

Big Data Analytics Competence and Transformational Leadership in Managerial Self-Efficacy for Data-Driven Decisions

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Abstract

The rapid digital transformation within the energy sector has increased organizational dependence on data-driven decision-making, where managerial effectiveness is shaped not only by technological capability but also by psychological readiness and leadership support. This study examines the influence of big data analytics competence and transformational leadership on managerial self-efficacy in data-driven decision-making. A quantitative explanatory design was applied, involving 72 managerial employees selected through total sampling. Data were collected using structured questionnaires with a five-point Likert scale and analyzed using multiple linear regression in SPSS version 26. The results show that big data analytics competence has a positive and significant effect on managerial self-efficacy ($\beta=0.221$; $p=0.003$), whereas transformational leadership has a stronger positive influence ($\beta=0.682$; $p<0.001$). Simultaneously, both variables significantly explained managerial self-efficacy ($R^2=0.681$; $F=72.541$; $p<0.001$). The study concludes that both factors enhance managerial self-efficacy, with transformational leadership being the more dominant factor. However, this study is limited by its single-organization context and cross-sectional design. Theoretically, this study integrates the Resource-Based View and Social Cognitive Theory, while practically, it emphasizes the need to strengthen analytical competence and transformational leadership to improve data-driven decision-making.

Keywords: Big Data Analytics Competence, Data-Driven Decision Making, Digital Transformation, Energy Sector, Managerial Self-Efficacy, Transformational Leadership

1. INTRODUCTION

Digital transformation has fundamentally shifted organizational decision-making processes from intuition-based approaches to data-driven decision-making. Organizations increasingly depend on digital systems, real-time information processing, and predictive analytics to improve their operational efficiency and strategic responsiveness (Verhoef et al., 2021; Vial, 2021). In the energy sector, digital transformation has become particularly important because operational activities involve complex distribution systems, real-time monitoring, predictive maintenance, and large-scale customer service management (Fadli, Husainah, & Maswanto, 2025).

In Indonesia, state-owned enterprises such as PT PLN (Persero) are currently undergoing extensive digital transformation initiatives to improve their operational reliability and service quality. PT PLN has integrated various digital technologies, including operational dashboards, smart monitoring systems, and data analytics platforms, to support managerial decision-making. PT PLN UP3 Madura was selected because it is actively implementing digital operational systems and data-driven monitoring platforms as part of Indonesia's state-owned enterprise digital transformation agenda. Consequently, managers are expected to possess technical analytical competencies and demonstrate psychological readiness to interpret complex information and make strategic decisions under uncertainty (Dwiastuty, Setyaningsih, & Novita, 2024).

Big data analytics competence has emerged as a strategic organizational capability that enables firms to transform large volumes of data into valuable insights for decision-making. Previous studies have indicated that big data analytics capabilities improve organizational performance, operational efficiency, and strategic responsiveness (Mikalef & Pateli, 2017; Wamba et al., 2017). However, prior research has primarily focused on organizational rather than psychological outcomes at the managerial level.

The perspective of social cognitive theory, individuals' beliefs regarding their capabilities influence how they process information, evaluate risks, and perform tasks in uncertain situations (Bandura, 1997). In managerial contexts, self-efficacy plays a critical role in shaping confidence, decisiveness, and persistence during decision-making (Janssen et al., 2017). Managers with higher self-efficacy are more likely to utilize analytical insights effectively and make timely decisions in complex conditions.

In addition to technical competence, transformational leadership plays a significant role in shaping managerial self-efficacy. Transformational leaders motivate employees through inspirational vision, intellectual stimulation, and individualized support ([Chike, Mbamalu, Oguanobi, & Egbunike, 2023](#)). Previous studies have shown that transformational leadership enhances psychological empowerment, organizational commitment, and self-efficacy ([Ansari, Abouraia, El Morsy, & Thumiki, 2024](#); [Hoch, Bommer, Dulebohn, & Wu, 2018](#)). In digital organizational environments characterized by uncertainty and technological change, leadership support is increasingly important for strengthening employees' psychological readiness ([Kurniawati & Margaretha, 2024](#)).

