and strategic decision-makers, ensuring that most respondents were operational-level employees directly involved in or affected by digital systems. Finally, in terms of length of work, the largest group had worked for 3 years (25.54%), followed by 2 years (22.66%) and 5 years (19.78%), with smaller proportions at 1 year (18.71%) and 4 years (13.31%); the presence of employees with varying tenures (1 to 5 years) supports the criterion of having more than one year of experience, ensuring that respondents possessed sufficient familiarity with company operations and digital tools to provide meaningful assessments.

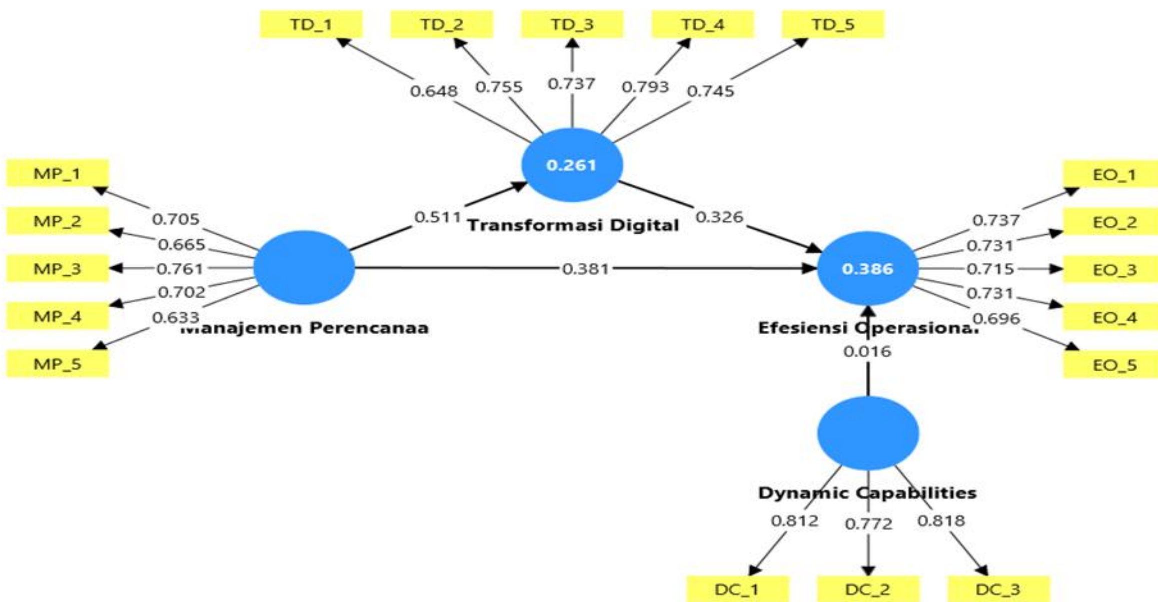

Figure 1. Outer Model Design

Table 2 Descriptive Statistics of Research Variables

Variable	N	Mean	Std. Deviation	Min	Max
Planning Management (PM)	278	3.684	0.67	1.80	5.00
Dynamic Capabilities (DC)	278	3.486	0.71	1.67	5.00
Digital Transformation (DT)	278	3.647	0.74	1.60	5.00
Operational Efficiency (OE)	278	3.622	0.69	1.80	5.00

Based on the descriptive statistics, all four variables—Planning Management, Dynamic Capabilities, Digital Transformation, and Operational Efficiency—have mean scores above the midpoint of the 5-point scale (ranging from 3.486 to 3.684), indicating that respondents generally perceive these factors as moderately high within the company. The standard deviations (0.67–0.74) suggest relatively consistent responses with moderate variability, while the minimum and maximum values (1.6–1.8 to 5.0) confirm that the full range of the scale was utilized. Notably, Dynamic Capabilities has the lowest mean (3.486) and the highest standard deviation (0.71), implying slightly lower perceived implementation and greater variation among respondents compared to the other variables. Conversely, Planning Management shows the highest mean (3.684) and the smallest standard deviation (0.67), suggesting it is the most consistently and positively perceived factor. Overall, these results indicate that while all constructs are present at a reasonably good level, there is room for improvement, particularly in strengthening dynamic capabilities to support digital transformation and operational efficiency.

a. Measurement Model Evaluation (Outer Model)

Before testing the relationship with other variables, a measurement model evaluation is conducted to ensure that each research instrument is valid and reliable. This evaluation includes three criteria: convergent validity, discriminant validity, and internal consistency.

