

Influence of Digital Leadership, Environmental Awareness, and Organizational Learning on Sustainable Supply Chain Performance through Green Supply Chain Innovation

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ABSTRACT

This study aims to examine the influence of digital leadership, environmental awareness, and organizational learning on sustainable supply chain performance through green supply chain innovation. This research was conducted in the cosmetics manufacturing industry in Ciledug, South Jakarta, Indonesia. A quantitative approach was used, with data collected from 240 employees involved in supply chain activities using purposive sampling. Data were analyzed using Partial Least Squares–Structural Equation Modeling (PLS-SEM) with SmartPLS 4. The results show that digital leadership, environmental awareness, and organizational learning have a positive and significant effect on green supply chain innovation. Green supply chain innovation also has a significant positive effect on sustainable supply chain performance and mediates the relationship between the independent variables and sustainable supply chain performance. These findings highlight the importance of digital leadership, environmental awareness, and organizational learning in improving sustainable supply chain performance through green innovation. This study provides practical insights for managers to strengthen digital capabilities and sustainability practices and contributes to the sustainable supply chain management literature.

Keywords: Digital Leadership, Environmental Awareness, Organizational Learning, Sustainability Supply Chain Performance, Green Supply Chain Innovation.

I. Introduction

Global environmental changes, increasing climate change issues, and growing pressure from regulators and society have encouraged companies to integrate economic, social, and environmental aspects into their operational activities. In this context, Sustainable Supply Chain Performance has become an important factor, as it reflects a company's ability to manage its supply chain efficiently while minimizing negative environmental impacts. The implementation of sustainable supply chain practices not only improves operational efficiency but also strengthens a company's competitiveness and long-term sustainability. One of the key factors contributing to improving Sustainable Supply Chain Performance is Green Supply Chain Innovation. Green Supply Chain Innovation refers to the implementation of environmentally friendly technologies, processes, and practices in supply chain activities to improve resource efficiency and reduce

environmental impact. Through these innovations, companies can enhance operational efficiency, reduce waste, and improve supply chain performance in a sustainable manner. The success of Green Supply Chain Innovation is influenced by various internal organizational factors, such as Digital Leadership, Environmental Awareness, and Organizational Learning. Digital Leadership refers to the ability of leaders to utilize digital technologies to support innovation and improve organizational operational effectiveness. Environmental Awareness reflects the level of organizational understanding and concern regarding the environmental impact of its operational activities, which encourages the adoption of environmentally friendly practices. Meanwhile, Organizational Learning refers to the organization's ability to acquire, develop, and apply knowledge to enhance innovation and organizational performance. Previous studies have shown that internal organizational factors play an important role in promoting innovation and improving Sustainable Supply Chain Performance. However, studies examining the role of Digital Leadership, Environmental Awareness, and Organizational Learning in influencing Sustainable Supply Chain Performance through Green Supply Chain Innovation as a mediating variable remain limited, particularly in the context of the cosmetic industry in Indonesia. The cosmetic industry has unique characteristics related to raw material usage, production processes, and waste management, which require effective and sustainable supply chain management. Based on this research gap, this study aims to analyze the effect of Digital Leadership, Environmental Awareness, and Organizational Learning on Sustainable Supply Chain Performance through Green Supply Chain Innovation as a mediating variable.

II. Literature Review and Hypothesis Development

Digital leadership refers to a leader's ability to effectively utilize digital technologies to drive organizational transformation, innovation, and performance improvement. According to (Tigre (2025) digital leadership involves the capability to integrate digital technologies into business strategies to enhance operational efficiency and competitiveness. Digital leaders play a crucial role in encouraging innovation, facilitating digital transformation, and fostering a culture that supports technological advancement. Furthermore, Gao & Gao (2024) explain that digital leadership includes competencies such as digital vision, technological adaptability, and the ability to promote innovation through digital initiatives. Leaders who possess strong digital capabilities can improve organizational responsiveness and support the implementation of sustainable practices, including green supply chains innovation. Previous studies have demonstrated that digital leadership significantly influences innovation and organizational performance. Organizations led by digitally competent leaders are more likely to adopt innovative practices and improve operational effectiveness (Miranti & Lunarindiah, 2025). Therefore, digital leadership is considered an essential factor in enhancing green supply chain innovation and sustainable supply chain performance (H. Li et al., 2024). Environmental awareness refers to the extent to which individuals and organizations recognize the importance of environmental protection and understand the environmental impact of their activities. According to Steg, (2025), environmental awareness plays a critical role in encouraging organizations to adopt environmentally friendly practices and sustainable innovations. Organizations with high environmental awareness tend to implement strategies aimed at reducing environmental impact, improving resource efficiency, and minimizing waste. Environmental awareness also influences organizational decision-making, encouraging companies to integrate sustainability into their operational and strategic activities. (Rusli & Usman, 2025). Previous research has shown that environmental awareness positively influences green innovation and sustainable performance. Firms with strong environmental awareness are more likely to implement environmentally friendly innovations, including green supply chain innovation (Wijayanti et al., 2024).