Despite extensive studies on big data analytics capabilities and transformational leadership, previous research has predominantly examined these variables separately and focused mainly on organizational performance outcomes. However, limited empirical attention has been paid to how technological capability and leadership jointly influence managerial self-efficacy in state-owned energy enterprises undergoing digital transformation. Therefore, this study investigates the influence of big data analytics competence and transformational leadership on managerial self-efficacy in data-driven decision-making at PT PLN (Persero) UP3 Madura. This study contributes theoretically by integrating the resource-based view and social cognitive theory to explain managerial self-efficacy in the context of digital transformation. Practically, this study provides recommendations for state-owned enterprises to strengthen their leadership capabilities and analytical competence to support effective data-driven decision-making.

2. LITERATURE REVIEW

2.1 Big Data Analytics Capability and Decision Making

The Resource-Based View (RBV) explains that organizations achieve sustainable competitive advantages through valuable, rare, inimitable, and non-substitutable resources. In the context of digital transformation, big data analytics competence represents a strategic organizational capability that enables managers to process complex information and improve decision quality ([Ghasemaghaj, 2020](#)). [M. Gupta and George \(2016\)](#) define big data analytics capability as the organizational ability to integrate technology, managerial capability, and analytical expertise to transform data into strategic value. Previous studies have indicated that analytical capabilities contribute significantly to operational efficiency, innovation, and organizational performance ([Damanik, Prasetyo, Alie, & Oktaria, 2025](#); [Mikalef & Pateli, 2017](#); [Wamba et al., 2017](#)).

In addition, big data analytics capabilities play a critical role in enhancing managerial decision-making effectiveness by enabling evidence-based judgments rather than intuition-based choices. Organizations equipped with a strong analytical infrastructure are better able to identify patterns, forecast trends, and respond proactively to environmental changes. This capability also supports real-time decision-making, which is increasingly important in dynamic and competitive business environments. Managers with higher analytical competence are more confident in interpreting complex datasets and translating them into actionable insights ([Damanik et al., 2025](#)). As a result, decision accuracy improves, while uncertainty and risk are reduced.

Furthermore, the integration of big data analytics into organizational processes fosters a culture of data-driven decision-making, in which empirical evidence becomes the foundation of strategic planning. This shift not only improves operational efficiency but also strengthens cross-functional collaboration, as different departments rely on shared data. In the long term, organizations that effectively leverage big data analytics capabilities tend to achieve higher adaptability and innovation performance ([Annisa & Hamzah, 2025](#)). Therefore, developing analytical competence among managers is essential for sustaining competitive advantage in the era of digital transformation.

At the managerial level, analytical competence functions as a mastery experience that strengthens self-efficacy ([Awan et al., 2021](#)). According to the social cognitive theory, mastery experience is the strongest source of self-efficacy because individuals develop confidence after successfully performing tasks requiring technical or analytical skills ([Bandura, 1997](#)). Managers who effectively interpret and utilize data analytics are more likely to feel confident in making strategic decisions. Therefore, the following hypothesis is proposed:

H₁: Big data analytics competence positively influences managerial self-efficacy in data-driven decision making

2.2 Transformational Leadership and Self-Efficacy

Transformational leadership refers to a leadership style that inspires followers through vision, motivation, intellectual stimulation, and individualized consideration ([Bass & Avolio, 1994](#)). Transformational leaders encourage innovation, provide psychological support, and motivate employees to exceed organizational expectations ([Astuti & Alam, 2025](#); [Fauzi et al., 2024](#)). According to social cognitive theory, self-efficacy can be strengthened through social persuasion, verbal encouragement, and emotional support ([Bandura, 1997](#)). Transformational leaders influence employees' psychological readiness by creating supportive organizational environments that reduce uncertainty and encourage confidence in the performance of complex tasks. Previous studies demonstrate that transformational leadership positively influences self-efficacy, empowerment, and adaptive behavior ([Ashari, Ladaina, & Hartini, 2024](#); [Hoch et al., 2018](#)). In digital transformation environments, transformational leadership becomes particularly important because employees often face technological uncertainty and operational complexity.