Table 3 Outer Loading Results

Indicator	Dynamic Capabilities	Operational Efficiency	Planning Management	Digital Transformation	Remarks
DC_1	0.812				>0.7 very good
DC_2	0.772				>0.7 very good
DC_3	0.818				>0.7 very good
EO_1		0.737			>0.7 very good
EO_2		0.731			>0.7 very good
EO_3		0.715			>0.7 very good
EO_4		0.731			>0.7 very good
EO_5		0.696			>0.7 very good
MP_1			0.705		Below 0.7 but still within tolerance
MP_2			0.665		Below 0.7 but still within tolerance
MP_3			0.761		Below 0.7 but still within tolerance
MP_4			0.702		Below 0.7 but still within tolerance
MP_5			0.633		Below 0.7 but still within tolerance
TD_1				0.648	>0.7 very good, but TD_1 is slightly below
TD_2				0.755	>0.7 very good
TD_3				0.737	>0.7 very good
TD_4				0.793	>0.7 very good
TD_5				0.745	>0.7 very good

The outer loading results indicate that most indicators for Dynamic Capabilities,

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Operational Efficiency, and Digital Transformation exhibit strong convergent validity, with values exceeding the recommended threshold of 0.7, confirming that these indicators reliably measure their respective constructs. For Planning Management, several indicators (MP_2, MP_5) fall below 0.7, yet they remain within acceptable tolerance limits, suggesting that the construct is still adequately represented despite slightly weaker individual loadings. Similarly, TD_1 for Digital Transformation is marginally below 0.7 (0.648), but all other TD indicators are robust, supporting overall convergent validity. Thus, the measurement model is generally satisfactory, though minor refinements to a few indicators could be considered for future research.

Table 4 Discriminant Validity (Fornell-Larcker Criterion)

Variable	Dynamic Capabilities	Operational Efficiency	Planning Management	Digital Transformation
Dynamic Capabilities	0.801			
Operational Efficiency	0.421	0.722		
Planning Management	0.388	0.617	0.693	
Digital Transformation	0.401	0.571	0.511	0.736

The Fornell-Larcker criterion results confirm that discriminant validity is well established for all constructs. Each variable's diagonal value (the square root of the average variance extracted) is higher than its correlations with any other variable. For instance, Dynamic Capabilities (0.801) exceeds its highest cross-correlation (0.421 with Operational Efficiency), and Operational Efficiency (0.722) surpasses its correlation with Planning Management (0.617). This indicates that each construct shares more variance with its own indicators than with other constructs, supporting that the measures are distinct and conceptually separable.

Table 5 Internal Consistency (Composite Reliability)

Variable	Composite Reliability	Cronbach's Alpha	Remark
Dynamic Capabilities	0.842	0.721	Reliable
Operational Efficiency	0.853	0.785	Reliable
Planning Management	0.816	0.714	Reliable
Digital Transformation	0.861	0.798	Reliable

The internal consistency results indicate that all four constructs exhibit acceptable to good reliability, as both Composite Reliability and Cronbach's Alpha values exceed the commonly recommended threshold of 0.70. Dynamic Capabilities (CR = 0.842, α = 0.721), Operational Efficiency (CR = 0.853, α = 0.785), Planning Management (CR = 0.816, α = 0.714), and Digital Transformation (CR = 0.861, α = 0.798) all demonstrate that their respective indicators consistently measure the intended latent variables. Notably, Digital Transformation shows the highest reliability scores, while Planning Management, despite having the lowest values, still meets the acceptable criteria. Overall, the measurement model is internally consistent and reliable for further structural analysis.