Organizational learning refers to the process through which organizations acquire, develop, and utilize knowledge to improve performance and adaptability. According to (Elbawab, 2024), organizational learning enhances an organization's ability to innovate and respond to environmental changes. Organizations that emphasize learning are more capable of adopting new technologies and innovative practices.

Organizational learning enables companies to continuously improve their operational processes and develop sustainable strategies (Pedraja-Rejas et al., 2025). Previous studies have shown that organizational learning significantly influences innovation and performance. Firms that actively engage in learning activities are more likely to develop green innovations and improve sustainable supply chain performance (Evenseth et al., 2022) and (Rad & Bocoş, 2024). Green supply chain innovation refers to the implementation of environmentally friendly technologies and practices within supply chain operations. According to Kumar et al, (2023), green supply chain innovation helps organizations reduce environmental impact while improving operational efficiency. Green supply chain innovation includes eco-friendly product design, waste reduction, energy efficiency, and sustainable procurement practices. This innovation enhances organizational sustainability and competitiveness (Saeed & Kersten, 2020). Previous research indicates that green supply chain innovation positively influences sustainable supply chain performance (Deng, 2024). Sustainable supply chain performance refers to the ability of supply chains to achieve economic, environmental, and social objectives simultaneously. According to Qiao (2023), sustainable supply chain performance integrates sustainability into supply chain management to enhance long-term organizational performance. Organizations that implement sustainable supply chain practices can improve operational efficiency, reduce environmental impact, and enhance competitiveness (Atieh & Abushaega, 2025).

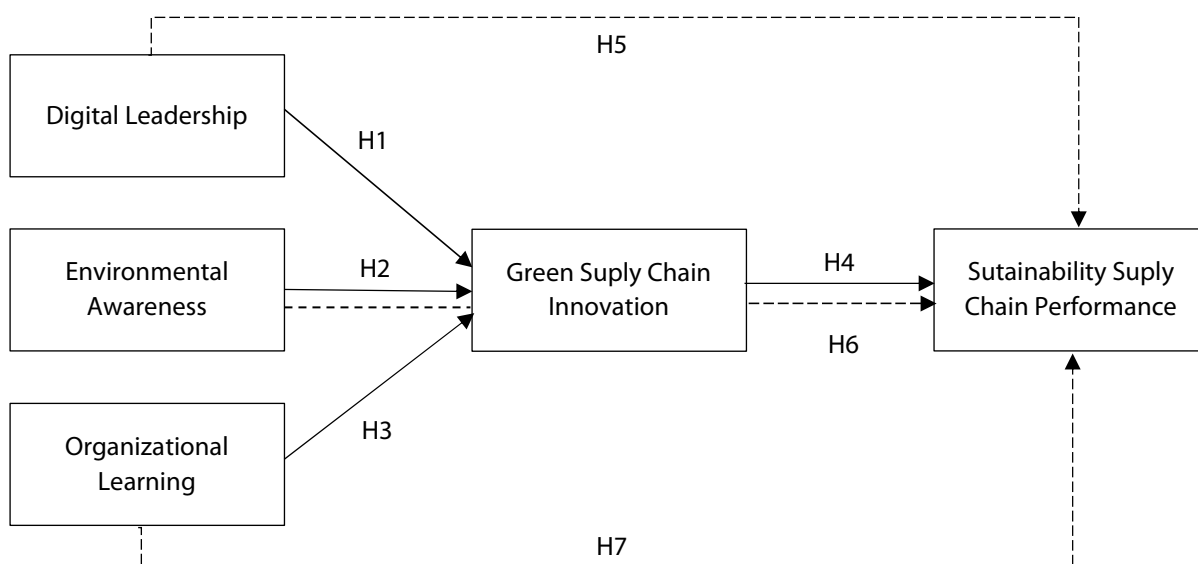


Figure 1. Conceptual Framework

H1 : Digital Leadership has a positive effect on Green Supply Chain Innovation

Organizational learning is a systematic process through which organizations acquire, develop, and utilize knowledge to enhance adaptability and innovation. A strong learning culture enables organizations to respond more effectively to environmental changes, optimize the use of technology, and integrate sustainability principles into supply chain operations. Organizational learning also serves as an essential foundation for green supply chain innovation by facilitating knowledge sharing and collaboration in the implementation of environmentally friendly technologies (Atieh & Abushaega, 2025). The ability of organizations to learn and adapt to digital technological developments has been shown to strengthen green innovation through improved supply chain collaboration (Cheng, 2024). Furthermore, effective organizational learning enables organizations to identify opportunities for green innovation through experience-based reflection and continuous process improvement (Kumar, 2023). Therefore, organizational learning plays a critical role in accelerating the transition toward sustainable supply chains. Thus, organizational learning has a positive influence on green supply chain innovation.

H2: Environmental Awareness has a positive effect on Green Supply Chain Innovation

Environmental awareness reflects the extent to which an organization is concerned about the environmental impacts of its business activities and encourages the adoption of sustainable practices. Organizations with a high level of environmental awareness tend to be more proactive in identifying opportunities for green innovation and improving business processes to become more environmentally friendly (Wu, 2024). Environmental awareness also plays a significant role in strengthening green supply chain innovation, as organizations become more adaptive, capable of utilizing technology efficiently, and more oriented toward operational sustainability (Atieh & Abushaega, 2025). Additionally, a high level of environmental awareness has been shown to enhance innovation capability in resource management and environmentally friendly production processes (Zhang et al., 2022). Thus, environmental awareness has a positive influence on green supply chain innovation.

