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The Role of Leadership in Enhancing Innovation through Knowledge Management as an Intervening Factor

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Innovation,
Full Mediation,
Digital Knowledge,
Organizational Transformation.

Abstract

This study aims to explore the relationship between leadership, knowledge management, and innovation at PT Nuon Digital Indonesia. Based on the analysis using Partial Least Squares Structural Equation Modeling (PLS-SEM), it was found that leadership does not have a direct significant impact on innovation but plays a crucial role in shaping effective knowledge management. Additionally, knowledge management was found to have a significant influence on innovation, serving as an important mediator in the relationship between leadership and innovation. This finding emphasizes that, although leadership can create the infrastructure and culture that support knowledge sharing, the success of innovation is more significantly determined by the capacity of knowledge management to accumulate, document, and distribute knowledge. Thus, knowledge management acts as a bridge between the leader's vision and the innovation outcomes that can be achieved. This study suggests that companies should focus more on developing systematic knowledge management systems to drive sustainable innovation. Practical implications for PT Nuon's management include the importance of transforming the role of leaders into knowledge enablers and implementing more formal and structured knowledge management practices.

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INTRODUCTION

Innovation has become a cornerstone of the business strategy in digital entertainment companies. Amid the rapid development of the industry, companies like PT Nuon Digital Indonesia must create added value through the development of innovative products and processes to maintain their competitive edge. Alongside the increasing importance of innovation, two factors are believed to play significant roles in driving innovation: effective leadership and strong knowledge management. Transformational leadership can create a work environment that fosters collaboration and creativity, while knowledge management serves as a means to manage, distribute, and utilize the knowledge within the organization (Kılıç & Uludağ, 2021; Nonaka, 2009).

However, despite many companies implementing innovation and knowledge management programs, not all organizations are able to optimize both in driving disruptive innovation creation. In PT Nuon Digital Indonesia, while the company has successfully launched several innovative products and services, there remains a gap between the innovation output and the ability to create disruptive innovations with high commercial value. Furthermore, a significant challenge is how to systematically manage the knowledge generated by employees so that it does not remain concentrated at the individual level but can be used collectively by the organization (Robertson et al., 2023).

This phenomenon reveals an important research gap, which is the extent to which effective leadership can influence the organization's ability to innovate, and how knowledge management can act as an intervening factor that strengthens this relationship. Although previous studies have identified the relationship between transformational leadership and innovation (Negara et al., 2024; Uddin et al., 2016), as well as the importance of knowledge management in supporting innovation (Foster et al., 2024), research on how these two factors interact within the context of the digital entertainment industry, particularly in Indonesia, remains limited.

The urgency of this research lies in the importance of understanding how PT Nuon Digital Indonesia can optimize leadership and knowledge management to drive more disruptive and sustainable innovation. This study aims to fill the existing research gap by exploring the role of leadership in enhancing innovation through knowledge management, as well as analyzing the impact of these two factors on the company's innovation performance.

The objectives of this study are:

- To identify and analyze the impact of leadership on innovation at PT Nuon.
- To analyze the role of knowledge management as an intervening factor in the relationship between leadership and innovation.
- To assess the performance of leadership, knowledge management, and innovation at PT Nuon Digital Indonesia.
- To provide practical recommendations for the company to optimize leadership and knowledge management to improve innovation.

Theoretically, this study is expected to enrich the literature on the relationship between leadership, knowledge management, and innovation, particularly within the context of the digital entertainment industry in Indonesia (Barney, 1991; Gentsoudi, 2022). Practically, the findings of this study are expected to offer innovative strategies for PT Nuon Digital Indonesia to enhance its innovation capacity and strengthen its knowledge management processes, ultimately enabling the creation of more impactful innovative products and services in the long term (Kogabayev & Maziliauskas, 2017; Teece, 2007).

Thus, this research is not only relevant to the company in question but also offers insights that can be adapted by other companies in the same sector or other digital industries in Indonesia.