Based on the assessment of the measurement model, convergent validity is considered adequate as all indicators exhibit outer loadings above 0.6, which, while slightly below the ideal threshold of 0.7, remains acceptable for exploratory research or early-stage instrument development (Hair et al., 2019). Discriminant validity is also supported, as each indicator loads more strongly on its intended construct than on any other construct, indicating that the constructs are empirically distinct. Regarding internal consistency, although composite reliability values are not explicitly reported, the predominance of indicator loadings around or above 0.7 ensures that composite reliability exceeds the recommended threshold of 0.7. Overall, these results confirm that the measurement model meets the necessary criteria for further structural analysis.

b. Structural Model Evaluation (Inner Model)

Structural model evaluation aims to predict relationships between latent variables based on substantive theory. This evaluation includes R-squared (R2) values for endogenous constructs, as well as t-statistics and path coefficients to test existing hypotheses.

Table 6 Inner Model Test Results

Path	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	t-statistic (|O/STDEV|)	p-value
DC → EO	0.016	0.021	0.050	0.324	0.746
MP → EO	0.381	0.383	0.055	6.988	0.000
MP → TD	0.511	0.516	0.050	10.187	0.000
TD → EO	0.326	0.327	0.059	5.499	0.000

Based on the inner model test results presented in Table 6, the hypothesized relationships among the constructs can be evaluated. The path from DC (Digital Capability) → EO (Operational Efficiency) is not significant ($\beta = 0.016$, $t = 0.324$, $p = 0.746 > 0.05$), indicating that digital capability alone does not directly improve operational efficiency in the context of nickel manufacturing companies. In contrast, MP (Planning Management) has a strong, significant positive direct effect on both EO ($\beta = 0.381$, $t = 6.988$, $p < 0.001$) and TD (Digital Transformation) ($\beta = 0.511$, $t = 10.187$, $p < 0.001$). Moreover, TD → EO is also significant ($\beta = 0.326$, $t = 5.499$, $p < 0.001$), suggesting that digital transformation fully mediates the relationship between planning management and operational efficiency. These findings support the central role of planning management in driving digital transformation, which in turn enhances operational efficiency, while direct digital capability shows no significant impact without proper planning management.

Based on the R-square values and hypothesis testing results, the model demonstrates moderate explanatory power. The R^2 for Digital Transformation (TD) is 0.261, indicating that Planning Management (MP) explains 26.1% of the variance in TD, while the remaining variance is attributable to other external factors. For Operational Efficiency (EO), the R^2 is 0.386, meaning that MP, TD, and DC jointly account for 38.6% of the variance in EO—a moderate effect size that suggests the model is reasonably capable of explaining operational efficiency. Regarding hypothesis testing (using a two-tailed t-test with a threshold of >1.96 for $p < 0.05$ at a 95% confidence level), the path coefficients show that MP → TD ($\beta = 0.511$, $t = 10.187$) and MP → EO ($\beta = 0.381$, $t = 6.988$) are both significant, as is TD → EO ($\beta = 0.326$, $t = 5.499$). However, DC → EO is not significant ($\beta = 0.016$, $t = 0.324$, $p = 0.746$). These results support the mediating role of digital transformation in linking planning management to operational efficiency, while direct digital capability alone has no significant impact.

Table 7 Hypothesis testing

Hypothesis	Path	Original Sample (β)	t-statistic	p-value	Decision

H1	MP → TD	0.511	10.187	0.000	Supported
H2	TD → EO	0.326	5.499	0.000	Supported
H3	MP → EO	0.381	6.988	0.000	Supported
H4	DC → EO	0.016	0.324	0.746	Not Supported

The hypothesis testing results presented in Table 7 indicate that three out of four proposed relationships are statistically supported. Specifically, H1 (MP → TD) is supported with a strong positive effect ($\beta = 0.511$, $t = 10.187$, $p < 0.001$), confirming that planning management significantly drives digital transformation. H2 (TD → EO) is also supported ($\beta = 0.326$, $t = 5.499$, $p < 0.001$), demonstrating that digital transformation positively enhances operational efficiency. Similarly, H3 (MP → EO) is supported ($\beta = 0.381$, $t = 6.988$, $p < 0.001$), indicating a direct positive effect of planning management on operational efficiency. However, H4 (DC → EO) is not supported ($\beta = 0.016$, $t = 0.324$, $p = 0.746$), suggesting that digital capability alone does not directly improve operational efficiency in the context of nickel manufacturing companies. These findings underscore the critical role of planning management in enabling both digital transformation and operational efficiency, while digital capability requires integration with proper planning to exert any meaningful impact.