H3: Organizational Learning has a positive effect on Green Supply Chain Innovation

Organizational learning is a systematic process through which organizations acquire and utilize knowledge to enhance adaptability and innovation. A strong learning culture enables organizations to respond more effectively to change, optimize the use of technology, and integrate sustainability principles into supply chain operations. Organizational learning also serves as an essential foundation for green supply chain innovation by facilitating knowledge sharing and collaboration in the implementation of environmentally friendly technologies (Atieh & Abushaega, 2025). The ability to learn and adapt to developments in digital technology has been shown to strengthen green innovation through improved supply chain collaboration (Cheng, 2024). Furthermore, effective organizational learning enables organizations to identify opportunities for green innovation through experience-based reflection and continuous process improvement (Kumar, 2023). Therefore, organizational learning plays a critical role in accelerating the transition toward sustainable supply chains. Thus, there is a positive influence of organizational learning on green supply chain innovation.

H4: Green Supply Chain Innovation has a positive effect on Sustainable Supply Chain Performance

Green supply chain innovation refers to the implementation of new ideas, technologies, and processes that emphasize resource efficiency and the reduction of environmental impacts throughout supply chain activities. This type of innovation plays a crucial role in improving sustainable supply chain performance by aligning economic, social, and environmental objectives (Olaleye & Mosleh, 2025). Green supply chain innovation also results from the integration of environmental strategies, technological advancement, and inter-organizational collaboration, which link environmentally friendly practices with improved operational and sustainability performance (Atieh & Abushaega, 2025). Through green supply chain innovation, organizations become more adaptive to environmental changes and regulatory requirements while simultaneously enhancing efficiency, flexibility, and long-term competitiveness (Zhaolei, 2023; Li, 2025).

H5: Digital Leadership has a positive effect on Sustainable Supply Chain Performance through Green Supply Chain Innovation

Digital leadership plays a strategic role in improving sustainable supply chain performance, with green supply chain innovation acting as a mediating variable. Digital leaders are capable of integrating digital technologies with sustainability principles to enhance operational efficiency, transparency, and environmentally friendly resource management across the supply chain (Hussein et al., 2024). Digital leadership also fosters an innovative and adaptive organizational culture that encourages the development of green innovation. In this context, green supply chain innovation serves as a mechanism that links digital

organizational capabilities with sustainable performance outcomes through the implementation of green technologies, strategic initiatives, and cross-functional collaboration (Atieh & Abushaega, 2025). Furthermore, digital transformation driven by digital leadership strengthens green innovation, which subsequently improves energy efficiency, reduces emissions, and enhances sustainable supply chain performance (Olaleye & Mosleh, 2025; Zhaolei, 2023).

H6: Environmental Awareness has a positive effect on Sustainable Supply Chain Performance through Green Supply Chain Innovation

Environmental awareness serves as a fundamental driver for organizations in implementing sustainable supply chain strategies. Organizations with a high level of environmental awareness tend to integrate environmental values into their supply chain activities, thereby enhancing efficiency and creating sustainable value. Environmental awareness also plays an important role in improving sustainable supply chain performance through green supply chain innovation (Atieh & Abushaega, 2025). It encourages organizations to develop green technologies, improve energy efficiency, and strengthen collaboration with supply chain partners. In this context, green supply chain innovation acts as a mediating mechanism between environmental awareness and sustainable supply chain performance (Olaleye & Mosleh, 2025). In addition, green innovation mediates this relationship by promoting environmentally friendly management practices that enhance organizational sustainability performance (Deng et al., 2024).

H7: Organizational Learning has a positive effect on Sustainable Supply Chain Performance through Green Supply Chain Innovation

Organizational learning enhances an organization's ability to manage knowledge, adapt to change, and promote sustainability-oriented innovation throughout the supply chain. Organizations with strong learning cultures tend to be more responsive and capable of integrating efficient and environmentally friendly practices. Organizational learning promotes green supply chain innovation through knowledge exchange and collaboration with supply chain partners (Qiao, 2023). The ability to learn and adapt to digital technologies also accelerates the integration of green technologies, thereby improving operational efficiency and reducing environmental impacts (Cheng, 2024). Furthermore, organizational learning supports green innovation in processes and logistics, which serves as a mediating mechanism between organizational learning and sustainable supply chain performance (Wang & Zhang, 2023; Atieh & Abushaega, 2025).