LITERATURE REVEIW

Organizational Behavior

Organizational behavior in modern technology industries integrates a balance between formal structure and social interactions that shape collective work dynamics. According to Wendt, organizations operate within two main dimensions: formal structure and informal social interactions (Wendt, 2021). This fundamental principle suggests that organizational behavior is not only governed by formal systems and procedures but also by spontaneous and unpredictable social dimensions. This informal dimension plays a crucial role in maintaining organizational flexibility and adaptability, which are essential in facing the rapid changes in the technology industry.

(Kettunen & Laanti, 2017) further reveal that software industry organizations adopting agile principles develop behavior patterns focused on collaboration, open communication, and shared responsibility. These principles emphasize the formation of self-organizing teams, which enable a more flexible and adaptive work dynamic in response to changing market needs. This statement aligns with findings from (Pronchakov et al., 2022), who stress that high-tech organizations must exhibit adaptive behavior oriented toward data and systemic dependencies between processes to maintain operational effectiveness and innovation.

Innovation Performance

Innovation is an integral component of competitive advantage in modern organizations. Kharkheli and Gavardashvili emphasize that innovation is a key element in organizational change and plays a vital role in ensuring that organizations remain relevant and competitive (Kharkheli & Gavardashvili, 2023). Innovation, whether in the

form of products or processes, enables companies to respond to external changes and create new value for customers.

Kogabayev and Maziliauskas (2017) add that investments in innovation have a direct impact on economic productivity and outcomes, with results depending on the type of innovation implemented. Furthermore, Yin argues that innovation cannot be separated from the underlying business model (Yin, 2024). An innovative business model allows companies to redesign their value proposition, distribution channels, customer relationships, and revenue streams, providing long-term competitive advantages.

Measuring innovation performance in organizations requires indicators that reflect the impact of innovation on products, technologies, and markets. Zhang et al. provide a comprehensive framework for measuring innovation performance, ranging from new product development, introduction of new technologies, to radical innovation and market penetration. These indicators can be adapted to measure innovation performance at PT Nuon Digital Indonesia, which focuses on the development of digital products and cutting-edge technology.

Leadership

Leadership within organizations serves as a guide to direct vision, a decision-maker determining strategy, and a key driver in creating a culture of innovation and sustainability. Gentsoudi (2022) reveals that leadership effectiveness is not only dependent on the personal characteristics of leaders but also on their ability to adapt leadership styles to the social, cultural, and organizational context.

On the other hand, Di (2022) emphasizes that leadership that drives innovation must be able to communicate a clear vision, support risk-taking, and provide necessary resources to support innovative ideas. Leaders who encourage experimentation and are willing to face uncertainty create a safe space for teams to innovate. The COVID-19 pandemic also demonstrated that inclusive and collaborative leaders can create more adaptive work environments, as described by (Gregston, 2023). In this context, transformational leadership has proven effective in enhancing creativity and innovation by building trust and collaboration within teams (Nadhira et al., 2025).

Knowledge Management (KM)

Knowledge management (KM) refers to the process of managing knowledge as a strategic asset within an organization. (Grant, 1996) explains that organizations function as platforms to integrate the knowledge possessed by their members. The knowledge owned by individuals must be effectively managed to ensure that it can be used collectively within the organization. Undocumented or poorly distributed knowledge can lead to the loss of valuable knowledge over time, especially as employees move in and out of the organization.

This concept is reinforced by Robertson et al. (2023), who emphasize the importance of knowledge management in supporting organizational performance. In practice, KM serves to optimize knowledge through coordination and collaboration among individuals and teams. This process involves knowledge creation, dissemination, absorption, and application of knowledge in organizational activities.

Knowledge-Based Dynamic Capabilities (KBDC)

The concept of Knowledge-Based Dynamic Capabilities (KBDC) is an extension of the Resource-Based View (RBV) and Dynamic Capabilities Theory, focusing on knowledge as a strategic resource. Robertson et al. (2023) define KBDC through four main dimensions: knowledge creation, knowledge diffusion, knowledge absorption, and knowledge impact. These dimensions complement each other in forming an organization's ability to adapt to external changes and improve innovation performance.