In this context, transformational leadership enhances individual confidence and facilitates collective capability within organizations by promoting knowledge sharing and collaborative problem-solving ([Al-Husseini, El Beltagi, & Moizer, 2021](#)). Leaders who actively engage with their teams can bridge the gap between technological demands and employee readiness, ensuring smoother adaptation to digital systems in the workplace. Furthermore, transformational leaders help create a learning-oriented culture in which mistakes are viewed as opportunities for improvement rather than failures. This encourages the continuous development of skills and reinforces employees' belief in their ability to master new technologies. Consequently, organizations led by transformational leaders are more likely to achieve successful digital transformation outcomes, as employees feel both supported and empowered to embrace change. Therefore, the following hypothesis is proposed:

H₂: Transformational leadership positively influences managerial self-efficacy in data-driven decision making

2.3 Comparative Influence of Transformational Leadership and Big Data Analytics Competence

While analytical competence provides managers with the technical capability to interpret information, transformational leadership strengthens psychological readiness through social persuasion and motivational reinforcement. In uncertain organizational environments, leadership support may exert a stronger influence on managerial self-efficacy than technical competence alone ([Dubey, Gunasekaran, Childe, Blome, & Papadopoulos, 2019](#)). Transformational leadership contributes to managerial self-efficacy by enhancing followers' confidence through inspiration, individualized consideration and intellectual stimulation. Leaders who demonstrate transformational behaviors can foster trust and encourage employees to exceed their perceived capabilities. This leadership style is particularly effective in digital transformation contexts, where employees often face uncertainty and rapidly changing technological requirements. By providing vision and emotional support, transformational leaders help managers develop a stronger sense of control and belief in their ability to execute complex tasks ([Setiawan, Wardhani, & Yanto, 2025](#)).

In comparison, big data analytics competence focuses more on technical and cognitive capabilities that enable managers to process and interpret data effectively. While this competence is essential for evidence-based decision-making, it may not fully address psychological barriers, such as uncertainty, fear of failure, or lack of confidence. Therefore, transformational leadership can complement analytical competence by strengthening the motivational and emotional dimensions of managerial self-efficacy. Moreover, previous studies suggest that leadership support often acts as a stronger predictor of self-efficacy in the early stages of digital adoption, whereas technical competence becomes more influential as individuals gain experience. The interaction between these two factors creates a balanced environment in which managers are both technically equipped and

psychologically empowered to make data-driven decisions. Therefore, the following hypothesis is proposed:

H₃: Transformational leadership has a stronger influence on managerial self-efficacy than big data analytics competence

2.4 Managerial Self-Efficacy in Data-Driven Decision Making

Managerial self-efficacy refers to managers' beliefs regarding their capabilities to perform decision-making tasks effectively in complex organizational situations ([Schiuma, Santarsiero, Carlucci, & Jarrar, 2024](#)). In digital organizational environments, managerial self-efficacy is increasingly important because managers are required to process large volumes of information, evaluate multiple alternatives, and make timely decisions under uncertainty ([Nugraha, Ritchi, & Adrianto, 2023](#)). According to social cognitive theory, self-efficacy influences how individuals think, behave, and respond to challenges ([Bandura, 1997](#); [Schunk & DiBenedetto, 2020](#)). Individuals with high self-efficacy tend to demonstrate stronger persistence, higher confidence, and greater resilience when facing difficult situations. In managerial contexts, self-efficacy affects the ability to interpret analytical information, evaluate risks, and consistently implement strategic decisions.

[Bandura \(1997\)](#) explained that self-efficacy is developed through four primary sources: mastery experiences, vicarious experiences, social persuasion, and emotional states. In this study, big data analytics competence represents mastery experience because managers gain confidence through the successful utilization of analytical systems. Transformational leadership contributes to social persuasion by providing motivational support, intellectual stimulation, and psychological encouragement.

Previous studies have indicated that managerial self-efficacy positively influences decision quality, adaptability, and organizational performance ([Hameli & Ordun, 2022](#); [Shamim et al., 2020](#)). Managers with strong self-efficacy are more likely to utilize technological systems effectively and make confident strategic decisions within dynamic organizational environments. Therefore, managerial self-efficacy is a critical psychological factor in supporting effective data-driven decision-making during organizational digital transformation.

2.5 Research Framework

From the Resource-Based View perspective, big data analytics competence represents a strategic organizational capability that enhances the managerial ability to process complex information. Meanwhile, Social Cognitive Theory explains that mastery experiences derived from analytical capability strengthen managerial self-efficacy. Transformational leadership further reinforces this process through social persuasion mechanisms that increase psychological readiness for data-driven decision-making.