III. Research Method

This study employs a quantitative research approach to examine the relationships among digital leadership, environmental awareness, organizational learning, green supply chain innovation, and sustainable supply chain performance. The population of this study consists of employees working in cosmetic manufacturing companies in Indonesia. The sample was selected using a non-probability sampling technique, specifically purposive sampling, in which respondents were chosen based on their involvement in supply chain and operational activities. A total of 240 respondents participated in this study. This sample size meets the minimum requirement for Structural Equation Modeling (SEM) analysis, as recommended by Hair et al. (2019), which suggests a minimum sample size of 200 for SEM analysis. Data were collected using a structured questionnaire distributed online. The questionnaire included measurement items adapted from previously validated studies to ensure reliability and validity. A pilot test was conducted with a small group of respondents to ensure the clarity and reliability of the questionnaire. Feedback from the pilot test was used to refine and improve the questionnaire. All items were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). This scale was used to measure respondents' perceptions of digital leadership, environmental awareness, organizational learning, green supply chain innovation, and sustainable

supply chain performance. The data were analyzed using Structural Equation Modeling (SEM). SEM was employed to evaluate measurement validity, reliability, and to test the proposed hypotheses. Validity was assessed using factor loadings (>0.50), while reliability was evaluated using Cronbach's alpha (>0.70). Model fit was evaluated using several fit indices, including:

- a. CFI (>0.90)
- b. RMSEA (<0.08)
- c. GFI (>0.90)

These indices indicate whether the proposed model adequately fits the observed data.

IV. Result and Discussion

4.1. Respondent Characteristics

This study involved 240 respondents who are employees working in cosmetic industry companies located in Ciledug, South Jakarta. The number of respondents is considered adequate to meet the sample requirements for data analysis and hypothesis testing using PLS-SEM. Based on gender, the respondents consisted of 115 male employees (47.9%) and 125 female employees (52.1%). This distribution indicates that female respondents slightly dominate the sample. This condition reflects the workforce composition in the cosmetic industry, which tends to have higher female participation. Based on age, respondents aged 20–30 years accounted for 79 individuals (32.9%), respondents aged 31–40 years totaled 80 individuals (33.3%), respondents aged 41–50 years totaled 64 individuals (26.7%), and respondents aged above 50 years totaled 17 individuals (7.1%). This distribution shows that the majority of respondents are within the productive age range, indicating that they are actively involved in organizational operations and decision-making processes. Based on education level, respondents with high school education accounted for 39 individuals (16.3%), diploma graduates accounted for 59 individuals (24.6%), bachelor's degree graduates accounted for 108 individuals (45.0%), master's degree graduates accounted for 29 individuals (12.1%), and doctoral degree graduates accounted for 5 individuals (2.1%). These results indicate that most respondents have a bachelor's degree, suggesting that they possess sufficient educational background to understand organizational processes, digital transformation, and sustainability practices.

Based on job position, respondents working as directors totaled 14 individuals (5.8%), managers totaled 50 individuals (20.8%), supervisors totaled 60 individuals (25.0%), and staff totaled 116 individuals (48.3%). This distribution indicates that the majority of respondents are operational staff, who are directly involved in day-to-day operational and supply chain activities. Based on work experience, respondents with 1–5 years of experience totaled 105 individuals (43.8%), respondents with 6–10 years totaled 99 individuals (41.3%), respondents with 11–15 years totaled 13 individuals (5.4%), and respondents with more than 15 years totaled 23 individuals (9.6%). This finding indicates that most respondents have moderate work experience, suggesting that they have sufficient knowledge and practical experience related to organizational operations and supply chain management. Overall, the respondent characteristics indicate that the sample is representative and relevant to the objectives of this study, as the respondents possess appropriate educational background, work experience, and organizational roles related to supply chain activities and sustainability practices. This study involved 240 respondents who are employees working in cosmetic industry companies located in Ciledug, South Jakarta. The number of respondents is considered adequate to meet the sample requirements for data analysis and hypothesis testing using PLS-SEM. Based on gender, the respondents consisted of 115 male employees (47.9%) and 125 female employees (52.1%). This distribution indicates that female respondents slightly dominate the sample. This condition reflects the workforce composition in the cosmetic industry, which tends to have higher female participation.

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4.2. Prerequisites Test

The validity test was conducted to evaluate the extent to which each measurement item accurately represents the construct being measured. An indicator is considered valid if the factor loading value exceeds 0.50. The results of the validity test are presented in Table 1.

Table 1. Validity Test

Measurement Item	Factor Loading	Decision
Digital Leadership		
1. Our leadership has a clear vision for digital transformation that is aligned with sustainability.	0.906	Valid
2. Top management promotes digital technologies to enable more environmentally friendly operations.	0.820	
3. We are proactive in adopting digital solutions to support greener and more sustainable operations.	0.847	
4. Our leaders encourage innovation in sustainable digital practices.	0.853	
Environmental Awareness		
1. We understand the environmental risks associated with our supply chain activities.	0.875	Valid
2. Our organization has policies that reflect environmental responsibility.	0.825	
3. We actively monitor compliance with environmental regulations and standards.	0.846	
4. Employees are aware of the ecological impacts of their activities.	0.869	
Organizational Learning		

1. We learn from previous environmental mistakes to improve our practices.	0.833	Valid
2. Knowledge about sustainability is shared across all departments.	0.809	
3. Our organization adapts quickly based on environmental feedback.	0.799	
4. Employees are encouraged to propose environmentally friendly improvements.	0.862	
Green Supply Chain Innovation		
1. We design products that minimize environmental impact.	0.820	Valid
2. Our logistics processes reduce waste and pollution.	0.841	
3. We implement reverse logistics systems.	0.801	
4. We collaborate with suppliers to develop more environmentally friendly solutions.	0.831	
5. We invest in low-emission technologies and materials.	0.855	
Sustainable Supply Chain Performance		
1. Our supply chain reduces carbon emissions.	0.792	Valid
2. We achieve cost savings through the implementation of sustainability practices.	0.870	
3. Our operations comply with environmental and social regulations and standards.	0.869	
4. Stakeholders perceive our supply chain as socially responsible and ethically managed.	0.877	
5. Sustainability initiatives enhance our competitive position in the market.	0.753	

The results of the validity test indicate that all indicators in this study have factor loading values above 0.40. Therefore, all indicators are considered valid and can be used for further analysis in the subsequent reliability testing stage.