In practice, knowledge creation involves the development of new ideas and solutions, such as those undertaken by PT Nuon Digital Indonesia in digital product development. Knowledge diffusion and knowledge absorption support the dissemination and application of knowledge across the organization, as well as the acceptance of external knowledge to enhance innovation processes. Finally, knowledge impact reflects the

organization's ability to use knowledge to generate innovations that improve operational efficiency and effectiveness (Rus et al., 2002; Suwarno & Silvianita, 2017).

Previous Studies

Table 1. presents several relevant previous studies related to this research topic. Studies by Uddin et al. (2016) and Molodchik et al. (2021) show that transformational leadership and knowledge management play crucial roles in supporting organizational innovation. Meanwhile, Prawira Negara et al. (2024) demonstrate that the combination of transformational leadership and knowledge management can accelerate innovation in organizations, with a focus on organizational learning and a collaborative culture.

Table 1. Previous International Journal Studies

No	Title, Researchers, and Publisher	Variables	Method	Findings	Similarities	Differences
1	A Study of the Impact of Transformational Leadership, Organizational Learning, and Knowledge Management on Organizational Innovation (Uddin et al., 2016)	Transformational Leadership, Knowledge Management, Organizational Innovation	Quantitative (SEM)	Transformational leadership enhances KM and innovation	Leadership, Knowledge Management, Innovation	Adds Organizational Performance variable
2	Mechanisms of Knowledge-Driven Innovation: Evidence from Russia (Molodchik et al., 2021)	Transformational Leadership, Knowledge Culture, Innovation	Quantitative (SEM-PLS)	Knowledge culture and leadership positively affect innovation	Leadership, Knowledge Management	Adds Proactive Behavior variable
3	Optimizing Transformational Leadership and Knowledge Management as Keys to Innovation (Negara et al., 2024)	Transformational Leadership, Knowledge Management, Innovation	Bibliometric Analysis	Transformational leadership affects innovation with KM as an intermediary	Leadership, Knowledge Management	Bibliometric-based analysis

METHOD

Research Design

This research adopts a quantitative approach to test the causal relationships between the variables studied. A quantitative approach is chosen because it allows for objective measurement of the effects of leadership on innovation, the effects of leadership on knowledge management, and the effects of knowledge management on innovation as an intervening variable. According to Sugiyono and Lestari (2021), the quantitative approach aims to analyze the relationship between variables statistically, enabling researchers to test hypotheses in a measurable and objective manner. This technique also allows for obtaining results that can be generalized to a larger population.

This approach uses primary data obtained through the distribution of questionnaires to respondents. The advantage of the quantitative approach lies in its ability to produce data that can be measured and statistically tested, allowing researchers to test previously formulated hypotheses (Hair, 2014).

Operationalization of Variables

This study operationalizes the variables based on the theories and conceptual framework outlined in Chapter 2. The variables studied consist of three main variables: Innovation as the dependent variable (Y), Leadership as the independent variable (X), and Knowledge Management as the intervening variable (Z). The operationalization of each variable is designed to facilitate data collection and statistical analysis.

1. Exogenous or Independent Variable (X)

Leadership in this study is operationalized based on theories explaining that transformational leadership plays a role in promoting innovation by communicating a clear vision and encouraging risk-taking (Di, 2022).

2. Endogenous or Dependent Variable (Y)

Innovation is measured using criteria such as new product creation, adoption of advanced technologies, and entry into new markets (Zhang, n.d.). Innovation is considered the result of applying innovation strategies driven by leadership and knowledge management.

3. Intervening Variable (Z)

Knowledge Management (KM) serves as the factor that mediates the relationship between leadership and innovation. This variable is measured through dimensions such as knowledge creation, knowledge diffusion, knowledge absorption, and knowledge impact within the organization (Robertson et al., 2023).

Research Phases

This research is carried out in several phases as outlined in Table 2., starting with problem identification and literature study to formulate hypotheses, followed by data analysis and conclusion drawing.