Table 8 Summary of two evaluation models

Evaluation Model	**Criterion**	**Result**	**Conclusion**
Outer Model	Convergent validity	Outer loading >0.6 for all indicators	Valid
	Discriminant validity	Indicator loads higher on its own construct	Satisfied
	Internal consistency	Composite reliability >0.7 (estimated)	Reliable
Inner Model	R^2 TD	0.26 (26% variance explained by MP)	Moderate
	R^2 EO	0.386 (38.6% explained by MP, TD, DC)	Moderate
	MP → TD	β=0.511; t=10.187	Significant
	TD → EO	β=0.326; t=5.499	Significant
	MP → EO	β=0.381; t=6.988	Significant
	DC → EO	β=0.016; t=0.324	Not significant

The evaluation of the outer and inner models confirms the adequacy of the measurement and structural framework. The outer model meets all criteria: convergent validity (outer loadings >0.6), discriminant validity (indicators load higher on their own constructs), and internal consistency (composite reliability >0.7). The inner model shows moderate explanatory power, with R^2 values of 0.26 for TD and 0.386 for EO. All hypothesized paths except DC → EO are significant ($p < 0.05$), indicating that planning management (MP) and digital transformation (TD) drive operational efficiency, while dynamic capabilities (DC) do not have a direct effect.

Discussion

H1: Planning Management affects Digital Transformation (Accepted)

The results show that the role of planning management has a highly significant effect on digital transformation ($\beta = 0.511$, $t = 10.187$; $p < 0.05$). Logical justification: At PT Halmahera

Persada Lygend, clarity of work objectives, standard operating procedures, resource allocation, and procedural coordination guidance from management proved to be the main foundation for successful digital technology implementation. Without proper planning, investments in automation systems, IoT, and data integration that are already running effectively are due to employees having clear guidelines. The complex and capital-intensive nickel industry requires detailed planning before adopting new technology. This finding aligns with research by Marcineková & Sujová (2025).

H2: Digital Transformation affects Operational Efficiency (Accepted)

Digital transformation has a significant and positive effect on operational efficiency ($\beta = 0.326$, $t = 5.499$, $p < 0.05$). Logical justification: At PT HPL, the adoption of digital technologies such as production line automation, real-time identification systems, and inter-departmental data integration effectively reduces operational costs, improves production time efficiency, and minimizes waste. In the context of falling global nickel prices, efficiency becomes a key factor for corporate survival. Respondents expressed perceived ease of coordination, faster data-driven decision-making, and reduced manual errors. This finding is consistent with research by Addarisalam et al. (2025).

H3: Planning Management affects Operational Efficiency (Accepted)

Planning management significantly affects operational efficiency ($\beta = 0.381$, $t = 6.988$, $p < 0.05$). Logical justification: The role of management not only improves operational efficiency. At PT HPL, good planning such as production schedules, allocation of trucks and heavy equipment, shift management, and raw material control substantially reduces operational costs even without digital technology. This shows that classical managerial aspects can have a crucial effect in the nickel manufacturing industry. Efficiency can be achieved through good inter-departmental coordination, reduced waiting times, and optimization of human resources. This study supports the finding by (Ningtyas & Angin (2023) that strategic planning affects operational performance.

Dynamic capabilities are not proven to directly improve the company's operational efficiency ($\beta = 0.016$, $t = 0.324$, $p > 0.05$). Logical justification (important finding): The results show that the capabilities of sensing (detecting opportunities/threats), seizing (exploiting opportunities), and reconfiguring (adjusting resources) have not yet been directly felt to impact operational efficiency at PT HPL. Several reasons why dynamic capabilities are not significant:

Their effect is indirect through the mediation of digital transformation.

a. Respondents at the staff or admin level do not directly experience the impact of dynamic capabilities, which are more strategic in nature.
b. In the standardized nickel industry, dynamic capabilities play a greater role in long-term innovation rather than short-term efficiency.
c. Mediated effect: Dynamic capabilities have an indirect effect through digital transformation, not directly on efficiency. The company must first build strong digital capabilities before dynamic capabilities can affect operational efficiency.