Table 2. Average Variance Extracted (AVE) Value

Variable	AVE	Decision
Digital Leadership	0.746	Valid
Environmental Awareness	0.729	
Organizational Learning	0.682	
Green Supply Chain Innovation	0.689	
Sustainable Supply Chain Performance	0.695	

The test results show that all constructs have Average Variance Extracted (AVE) values above 0.50. This indicates that each construct is able to explain more than half of the variance of its respective indicators. Therefore, it can be concluded that all constructs in this study meet the criteria for convergent validity.

Table 3. Discriminant Validity Test

Variable	Green Supply Chain Innovation	Digital Leadership	Environmental Awareness	Sustainable Supply Chain Performance	Organizational Learning
Green Supply Chain Innovation	0.830				
Digital Leadership	0.741	0.864			

Environmental Awareness	0.663	0.575	0.854		
Sustainable Supply Chain Performance	0.782	0.601	0.744	0.834	
Organizational Learning	0.629	0.506	0.578	0.710	0.826

The test results indicate that the square root of the Average Variance Extracted (AVE) for each construct is greater than its correlations with other constructs. For example, the Digital Leadership construct has a square root of AVE value of 0.864, which is higher than its correlations with other constructs, including Green Supply Chain Innovation. A similar pattern is observed for the other constructs, where the diagonal values are consistently higher than the inter-construct correlation values. These findings indicate that each variable has a strong ability to distinguish itself from other constructs. Therefore, all variables in the research model meet the criteria for discriminant validity.

Table 4. Reliability Test

Variable	Cronbach's Alpha	Composite Reliability	Decision
Digital Leadership	0.886	0.893	Reliable
Environmental Awareness	0.877	0.884	
Organizational Learning	0.845	0.845	
Green Supply Chain Innovation	0.887	0.890	
Sustainable Supply Chain Performance	0.890	0.898	

The reliability test results indicate that all research variables have Cronbach's Alpha values above 0.60, indicating an adequate level of internal consistency. These findings show that the variables Digital Leadership, Environmental Awareness, Organizational Learning, Green Supply Chain Innovation, and Sustainable Supply Chain Performance demonstrate good reliability. Therefore, all indicators used in this study are considered stable and reliable as measurement instruments.

4.3. Goodness of Fit

The Goodness of Fit test was conducted to evaluate the overall suitability of the research model with the observed data. This test helps determine whether the proposed structural model is appropriate for explaining the relationships among the variables in the study. The results of the Goodness of Fit test are presented in Table 5.

Table 5. Goodness of Fit Test

Index	Saturated Model	Estimated Model	Decision
SRMR	0.070	0.093	Poor Fit
D_ULS	1.246	2.207	Good Fit
D_G	1.045	1.146	Good Fit
NFI	0.724	0.706	Poor Fit
Chi-square	1252.741	1333.321	Poor Fit

The results of the Goodness of Fit test indicate that several indices, such as SRMR, NFI, and Chi-square, fall into the poor fit category. However, other indices, namely D_ULS and D_G, indicate a good fit. In the PLS-SEM approach, the evaluation of Goodness of Fit is considered supportive and is not the primary basis for

assessing overall model adequacy. Therefore, as long as some indices meet the good fit criteria, the research model can still be considered acceptable and may proceed to the hypothesis testing stage.

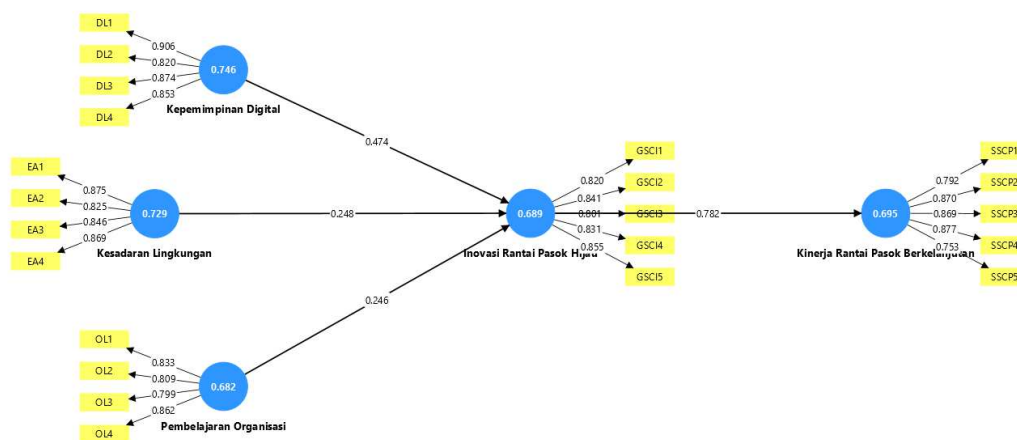


Figure 2. Graph

4.4. Hypothesis Testing

The hypothesis testing was conducted to examine the relationships among the research variables using the Structural Equation Modeling (SEM) approach with SmartPLS. The evaluation was based on the values of the original sample (O), t-statistics, and p-values. A hypothesis is considered supported if the p-value is less than 0.05. The results of the hypothesis testing are presented in Table 6.