Table 2. Research Phases and Main Activities

Research Phases	Main Activities	Output
Phase I: Preparation and Planning	Problem identification, literature study, proposal preparation	Theoretical foundation and hypotheses
Phase II: Variable & Sample Development	Operationalization of variables, scale establishment, and sample selection	Development of research instruments
Phase III: Data Collection	Questionnaire distribution, data tabulation	Data ready for analysis
Phase IV: Data Analysis	Respondent profile analysis, hypothesis testing	Statistical analysis results
Phase V: Final Reporting	Results discussion, conclusion drawing	Research report

Population and Sample

1. Population

The population in this study consists of all active employees at PT Nuon Digital Indonesia involved in the company's operational activities. This population is chosen because of their relevance to the research topic, particularly in the areas of leadership, knowledge management, and innovation.

2. Sample

The sample in this study is selected using a non-probability sampling technique with purposive sampling method. The sample consists of 157 respondents selected based on inclusion criteria, namely active employees at PT Nuon who have direct supervisors within the company's operational structure. Senior management is excluded from the sample due to their lack of relevant direct supervision in daily operational contexts (Sugiyono & Lestari, 2021).

Data Collection

Data collection is conducted using a questionnaire that measures respondents' perceptions of the variables being studied. The questionnaire employs an ordinal scale with a Likert model consisting of five response levels: Strongly Agree, Agree, Neutral, Disagree, and Strongly Disagree. Each statement item is measured using a 1-5 Likert scale, which allows the researcher to measure the level of agreement or evaluation by respondents regarding the phenomenon being studied (Sugiyono & Lestari, 2021).

Data Analysis Techniques

1. Descriptive Analysis

Descriptive analysis is used to describe the basic characteristics of the data before further analysis is conducted. The collected data will be analyzed by calculating cumulative values and percentages for each item in the questionnaire (Sugiyono & Lestari, 2021).

2. Structural Equation Modeling (SEM)

Data analysis is performed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS software. This technique is used to test relationships between latent variables and their indicators simultaneously (Sarstedt et al., 2021). The PLS-SEM approach is chosen due to its flexibility in handling small to medium sample sizes and the lack of normal distribution assumptions on the data.

3. Measurement Model Evaluation (Outer Model)

The measurement model is evaluated to ensure the convergent and discriminant validity of the indicators used in the study. This testing includes composite reliability and Cronbach's alpha to measure construct reliability, as well as convergent validity and discriminant validity to ensure the quality of the measurement model (Ghozali, 2008).

4. Structural Model Evaluation (Inner Model)

The structural model is evaluated using coefficient of determination (R^2), effect size (F^2), and path coefficients. This evaluation helps to determine the strength of relationships between latent variables and to test the proposed hypotheses (Hair, 2014).

5. Hypothesis Testing

Hypothesis testing is conducted using the bootstrapping technique to obtain t-statistics and p-values, which are used to determine whether the hypotheses are accepted or rejected based on statistical significance (Hair, 2014).

RESULT AND DISCUSSION

Respondent Characteristics

This study involves all active employees of PT Nuon Digital Indonesia as the population. Based on 2025 data, the total number of employees is 166. Understanding the profile of this population is important to describe the context in which the study was conducted. As the first step, the characteristics of the employees were analyzed based on gender and position.

1. Respondent Characteristics by Gender

Table 3. Respondents by Gender

No	Gender	Number of People	Percentage
1	Male	103	62.05%
2	Female	63	37.95%
	Total	166	100%

Source: Data Processed by Author, 2025

Based on the table, the majority of employees at PT Nuon Digital Indonesia are male, totaling 103 people (62.05%), while female employees total 63 (37.95%). Although the digital industry is typically male-dominated, the proportion of female employees remains significant.