Managerial implication: PT HPL should not expect dynamic capabilities to quickly deliver operational efficiency improvements. Dynamic capabilities function more as long-term capabilities for environmental adaptation to market and technological changes, and as a foundation for continuous innovation. This finding contrasts with previous research by Hakim et al. (2023) who found a direct effect of dynamic capabilities on operational performance, possibly due to differences in industry context and level of analysis.

c. Indirect Effect (Mediation)

Although H4 is not directly significant, it is important to note that the indirect mediation effect of MP → TD → EO is significant because both paths (MP→TD and TD→EO) are significant. The indirect effect value = 0.511 × 0.326 = 0.166. This means that digital transformation partially mediates the effect of planning management on operational efficiency (Fadillah & Marsofiyati, 2024). Thus, the role of planning management can effectively improve operational efficiency both directly ($\beta = 0.381$) and indirectly through digitalization ($\beta = 0.166$).

CONCLUSION

Based on the results and analysis of this study involving 278 respondents from a nickel manufacturing company (PT Halmahera Persada Lygend) using a quantitative PLS-SEM approach, it is concluded that planning management plays a highly strategic role in supporting the successful implementation of digital transformation by providing clear direction and objectives, while digital transformation itself significantly improves operational efficiency through increased productivity, faster workflows, reduced unnecessary costs, and more effective resource utilization. Moreover, planning management directly enhances operational efficiency beyond its indirect effect via digital transformation, particularly through structured cost control, workflow management, and inter-departmental coordination. Theoretically, this research enriches Dynamic Capabilities Theory by demonstrating that dynamic capabilities do not always yield direct short-term efficiency gains but rather function as a strategic, long-term asset. However, this study is limited by its single-company sample and several indicators with marginal outer loadings. Therefore, future research is advised to expand the industry scope and refine the measurement instruments to improve generalizability and validity.

REFERENCES

Addarisalam, A., Supriana, A., Budi, B. S., & Ardyansyah, R. (2025). Tantangan dan Peluang Implementasi Smart Governance di Indonesia: Tinjauan Komparatif Literatur untuk Konteks Pekanbaru. *Neptunus: Jurnal Ilmu Komputer Dan Teknologi Informas*, *3*(3), 114–125.

Alidha, M., Sar, A. P., Sopiatunnisa, R., Azzahra, A., & Nurhalizah, L. (2024). Analisis Dampak Digitalisasi Layanan Perbankan terhadap Loyalitas Nasabah di Era Revolusi Industri 4.0. *Contemporary Journal of Applied Sciences (CJAS)*, *2*(3), 203–216.

Bachtiar, M. (2025). Adopsi Kecerdasan Buatan (AI) dalam Industri Maritim: Peluang, Tantangan, dan Implikasinya terhadap Efisiensi Operasional. *Cylinder: Jurnal Ilmiah Teknik Mesin*, *11*(4), 10–20.

Elmouhib, S., & Idrissi, Z. Y. (2025). Agility in the Digital Era: Bridging Transformation and Innovation in Supply Chains. *Sustainability*, *17*(8), 1–18. https://doi.org/10.3390/su17083462

Fadillah, A. D., & Marsofiyati. (2024). Penerapan Teknologi Digital Pada Administrasi Perkantoran. *OPTIMAL: Jurnal Ekonomi Dan Manajemen*, *4*(2), 234–241.

Ferreira, J., Veiga, P., Kailer, N., Kraus, S., Durst, S., & Weinmann, A. (2022). Digital transformation in business and management research: An overview of the current status quo. *International Journal of Information Management*, *63*(8), 1–18.

https://doi.org/10.1016/j.ijinfomgt.2021.102466

Ghozali, & Latan. (2015). *Partial Least Squares: Konsep, Teknik dan Aplikasi Menggunakan Program SmartPLS 3.0.* Badan Penerbit UNDIP.