Table 6. Hypothesis Testing Results

Hypothesis	Original Sample (O)	T-Statistics	P-Values	Decision
H1: Digital Leadership has a positive effect on Green Supply Chain Innovation.	0.474	10.041	0.000	Supported
H2: Environmental Awareness has a positive effect on Green Supply Chain Innovation.	0.248	4.912	0.000	
H3: Organizational Learning has a positive effect on Green Supply Chain Innovation.	0.246	4.620	0.000	
H4: Green Supply Chain Innovation has a positive effect on Sustainable Supply Chain Performance.	0.782	14.214	0.000	
H5: Digital Leadership has a positive effect on Sustainable Supply Chain Performance through Green Supply Chain Innovation.	0.371	7.961	0.000	
H6: Environmental Awareness has a positive effect on Sustainable Supply Chain Performance	0.194	4.648	0.000	

through Green Supply Chain Innovation.				
H7: Organizational Learning has a positive effect on Sustainable Supply Chain Performance through Green Supply Chain Innovation.	0.192	4.198	0.000	

a. Digital Leadership has a positive and significant effect on Green Supply Chain Innovation

The results of the hypothesis testing indicate that Digital Leadership has a positive and significant effect on Green Supply Chain Innovation. This is evidenced by a p-value of 0.000, which is below the significance threshold of 0.05, an original sample value of 0.474, and a t-statistic of 10.041, which exceeds the critical value of 1.96. These results confirm that Digital Leadership significantly contributes to the improvement of Green Supply Chain Innovation. Therefore, Hypothesis 1 is supported. This finding suggests that organizations with strong digital leadership are better able to promote environmentally friendly innovation within their supply chain activities. Digital leaders play an important role in encouraging the adoption of digital technologies, improving operational efficiency, and supporting innovation processes. The integration of digital technologies enables organizations to enhance information transparency, improve coordination, and optimize supply chain operations in a more sustainable manner. Furthermore, digital leadership helps organizations adapt to technological changes and environmental challenges. Leaders who possess strong digital competencies can encourage innovation, facilitate technological transformation, and promote environmentally sustainable practices. As a result, digital leadership strengthens the organization's ability to develop green supply chain innovation and improve overall sustainability performance.

b. Environmental Awareness has a positive and significant effect on Green Supply Chain Innovation

The results of the analysis show that Environmental Awareness has a positive and significant effect on Green Supply Chain Innovation. This is indicated by a p-value of 0.000, an original sample value of 0.248, and a t-statistic of 4.912, which exceeds the critical value of 1.96. These findings confirm that Environmental Awareness significantly contributes to improving Green Supply Chain Innovation. Therefore, Hypothesis 2 is supported. This result indicates that organizations with higher environmental awareness are more likely to implement environmentally friendly innovations in their supply chain activities. Environmental awareness encourages organizations to recognize the importance of sustainability and adopt green practices that minimize environmental impact. Organizations that prioritize environmental sustainability tend to invest in environmentally friendly technologies, improve resource efficiency, and implement sustainable operational practices. In addition, environmental awareness strengthens the organization's commitment to sustainability and encourages continuous improvement in environmentally friendly innovation. This awareness enables organizations to develop sustainable supply chain strategies and improve their environmental and operational performance.

c. Organizational Learning has a positive and significant effect on Green Supply Chain Innovation

The results of the hypothesis testing indicate that Organizational Learning has a positive and significant effect on Green Supply Chain Innovation. This is supported by a p-value of 0.000, an original sample value of 0.246, and a t-statistic of 4.620, which exceeds the critical value of 1.96. These findings confirm that Organizational Learning significantly contributes to enhancing Green Supply Chain Innovation. Therefore, Hypothesis 3 is supported. This finding suggests that organizations that actively promote learning and knowledge sharing are more capable of developing environmentally friendly innovations. Organizational learning enables companies to acquire new knowledge, improve operational processes, and strengthen their ability to implement sustainable practices. Furthermore, organizational learning enhances the organization's adaptability to technological and environmental changes. Organizations that continuously learn and improve

their capabilities are better able to develop innovative solutions and improve the sustainability performance of their supply chains.

d. Green Supply Chain Innovation has a positive and significant effect on Sustainable Supply Chain Performance