2. Respondent Characteristics by Position

The organizational structure at PT Nuon Digital Indonesia is divided into several levels, from the Board of Directors (BoD) to Staff. The distribution of employees by position is as follows:

Table 4. Respondents by Position Category

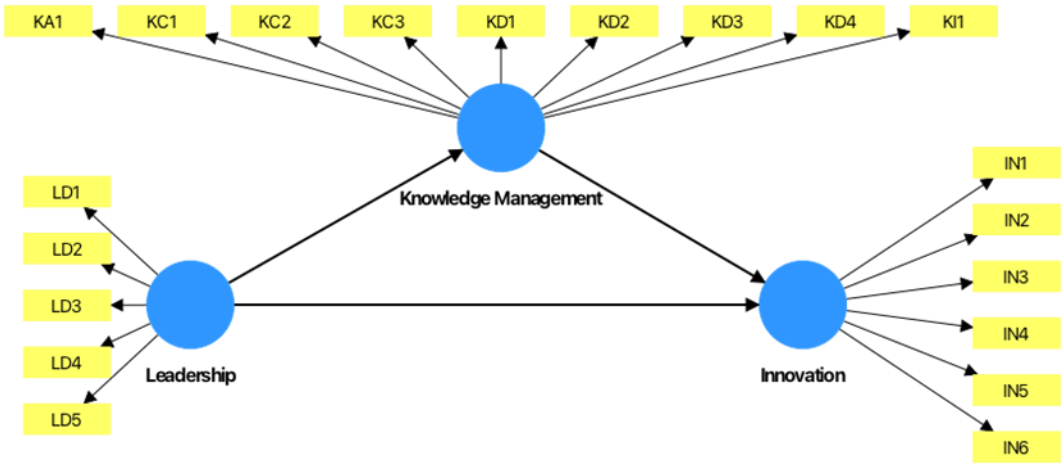
No	Position/Role	Number of People	Percentage
1	BoD (Board of Directors)	3	1.81%
2	VP/EVP	6	3.61%
3	GM / SM	7	4.22%
4	Manager / Expert	36	21.69%
5	SPV / Junior Expert	34	20.48%
6	Staff	80	48.19%
	Total	166	100%

Source: Data Processed by Author, 2025

This table shows that the largest group of employees are at the staff level, with 80 people (48.19%), followed by the middle management levels (Manager/Expert and SPV/Junior Expert), which together account for over 40%. This reflects a relatively lean organizational structure, yet with a strong operational base at the staff level.

Research Results

Data processing was conducted using the SmartPLS application in accordance with the Structural Equation Modeling (SEM-PLS) procedure. The testing was done in two iterative stages: the initial model and the final model after reducing invalid indicators.



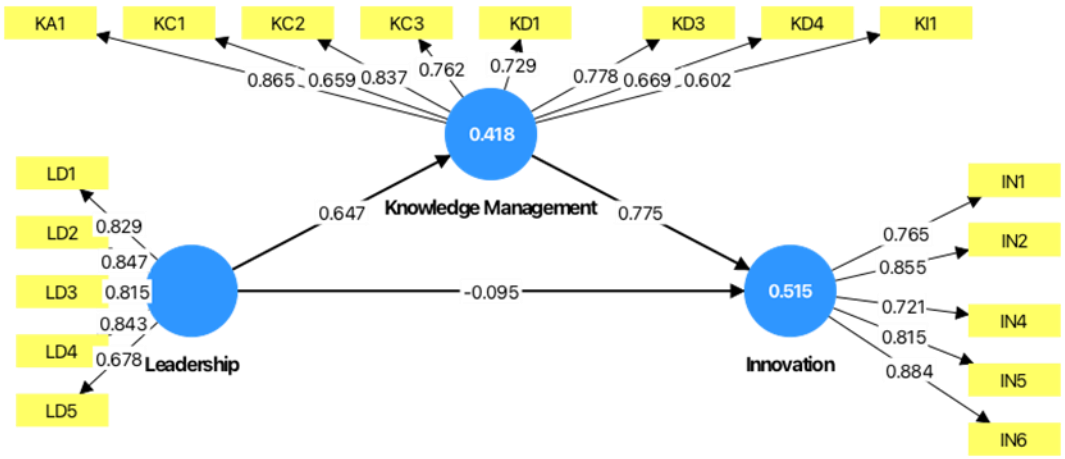
Source: Data Processed by Author, 2025

Figure 1. *Data Processing Results Before Indicator Reduction*

1. *Measurement Model Evaluation (Outer Model)*
   a. *Convergent Validity*

Convergent validity measures how well the indicators reflect the latent variables being measured. In this study, convergent validity was evaluated using outer loading. Based on the evaluation results, several indicators had

outer loading values below the 0.70 standard and were removed to improve the Average Variance Extracted (AVE) value.