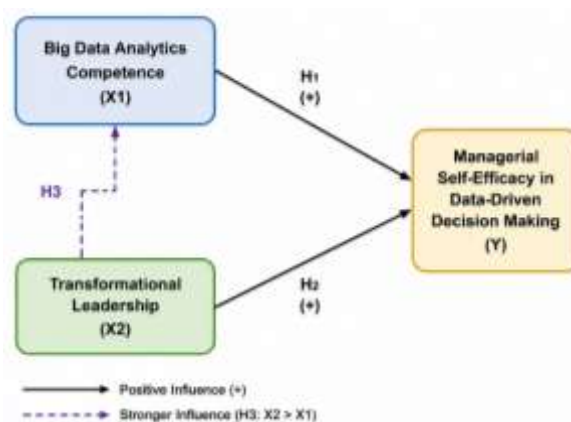


Figure 1. Research framework

Figure 1 illustrates the relationships between big data analytics competence (X_1), transformational leadership (X_2), and managerial self-efficacy in data-driven decision-making (Y).

The model shows that both independent variables have a positive influence on managerial self-efficacy, with transformational leadership expected to have a stronger effect compared to big data analytics competence.

3. METHODOLOGY

3.1 Research Design

This study employed a quantitative explanatory research design to examine the causal relationship between big data analytics competence, transformational leadership, and managerial self-efficacy in data-driven decision-making (Creswell & Creswell, 2017). Explanatory research was selected because this study aimed to test hypotheses grounded in established theoretical frameworks. The research was conducted at PT PLN (Persero) UP3 Madura, an electricity distribution unit implementing digital transformation initiatives through data-driven operational systems and digital monitoring platforms.

3.2 Population and Sampling

The population consisted of 72 managerial-level employees, including managers, assistant managers, and team leaders, involved in operational and strategic decision-making processes. A total sampling technique was employed because all population members met the research criteria, and the population size was relatively limited. The sample size also satisfied the regression adequacy requirements with an observation-to-predictor ratio of 36:1. A priori power analysis using G'Power indicated that a minimum sample size of 68 respondents was sufficient for detecting medium effect sizes ($f^2=0.15$) with $\alpha=0.05$ and statistical power of 0.80.

3.3 Measurement of Variables

Data were collected using structured questionnaires based on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Table 1. Operationalization of variables

Variables	Dimensions	Indicators	Source
Big Data Analytics Competence	Technical capability	Understanding big data concepts, ability to use analytical tools, and ability to interpret analytical results	M. Gupta and George (2016) and Mikalef, Pappas, Krogstie, and Giannakos (2018)
Transformational Leadership	Idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration	Visionary leadership, motivational encouragement, innovative stimulation, and individualized support	Bass and Avolio (1994)
Managerial Self-Efficacy	Decision confidence, risk management, decisiveness, and implementation consistency	Confidence in decision making, courage in facing risks, decisiveness, and consistency	Bandura (1997)

Table 1 shows that transformational leadership was measured using items adapted from the Multifactor Leadership Questionnaire (MLQ-5X) developed by [Bass and Avolio \(1994\)](#). Big data analytics competence was adapted from [S. Gupta, Drave, Dwivedi, Baabdullah, and Ismagilova \(2020\)](#) and [Mikalef et al. \(2018\)](#). Managerial self-efficacy was adapted from Bandura's self-efficacy framework and the General Self-Efficacy Scale developed by [Bandura \(1997\)](#).

3.4 Validity and Reliability Testing

Construct validity was evaluated using exploratory factor and item loading analyses. All factor loadings exceeded 0.70, indicating acceptable convergent validity of the measurement model. The Composite Reliability (CR) values exceeded 0.70, and the Average Variance Extracted (AVE) values exceeded 0.50 for all constructs. Reliability testing using Cronbach's alpha indicated strong internal consistency across all measured constructs. As shown in Table 2, the big data analytics competence variable yielded a reliability coefficient of 0.86, while transformational leadership demonstrated a higher value of 0.91, indicating excellent internal consistency. Meanwhile, the Cronbach's alpha for managerial self-efficacy was 0.88, reflecting strong reliability. Overall, these results confirm that all the instruments used in this study are reliable for further analysis.

