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THE IMPACT OF DYNAMIC CAPABILITIES AND STAKEHOLDER PRESSURE ON SUSTAINABLE SUPPLY CHAIN PERFORMANCE IN THE MANUFACTURING INDUSTRY

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ABSTRACT

This study aims to analyze how dynamic capabilities and stakeholder pressure influence sustainable supply chain performance, with green supply chain innovation (GSCI) serving as a mediating variable in Indonesian manufacturing companies. Dynamic capabilities are represented by digital leadership, environmental awareness, and organizational learning, while stakeholder pressure is positioned as the main external factor. The research uses a quantitative approach with partial least squares–structural equation modeling (PLS-SEM) on data collected from 152 respondents. The results show that digital leadership, environmental awareness, and stakeholder pressure positively influence GSCI, while organizational learning has no significant effect. Furthermore, GSCI is proven to positively affect sustainable supply chain performance and mediates the influence of digital leadership, environmental awareness, and stakeholder pressure on sustainable supply chain performance, but does not mediate the relationship between organizational learning and sustainable supply chain performance. These findings confirm that green supply chain innovation is a key mechanism in translating internal capabilities and external pressures into improved sustainable supply chain performance, contributing theoretically to the development of Dynamic Capabilities Theory and Stakeholder Theory, as well as providing practical implications for sustainable supply chain management in the manufacturing sector.

Keywords : Green Supply Chain Innovation; Dynamic Capabilities; Sustainable Supply Chain Performance

ABSTRAK

Studi ini bertujuan untuk menganalisis bagaimana kemampuan dinamis dan tekanan pemangku kepentingan mempengaruhi kinerja rantai pasokan berkelanjutan, dengan inovasi rantai pasokan hijau (GSCI) berfungsi sebagai variabel mediasi di perusahaan manufaktur Indonesia. Kemampuan dinamis diwakili oleh kepemimpinan digital, kesadaran lingkungan, dan pembelajaran organisasi, sedangkan tekanan pemangku kepentingan diposisikan sebagai faktor eksternal utama. Penelitian ini menggunakan pendekatan kuantitatif dengan partial least squares–structural equation modeling (PLS-SEM) pada data yang dikumpulkan dari 152 responden. Hasil penelitian menunjukkan bahwa kepemimpinan digital, kesadaran lingkungan, dan tekanan pemangku kepentingan berpengaruh positif terhadap GSCI, sedangkan pembelajaran organisasi tidak memiliki efek yang signifikan. Selain itu, GSCI terbukti berdampak positif pada kinerja rantai pasokan yang berkelanjutan dan memediasi pengaruh kepemimpinan digital, kesadaran lingkungan, dan tekanan pemangku kepentingan terhadap kinerja rantai pasokan yang berkelanjutan, tetapi tidak memediasi hubungan antara pembelajaran organisasi dan kinerja rantai pasokan yang berkelanjutan. Temuan ini menegaskan bahwa inovasi rantai pasokan hijau adalah mekanisme kunci dalam menerjemahkan kemampuan internal dan tekanan eksternal ke dalam peningkatan kinerja rantai pasokan berkelanjutan, berkontribusi secara teoritis pada pengembangan Teori

Kemampuan Dinamis dan Teori Pemangku Kepentingan, serta memberikan implikasi praktis untuk manajemen rantai pasokan berkelanjutan di sektor manufaktur.

Kata Kunci : Inovasi Rantai Pasokan Hijau; Kemampuan Dinamis; Kinerja Rantai Pasokan Berkelanjutan

INTRODUCTION

Factories in Indonesia, particularly those producing food and beverages, textiles, and chemicals, have turned out to be the largest contributors to carbon pollution and energy waste in our country. Although these industries continue to grow rapidly, their negative impact on the environment is becoming increasingly alarming, compelling companies to immediately adopt more environmentally friendly supply chain systems (Badan Pusat Statistik, 2024; Christi et al., 2025). The pressure is coming from all sides: the government is enacting stricter regulations regarding sustainability reporting, while investors and consumers are growing increasingly vocal in demanding transparency regarding companies' ESG practices. Research in the pharmaceutical industry even shows that companies that excel in logistics, are innovative, and are smart about managing costs will have a competitive edge and find it easier to meet these sustainability demands (Xaviera et al., 2024). If a company fails to meet sustainability standards, the risks are significant (Proxsis, 2025; Wordsmith, 2025). So now, eco-friendly business practices are no longer just a trend or an option, but have become a strategic necessity for companies to remain viable and competitive.