Source: Data Processed by Author, 2025

Figure 2. *Data Processing Results After Indicator Reduction with Outer Loadings*

Table 5. *List of Reduced Indicators*

Variable	Indicator	Outer Loading	Description	Decision
Innovation	IN3	0.107	Invalid	Removed
Knowledge Management	KD2	0.333	Invalid	Removed

Source: Primary Data Processed by Author, 2025

Table 6. *Outer Loadings Data*

Variable	Indicator	Outer Loading	Status
Innovation	IN1	0.775	Valid
	IN2	0.848	Valid
	IN4	0.714	Valid
	IN5	0.821	Valid
	IN6	0.880	Valid
Knowledge Management	KA1	0.908	Valid
	KC1	0.659	Valid
	KC2	0.854	Valid
	KC3	0.806	Valid
	KD1	0.735	Valid
	KD3	0.791	Valid
	KD4	0.669	Valid
	KI1	0.602	Valid
Leadership	LD1	0.861	Valid
	LD2	0.880	Valid
	LD3	0.779	Valid
	LD4	0.855	Valid
	LD5	0.678	Valid

Source: Primary Data Processed by Author, 2025

All remaining indicators after reduction meet the validity standard with outer loading values > 0.60.

b. Discriminant Validity

Discriminant validity measures how well a construct can be distinguished from other constructs. This test was conducted using the Heterotrait-Monotrait Ratio (HTMT), and the results showed that all constructs in the model were well distinguished.

Table 7. *Heterotrait-Monotrait Ratio (HTMT) Test Results*

Variable	Leadership	Knowledge Management	Innovation
Innovation			
Knowledge Management	0.817		
Leadership	0.458	0.720	

Source: Primary Data Processed by Author, 2025

c. Composite Reliability

Composite reliability is used to assess the consistency of indicators in measuring constructs. High composite reliability and Cronbach's Alpha values indicate that the constructs in this study are reliable.

Table 8. *Cronbach's Alpha and Composite Reliability Test Results*

Variable	Cronbach's Alpha	Composite Reliability (rho_a)	Composite Reliability (rho_c)	Description
Innovation	0.867	0.867	0.905	Reliable
Knowledge Management	0.881	0.886	0.907	Reliable
Leadership	0.863	0.876	0.901	Reliable

Source: Primary Data Processed by Author, 2025

2. Structural Model Evaluation (Inner Model)

After the measurement model evaluation, the next step is the structural model evaluation to test the research hypotheses.

a. Multicollinearity Test

The multicollinearity test was conducted to ensure that there is no excessive correlation between independent variables. Based on the results obtained, there is no multicollinearity issue in this model.

Table 9. *Multicollinearity Test Results*

Variable	Leadership	Knowledge Management	Innovation
Innovation			
Knowledge Management	1.719		
Leadership	1.719	1.000	

Source: Primary Data Processed by Author, 2025

b. R-Square (R^2)

R^2 indicates how well the model explains variance in the dependent variables. The research results show that the R^2 value for Innovation is 0.515 and for Knowledge Management is 0.418, both falling into the moderate category.

Table 10. *Coefficient of Determination (R^2) Test Results*

Variable	R-Square	R-Square Adjusted
Innovation	0.515	0.509
Knowledge Management	0.418	0.414

Source: Primary Data Processed by Author, 2025

c. F-Square (F^2)

F-Square measures the extent of a variable's impact on other variables. The results indicate that Leadership has a small impact on Innovation but a very large impact on Knowledge Management.