Table 2. Construct validity and reliability

Variables	Loading	AVE	CR	Cronbach Alpha
Big Data Analytics Competence	>0.70	0.61	0.88	0.86
Transformational Leadership	>0.70	0.67	0.91	0.91
Managerial Self-Efficacy	>0.70	0.64	0.89	0.88

Table 3 shows that to address common method bias, Harman's single-factor test was conducted. The first factor accounted for 34.2% of the total variance, below the 50% threshold, indicating that common method variance was not a serious issue.

Table 3. Harman's Single-Factor Test Results for Common Method Bias Assessment

Test	Result
Harman Single Factor	34.2%
Threshold	<50%
Conclusion	No serious common method bias

3.5 Data Analysis Technique

Data were analyzed using SPSS version 26 through multiple linear regression analyses. Multiple regression was selected because this study aimed to examine the simultaneous and partial effects of multiple independent variables on managerial self-efficacy.

The regression equation is expressed as follows:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + e \quad (1)$$

Where Y represents managerial self-efficacy, X_1 denotes big data analytics competence, and X_2 refers to transformational leadership. where α is a constant, β represents the regression coefficients, and e is the error term. Prior to hypothesis testing, classical assumption tests were performed to ensure the validity of the regression model. These tests included the normality test to examine data distribution, the multicollinearity test to assess correlations among independent variables, the heteroscedasticity test to check the variance consistency of residuals, and the autocorrelation test to determine the independence of error terms.

4. RESULT AND DISCUSSION

4.1 Respondent Characteristics

Table 4. Respondent demographics

Characteristic	Category	Frequency	Percentage (%)
Position	Manager	15	20.8
	Assistant Manager	27	37.5
	Team Leader	30	41.7
Work Experience	1–3 years	18	25.0
	4–6 years	29	40.3

Characteristic	Category	Frequency	Percentage (%)
	>6 years	25	34.7
Education	Bachelor Degree	49	68.1
	Master Degree	23	31.9

Table 4 shows that the majority held the position of team leader (41.7%), followed by assistant manager (37.5%) and manager (20.8%). In terms of work experience, most respondents had 4–6 years of experience (40.3%), while 34.7% had more than 6 years, and 25.0% had 1–3 years of experience. Regarding educational background, most respondents held a bachelor's degree (68.1%), while the remaining 31.9% had a master's degree. Overall, the sample was dominated by mid-level employees with moderate work experience and undergraduate education. The respondent profile indicates that most participants possessed considerable managerial experience and educational backgrounds relevant to data-driven operational environments.

4.2 Descriptive Statistics and Correlation Analysis

Table 5. Descriptive statistics and correlation matrix

Variables	Mean	SD	X_1	X_2	Y
Big Data Analytics Competence	4.02	0.56	1		
Transformational Leadership	4.15	0.49	0.521	1	
Managerial Self-Efficacy	4.08	0.52	0.603	0.771	1

Table 5 shows that all variables have relatively high mean scores, indicating generally positive perceptions among respondents. Transformational leadership recorded the highest mean ($M=4.15$, $SD=0.49$), followed by managerial self-efficacy ($M=4.08$, $SD=0.52$), and big data analytics competence ($M=4.02$, $SD=0.56$). The correlation results indicate that all the variables are positively related. Big data analytics competence showed a moderate correlation with transformational leadership ($r=0.521$) and managerial self-efficacy ($r=0.603$). Meanwhile, transformational leadership had a strong positive relationship with managerial self-efficacy ($r=0.771$), suggesting that higher leadership quality is associated with higher managerial self-efficacy. Overall, the results demonstrate consistent positive relationships between the study variables. The descriptive statistics indicate relatively high levels of analytical competence, transformational leadership, and managerial self-efficacy among the respondents.

4.3 Classical Assumption Testing

Table 6. Classical assumption test results

Test	Indicator	Result	Conclusion
Normality	Shapiro-Wilk Sig.	0.081	Normal
Multicollinearity	Tolerance	>0.10	No multicollinearity
	VIF	<10	No multicollinearity
Heteroscedasticity	Glejser Sig.	>0.05	No heteroscedasticity
Autocorrelation	Durbin-Watson	1.941	No autocorrelation

Table 6 shows that the regression model meets all the required statistical assumptions. The normality test using the Shapiro-Wilk test produced a significance value of 0.081, indicating that the data were normally distributed. The multicollinearity test showed tolerance values above 0.10 and VIF values below 10, confirming that no multicollinearity existed among the independent variables. The heteroscedasticity test using the Glejser method resulted in significance values above 0.05, indicating no heteroscedasticity. Additionally, the Durbin-Watson value of 1.941 suggests that there is no autocorrelation in the data. Overall, these results confirm that the regression model is statistically appropriate for the analysis. The results indicate that all the classical assumptions were satisfied.