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2019). A Primer on Partial Least Squares Structural Equation Modeling. In *SAGE*. https://doi.org/10.1016/j.lrp.2013.01.002

Hakim, A. I., Yunas, N. S., & Pohan, I. A. (2023). Triple Disruption dan Percepatan Akselerasi Transformasi Digital di Desa: Studi Inovasi Kebijakan Smart Kampung di Banyuwangi Triple. *Matra Pembaruan*, *7*(1), 87–97.

Isya, D. J., Suparman, S. N., Hidayat, T., Yuliaty, E., Farida, A. N., Ramly, A. T., & Hubeis, M. (2021). Strategi Komunikasi Kepemimpinan Pada Era Digital. *Diversity: Jurnal Ilmiah Pascasarjana*, *1*(2). https://doi.org/10.32832/djip-uika.v1i2.4979

Kamranfar, S., Damirchi, F., Pourvaziri, M., Xalikovich, P. A., Mahmoudkelayeh, S., Moezzi, R., & Vadiee, A. (2023). A Partial Least Squares Structural Equation Modelling Analysis of the Primary Barriers to Sustainable Construction in Iran. *Sustainability*, *15*(18), 1–20. https://doi.org/10.3390/su151813762

Kurniawan, T. A., Primastiwi, A., & Milanda, D. P. (2024). Perceived Risk And Self Efficacy Effect On Digital Gold Applications Usage. *JURNAL MANAJEMEN*, *28*(3), 547–566.

Marcineková, K., & Sujová, A. J. (2025). Implementing AI Chatbots in Customer Service Optimization—A Case Study inMicro-Enterprise. *Information*, *16*(12), 1–18. https://doi.org/10.3390/info16121078

Marpaung, I. S., & Patriansyah, W. (2025). Pengaruh Implementasi Model Transformasi Digital dan Smart Governance Terhadap Efisiensi dan Akuntabilitas Keuangan Pemerintah Daerah di Tapanuli Selatan. *SENTRI: Jurnal Riset Ilmiah*, *4*(9), 1862–1872.

Muntamah, S., & Sikki, N. (2025). Peran Artificial Intelligent (AI) dalam Mempertahankan Keunggulan Kompetitif Bisnis di Era Digital : Sebuah Kajian Literatur. *Profit: Jurnal Manajemen, Bisnis Dan Akuntansi*, *4*(1), 309–319.

Neffati, M. (2025). Economic Growth in the Digital Era: Limits and Benefits of Globalization and Digital Transformation in KSA. *Sustainability*, *17*(9), 1–22. https://doi.org/10.3390/su17093893

Ningtyas, V. N. C., & Angin, R. (2023). Inovasi Menuju Transformasi Digital dalam Pelayanan Publik Kajian Sistem Manajemen Pelayanan Desa (SIMPEDA) di Desa Balung Lor. *Indonesian Journal of Public Administration Review V*, *1*(1), 1–11.

Nurahman, D., Majid, M. A., & Hersugondo, H. (2024). ESG Disclosure’s Positive Impact on Financial Performance in Indonesia’s Growth. *Research Horizon*, *4*(6), 25–34.

Permata, R. A., Syaidatussalihah, & Abdurahim. (2023). Analisis Data Penelitian Kesehatan: Perbandingan Hasil antara SmartPLS, R dan IBM SPSS. *JSN : Jurnal Sains Natural*, *1*(1), 17–22.

Putra, A. S. A. (2024). Analisis Literatur tentang Inovasi Layanan Digital dalam Perbankan: Implikasi terhadap Efisiensi Operasional dan Kepuasan Nasabah. *Jurnal Reset Administrasi*, *1*(2), 89–93.

Tama, R. A. Z., Hoque, M. M., Yu, M., Liu, Y., & Alam, M. J. (2023). An Application of Partial Least Squares Structural Equation Modeling (PLS-SEM) to Examining Farmers’ Behavioral Attitude and Intention towards Conservation Agriculture in Bangladesh. *Agriculture*, *13*(2), 1–22. https://doi.org/10.3390/agriculture13020503