The results of the hypothesis testing indicate that Green Supply Chain Innovation has a positive and significant effect on Sustainable Supply Chain Performance. This is evidenced by a p-value of 0.000, an original sample value of 0.782, and a t-statistic of 14.214, which exceeds the critical value of 1.96. These results indicate a strong positive relationship between Green Supply Chain Innovation and Sustainable Supply Chain Performance. Therefore, Hypothesis 4 is supported. This finding confirms that the implementation of environmentally friendly innovations significantly improves sustainable supply chain performance. Green supply chain innovation enables organizations to enhance operational efficiency, reduce environmental impact, and improve overall sustainability performance. In addition, organizations that adopt green innovation practices are better able to strengthen their competitiveness, optimize resource utilization, and achieve long-term sustainability. These results highlight the important role of green innovation in achieving sustainable supply chain performance.

e. Digital Leadership has a positive and significant effect on Sustainable Supply Chain Performance through Green Supply Chain Innovation

The results of the mediation analysis indicate that Digital Leadership has a positive and significant effect on Sustainable Supply Chain Performance through Green Supply Chain Innovation. This is supported by a p-value of 0.000 (< 0.05), an original sample coefficient of 0.371, and a t-statistic of 7.961 (> 1.96), confirming that the indirect effect is statistically significant. These findings demonstrate that Green Supply Chain Innovation plays an important mediating role in strengthening the relationship between Digital Leadership and Sustainable Supply Chain Performance. Digital Leadership reflects the ability of organizational leaders to utilize digital technologies, promote innovation, and support organizational transformation in response to environmental and technological changes. Leaders with strong digital competencies are better able to encourage the adoption of advanced technologies, facilitate data-driven decision-making, and promote innovative solutions within supply chain activities. This leadership capability creates a supportive environment that enables organizations to develop and implement Green Supply Chain Innovation. Through Digital Leadership, organizations are better able to integrate digital technologies into environmentally sustainable supply chain practices, such as improving operational efficiency through automation, optimizing resource utilization, enhancing supply chain transparency, and reducing environmental impact.

Digital technologies also enable organizations to monitor environmental performance, improve coordination with supply chain partners, and develop innovative solutions that support sustainability objectives. As a result, Digital Leadership indirectly contributes to improving Sustainable Supply Chain Performance by enabling the effective implementation of Green Supply Chain Innovation. Furthermore, Green Supply Chain Innovation serves as a critical mechanism that translates Digital Leadership into improved performance outcomes. Digital Leadership alone may not directly improve Sustainable Supply Chain Performance unless it is supported by innovation that transforms leadership capabilities into practical and sustainable operational improvements. When leaders actively promote digital transformation and innovation, organizations become more capable of implementing environmentally friendly supply chain practices, which ultimately enhance operational efficiency, environmental performance, and long-term sustainability. These findings highlight the importance of Digital Leadership in driving organizational innovation and achieving sustainable supply chain performance. Organizations that develop strong digital leadership capabilities are more likely to successfully implement Green Supply Chain Innovation and achieve superior sustainability outcomes. Therefore, it can be concluded that Green Supply Chain Innovation significantly mediates the relationship between Digital Leadership and Sustainable Supply Chain Performance. Based on these results, Hypothesis 5 is supported.

f. Environmental Awareness has a positive and significant effect on Sustainable Supply Chain Performance through Green Supply Chain Innovation

The results of the mediation analysis indicate that Environmental Awareness has a positive and significant effect on Sustainable Supply Chain Performance through Green Supply Chain Innovation. This is supported by a p-value of 0.000 (< 0.05), an original sample coefficient of 0.194, and a t-statistic of 4.648 (> 1.96), confirming the statistical significance of the indirect relationship. These findings suggest that Environmental Awareness plays a crucial role in encouraging organizations to adopt environmentally responsible practices, which in turn stimulate the development and implementation of Green Supply Chain Innovation. Organizations with a higher level of environmental awareness tend to recognize the importance of minimizing environmental impact, improving resource efficiency, and complying with environmental regulations. This awareness encourages companies to integrate environmentally friendly approaches into their supply chain processes, such as adopting eco-friendly materials, improving waste management, optimizing energy usage, and implementing sustainable production and logistics systems. Through these innovative green practices, organizations are able to enhance operational efficiency, reduce environmental risks, and strengthen overall supply chain sustainability. Furthermore, Green Supply Chain Innovation acts as an important mediating mechanism that transforms environmental awareness into tangible performance outcomes. Without innovation, environmental awareness alone may not directly improve supply chain performance. However, when environmental awareness is translated into concrete innovative actions, it can significantly contribute to improving economic, environmental, and operational performance simultaneously. This indicates that organizations must not only develop environmental awareness but also actively support innovation initiatives to achieve sustainable supply chain performance. Therefore, these findings confirm that Green Supply Chain Innovation successfully mediates the relationship between Environmental Awareness and Sustainable Supply Chain Performance. Based on these results, Hypothesis 6 is supported.

g. Organizational Learning has a positive and significant effect on Sustainable Supply Chain Performance through Green Supply Chain Innovation

The results of the hypothesis testing show that Organizational Learning has a positive and significant effect on Sustainable Supply Chain Performance through Green Supply Chain Innovation. This is evidenced by a p-value of 0.000 (< 0.05), an original sample value of 0.192, and a t-statistic of 4.198 (> 1.96), indicating that the indirect relationship is statistically significant. These findings demonstrate that Organizational Learning plays a fundamental role in facilitating Green Supply Chain Innovation, which subsequently improves Sustainable Supply Chain Performance. Organizational Learning enables companies to acquire, develop, and utilize knowledge related to environmentally sustainable practices and technological advancements. Through continuous learning processes, organizations are able to improve their capabilities in identifying environmental challenges, developing innovative solutions, and adapting to dynamic environmental and market demands. This learning process enhances employees' skills, strengthens knowledge sharing, and encourages the adoption of new technologies and environmentally friendly supply chain practices. Moreover, Organizational Learning helps organizations build innovation capabilities by promoting continuous improvement and knowledge integration across different operational functions.