Table 11. *Effect Size (F^2) Test Results*

Variable	Leadership	Knowledge Management	Innovation
Leadership	-	-	-
Knowledge Management	0.721	-	-
Innovation	0.011	0.719	-

Source: Primary Data Processed by Author, 2025

Hypothesis Testing

Hypothesis testing was conducted using bootstrapping in SmartPLS. The hypothesis test results show that Leadership has a positive effect on Knowledge Management, and Knowledge Management has a significant effect on Innovation. However, the direct effect of Leadership on Innovation is not significant, and the role of Knowledge Management as a mediator is proven to be significant.

Table 12. *Hypothesis Testing Results with Bootstrapping*

Hypothesis	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values	Result
H1: LD→IN	-0.095	-0.099	0.082	1.167	0.243	Rejected
H2: LD→KM	0.647	0.650	0.048	13.601	0.000	Accepted
H3: KM→IN	0.775	0.781	0.064	12.096	0.000	Accepted
H4: LD→KM→IN	0.501	0.508	0.058	8.592	0.000	Accepted

Source: Primary Data Processed by Author, 2025

Discussion of Results

1. Leadership's Effect on Innovation (H1)

The testing of H1 shows that Leadership does not have a significant direct effect on Innovation. This finding contradicts the general theory that leadership directly affects innovation (Di, 2022)*. However, in the context of PT Nuon Digital Indonesia, this result suggests that support or instructions from leaders are not sufficient to drive innovation. Instead, social interactions and employees' technical capabilities play a more significant role in fostering innovation.*

2. Leadership's Effect on Knowledge Management (H2)

The results of H2 show that Leadership has a positive and significant effect on Knowledge Management. This finding aligns with the theory stating that effective leadership creates an environment conducive to knowledge sharing (Kılıç & Uludağ, 2021)*. At PT Nuon, leaders act as facilitators who encourage collaboration among employees.*

3. Knowledge Management's Effect on Innovation (H3)

The results of H3 show that Knowledge Management has a significant effect on Innovation. This reinforces the application of the Knowledge-Based Dynamic Capabilities (KBDC) concept, which asserts that knowledge management is a key factor in driving innovation (Robertson et al., 2023)*.*

4. Role of Knowledge Management as an Intervening Variable (H4)

The results of H4 show that Knowledge Management serves as a full mediator between Leadership and Innovation. This finding suggests that effective leadership does not solely rely on direct instructions but also on knowledge management that drives sustainable innovation.

Based on the research findings, Knowledge Management is proven to be a key factor that strengthens the relationship between Leadership and Innovation at PT Nuon Digital Indonesia. Without effective knowledge management, the impact of leadership on innovation cannot be maximized. Therefore, the company needs to focus on developing a knowledge management ecosystem to improve innovation performance.

CONCLUSION

This study explores the relationship between leadership, knowledge management, and innovation at PT Nuon Digital Indonesia, revealing several important strategic findings. First, leadership does not have a direct impact on innovation, indicating that instructions and vision from leaders alone are not sufficient to drive innovation in a highly technical environment like the digital industry. Second, leadership proves to play a significant role in shaping effective knowledge management, with leaders serving as the primary drivers in creating a culture of knowledge sharing. Third, knowledge management emerges as a crucial determinant in enhancing innovation, confirming that innovation is produced through the accumulation of collective knowledge. Fourth, this study also finds that knowledge management acts as a full mediator in the relationship between leadership and innovation, emphasizing that innovation can only occur through the knowledge capacity built by leaders. Overall, knowledge management serves as an important bridge connecting leadership with innovation outcomes reflected in the company's products and services.

Recommendations for Future Research

Based on the findings of this study, several recommendations for future research can be made. First, further exploration of the mediating role of knowledge management is necessary, by adding moderating variables such as organizational culture or information technology, to see how these factors can influence the relationship between leadership and innovation. Second, in-depth research on the Knowledge-Based Dynamic Capabilities (KBDC) theory could be conducted to identify specific dimensions, such as knowledge protection and knowledge integration, that have the most impact on certain types of innovation (radical vs. incremental). Future research could also consider other sectors or industries with different characteristics to expand the understanding of this concept. Additionally, further testing of the impact of external and internal environments on the dynamics between leadership, knowledge management, and innovation could provide new, more comprehensive insights.

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