4.4 Hypothesis Testing

Table 5. Multiple linear regression results

Variables	B	Std. Error	Standardized β	t	Sig.
Constant	0.842	0.394	-	2.137	0.036
Big Data Analytics Competence	0.195	0.064	0.221	3.041	0.003
Transformational Leadership	0.754	0.081	0.682	9.284	0.000

Table 5 shows that the model has strong explanatory power, with an R^2 value of 0.681 and an adjusted R^2 of 0.672, indicating that 68.1% of the variance in managerial self-efficacy is explained by big data analytics competence and transformational leadership. The model was also statistically significant, as indicated by an F-value of 72.541 with a significance level of 0.000. Individually, both independent variables had a positive and significant effect on managerial self-efficacy. Big data analytics competence shows a significant positive effect ($\beta=0.221$, $t=3.041$, $p=0.003$), whereas transformational leadership has a stronger and more dominant influence ($\beta=0.682$, $t=9.284$, $p<0.001$). Overall, the results confirm that both factors play an important role in enhancing managerial self-efficacy, with transformational leadership being the most influential predictor.

Table 6. Summary of Hypothesis Testing

Hypothesis	Relationship	β	Sig.	Decision
H_1	Big Data Analytics Competence $\rightarrow$ Managerial Self-Efficacy	0.221	0.003	Supported
H_2	Transformational Leadership $\rightarrow$ Managerial Self-Efficacy	0.682	0.000	Supported
H_3	Transformational Leadership has stronger influence than Big Data Analytics Competence	$0.682 > 0.221$	-	Supported

Table 6 indicates that all proposed hypotheses are supported. Big data analytics competence has a positive and significant effect on managerial self-efficacy ($\beta=0.221$, $p=0.003$), confirming H_1 . Similarly, transformational leadership has a positive and significant effect on managerial self-efficacy ($\beta=0.682$, $p<0.001$), supporting H_2 . Furthermore, the comparison of standardized coefficients shows that transformational leadership has a stronger influence on managerial self-efficacy than big data analytics competence ($0.682 > 0.221$), thereby supporting H_3 . Overall, the findings suggest that while both factors are important, transformational leadership is the dominant predictor of managerial efficacy.

Table 7. Effect size analysis

Variables	f^2	Interpretation
Big Data Analytics Competence	0.12	Moderate
Transformational Leadership	0.48	Large

Table 7 shows the effect size (f^2) results, indicating that both independent variables contribute meaningfully to managerial self-efficacy, although with different magnitudes. Big data analytics competence showed a moderate effect size ($f^2=0.12$), suggesting a meaningful but relatively limited contribution to the model. In contrast, transformational leadership demonstrated a large effect size ($f^2=0.48$), indicating a substantial and dominant influence on managerial self-efficacy. Overall, these findings confirm that while both variables are important, transformational leadership has a considerably stronger practical impact than big data analytics competence.

4.5 Discussion

The findings demonstrate that big data analytics competence positively influences managerial self-efficacy in data-driven decision-making (Mikalef et al., 2018; Wamba et al., 2017). This result

suggests that managers with stronger analytical capabilities tend to feel more confident when interpreting operational information and making strategic decisions. Analytical competence enables managers to transform complex data into meaningful insights, thereby reducing uncertainty and enhancing their perceived control over decision-making situations.

From the perspective of Social Cognitive Theory, analytical competence functions as a mastery experience that strengthens self-efficacy. Managers who successfully utilize analytical systems develop stronger beliefs regarding their capabilities in handling operational challenges. This finding supports previous studies indicating that big data analytics capabilities improve decision quality and organizational responsiveness ([Mikalef & Pateli, 2017](#); [Wamba et al., 2017](#)). However, the findings revealed that transformational leadership exerted a substantially stronger influence on managerial self-efficacy than on analytical competence. This result indicates that psychological support and motivational reinforcement may play more critical roles than technical capabilities in shaping managerial confidence during digital transformation.