As a result, companies become more capable of implementing Green Supply Chain Innovation, such as eco-efficient production methods, sustainable sourcing, green logistics, and environmentally responsible product development. These innovations contribute significantly to improving operational efficiency, reducing environmental impact, and enhancing overall supply chain performance. Green Supply Chain Innovation serves as a critical mediating variable that connects Organizational Learning with Sustainable Supply Chain Performance. This indicates that Organizational Learning alone may not directly improve performance unless it is translated into innovative practices. When organizations effectively utilize their learning capabilities to develop and implement green innovations, they are more likely to achieve superior sustainable supply chain performance. Therefore, it can be concluded that Green Supply Chain Innovation

effectively mediates the relationship between Organizational Learning and Sustainable Supply Chain Performance. Based on these findings, Hypothesis 7 is supported.

V. Conclusion

This study aims to examine the effect of digital leadership, environmental awareness, and organizational learning on sustainable supply chain performance, with green supply chain innovation serving as a mediating variable. Based on the results of data analysis using Partial Least Squares Structural Equation Modeling (PLS-SEM), the findings indicate that digital leadership has a positive and significant effect on green supply chain innovation. This result suggests that leaders who effectively utilize digital technologies are able to support the implementation of environmentally friendly innovations and enhance organizational capabilities in adopting sustainable practices. Digital leadership plays a crucial role in facilitating technological integration, improving operational efficiency, and encouraging environmentally oriented innovation within supply chain activities. The results also show that environmental awareness has a positive and significant effect on green supply chain innovation. This finding indicates that organizations with a strong awareness of environmental sustainability are more likely to implement environmentally friendly innovations in their supply chain processes. Environmental awareness encourages organizations to adopt sustainable practices, improve resource efficiency, and reduce environmental impact, thereby strengthening green innovation capabilities. Furthermore, organizational learning was found to have a positive and significant effect on green supply chain innovation. This result indicates that organizations that actively promote learning, knowledge sharing, and continuous improvement are better able to develop and implement environmentally friendly innovations. Organizational learning enhances the organization's ability to adapt to technological developments, improve operational processes, and support the successful implementation of green supply chain innovation. In addition, green supply chain innovation has a positive and significant effect on sustainable supply chain performance. This finding confirms that the implementation of green innovation contributes to improved operational efficiency, reduced environmental impact, and enhanced sustainability performance.

Organizations that adopt green supply chain innovation are better able to achieve sustainable performance by integrating environmental considerations into their supply chain management practices. Moreover, the results indicate that green supply chain innovation mediates the relationship between digital leadership, environmental awareness, organizational learning, and sustainable supply chain performance. This finding suggests that green supply chain innovation serves as an important mechanism through which organizational capabilities, including digital leadership, environmental awareness, and organizational learning, contribute to improving sustainable supply chain performance. This highlights the strategic importance of green innovation in strengthening the relationship between organizational capabilities and sustainability outcomes. This study provides important theoretical implications by contributing to the development of sustainable supply chain management literature. Specifically, this study highlights the role of digital leadership, environmental awareness, and organizational learning as key factors that influence green supply chain innovation and sustainable supply chain performance. In addition, this study emphasizes the mediating role of green supply chain innovation, which provides a deeper understanding of how organizational capabilities influence sustainability performance through innovation mechanisms. From a practical perspective, the findings of this study provide valuable insights for organizational leaders and managers, particularly in the cosmetic industry. Organizations are encouraged to strengthen digital leadership capabilities to support technological innovation and sustainability initiatives. In addition, organizations should enhance environmental awareness by promoting environmentally responsible practices and integrating sustainability principles into organizational strategies.

Furthermore, organizations should foster a strong learning culture to support continuous improvement and innovation. By strengthening these organizational capabilities, companies can enhance green supply chain innovation and improve sustainable supply chain performance. Despite its contributions,

this study has several limitations. First, this study was limited to employees working in cosmetic industry companies located in Ciledug, South Jakarta, which may limit the generalizability of the findings to other industries and geographical areas. Second, this study used a cross-sectional research design, which captures data at a single point in time and does not fully reflect changes over time. Third, this study relied on self-reported data from respondents, which may be subject to response bias. Therefore, future research is recommended to expand the research scope by including different industries and geographical regions to enhance the generalizability of the findings. Future studies may also use longitudinal research designs to examine the long-term effects of digital leadership, environmental awareness, organizational learning, and green supply chain innovation on sustainable supply chain performance. In addition, future research may consider including additional variables, such as organizational culture, technological capability, or environmental regulation, to provide a more comprehensive understanding of the factors influencing sustainable supply chain performance.

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