According to [Bandura \(1997\)](#) Social Cognitive Theory, self-efficacy is influenced not only by mastery experiences but also by social persuasion and emotional support. Transformational leaders strengthen employees' beliefs in their capabilities by providing inspirational motivation, intellectual stimulation and individualized consideration. In the context of PT PLN UP3 Madura, where managers must continuously adapt to digital operational systems, leadership support appears to reduce psychological uncertainty more effectively than technical competence.

These findings support previous studies by [Hoch et al. \(2018\)](#), which demonstrated that transformational leadership enhances employees' psychological empowerment and confidence in performing complex tasks. Leaders who encourage innovation, provide constructive feedback, and create supportive organizational environments significantly strengthen employees' willingness to use analytical insights during decision-making processes.

Compared with [Wati and Nasution \(2025\)](#), the standardized effect of transformational leadership found in this study ($\beta=0.682$) appears substantially stronger. This difference may be influenced by the organizational characteristics of state-owned enterprises, where hierarchical leadership and psychological support remain highly influential in digital transformation processes. In the context of PT PLN UP3 Madura, leadership behavior may play a more dominant role because managers operate within complex operational systems that require both technical adaptation and psychological reassurance during decision making. The findings also highlight the importance of integrating technological capabilities and human-centered leadership in digital transformation initiatives. While big data analytics competence provides the technical foundation for interpreting operational information, transformational leadership creates the psychological environment necessary for effective utilization of analytical insights.

Nevertheless, the claim regarding the complementary relationship between analytical competence and transformational leadership remains conceptual because this study did not empirically test the interaction effects between the variables. Consequently, future research should investigate the roles of leadership support, digital culture, and psychological empowerment as potential moderators or mediation mechanisms. From a practical perspective, the findings suggest that PT PLN and similar state-owned enterprises should strengthen their leadership development programs alongside digital capability initiatives. Organizations should provide digital leadership certification programs, analytical competency training, and mentoring systems that encourage managers to confidently utilize data analytics in operational decision-making.

5. CONCLUSIONS

5.1 Conclusion

This study concludes that both big data analytics competence and transformational leadership have a significant positive influence on managerial self-efficacy in data-driven decision-making. The results indicate that transformational leadership exerts a stronger effect than big data analytics competence, highlighting the critical role of leadership behavior in shaping managerial confidence in digital transformation contexts. Managers with higher analytical competence and strong transformational leadership support tend to demonstrate greater self-efficacy in making data-driven

decisions. These findings reinforce the importance of integrating technological capabilities with supportive leadership practices to enhance managerial effectiveness in state-owned enterprises undergoing digital transformation.

5.2 Research Limitations

This study had several limitations. First, the cross-sectional research design limits causal interpretation because data were collected at a single point in time. Future studies should employ longitudinal or experimental designs. Second, the study relied on self-reported questionnaires collected from a single source, which may have increased the risk of common method and social desirability biases. Future studies should integrate multi-source data, such as supervisor evaluations and objective decision-making performance indicators. Third, this study was conducted within a single organizational unit of PT PLN, limiting its generalizability across industries and organizational contexts. Future studies should involve multiple state-owned enterprises and cross-sector comparisons. Finally, future research should examine additional variables, such as psychological empowerment, digital mindset, organizational culture, and data-driven culture, to obtain a more comprehensive understanding of managerial behavior in digital transformation environments.

5.3 Suggestions and Directions for Future Research

Future research should expand the scope of analysis by involving multiple organizations or different industrial sectors to improve the generalizability of the findings. Subsequent studies should consider longitudinal research designs to better capture changes in managerial self-efficacy over time during digital transformation processes. Future studies should examine potential mediating or moderating variables, such as digital culture, psychological empowerment, or organizational learning, to provide a more comprehensive understanding of the relationships among variables. Further research should explore qualitative approaches to gain deeper insights into managerial experiences in utilizing big data analytics and leadership support in decision-making processes.

AUTHOR CONTRIBUTION

The authors contributed equally to this study. MDAL was responsible for the conceptualization, data collection, and initial manuscript drafting. UM contributed to the data analysis, interpretation of the results, and methodological development. BH contributed to the literature review refinement, validation of research instruments, and critical revision of the manuscript. All authors participated in reviewing and approving the final version of the manuscript and agreed to be accountable for all aspects of the study.

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