However, manufacturing companies face limitations in internal capabilities—such as digital leadership, environmental awareness, and organizational learning—that are necessary to respond to external pressures and adopt low-emission technologies (Dinâmicas, 2025). Green supply chain innovation (GSCI) serves as a critical bridge between internal capabilities and external pressures to enhance supply chain performance. Although global studies demonstrate that GSCI effectively improves efficiency, quality, and sustainability (Cheng et al., 2024), empirical evidence in Indonesia remains limited.

Both nationally and internationally, pressure from various stakeholders is growing stronger in urging companies to strengthen sustainable practices and transparency in ESG reporting. Empirical findings in the Indonesian context confirm that stakeholder pressure is associated with the adoption of environmentally friendly practices and the level of corporate sustainability disclosure, making such pressure an external catalyst for organizational transformation (Crisandhy et al., 2022).

Nevertheless, companies need internal capabilities to respond to external pressures effectively. Dynamic Capabilities Theory states that to achieve a competitive advantage in a dynamic environment, an organization must build the capacity to identify changes in external conditions, optimize available opportunities, and adapt its internal competencies (Teece, 2018).

Capabilities such as digital leadership, environmental awareness, and organizational learning are essential competencies for identifying opportunities, implementing environmentally friendly technologies, and transforming operational processes toward sustainability. Recent research indicates a positive correlation between these capabilities and Green Supply Chain Innovation (Atieh & Abushaega, 2025). To transform internal capabilities and external pressures into measurable performance outcomes, organizations require an applied mechanism: Green Supply Chain Innovation (GSCI). Literature reviews explain that GSCI serves as an operational intermediary that converts organizational capabilities and stakeholder demands into improved supply chain performance (Y. Feng et al., 2022).

A number of international studies have demonstrated that GSCI is supported by digital transformation and dynamic capabilities, and has a positive impact on sustainable supply chain performance. However, most of this research was conducted in the context of other countries or industries outside of manufacturing, so these findings cannot necessarily be applied to the Indonesian manufacturing sector, which has unique characteristics in terms of supply chain characteristics, levels of digitalization, and different supplier configurations. Thus, an empirical study in a domestic context is needed to verify and adapt these research results (Atieh & Abushaega, 2025; Y. Feng et al., 2022).

In addition to contextual limitations, there is a theoretical and empirical gap: a large number of studies examine the relationship between internal capabilities → GSCI → performance (mediation model) or stakeholder pressure → green practices (direct model) (Özgül & Zehir, 2023; Singh et al., 2022), yet few have tested a comprehensive model that integrates three dynamic capabilities (digital leadership, environmental awareness, organizational learning) alongside stakeholder pressure as concurrent predictors, with GSCI as a mediating variable for sustainable supply chain performance (Atieh & Abushaega, 2025), particularly in manufacturing firms in developing countries such as Indonesia. This research gap limits the capacity of policymakers and managerial practitioners to formulate effective and targeted interventions.

This study aims to address the gap in empirical evidence by examining how digital leadership, environmental awareness, organizational learning, and stakeholder pressure influence green supply chain performance in Indonesia's manufacturing industry, with sustainable supply chain innovation serving as the connecting bridge. This study not only seeks to enrich the theoretical understanding of dynamic capabilities and stakeholder theory in the context of developing countries but also provides practical benefits for manufacturing managers in determining capability development priorities and designing appropriate green innovation programs, while assisting policymakers in formulating effective incentives and funding schemes to encourage the adoption of environmentally friendly practices in the manufacturing sector.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Dynamic capabilities

Dynamic capabilities are an organization's high-level ability to detect opportunities and threats (sensing), capitalize on those opportunities (seizing), and reconfigure organizational resources and structures (transforming) in order to maintain and renew competitive advantage in a rapidly changing environment (Teece, 2018). This theory emerged to address the limitations of the Resource-Based View (RBV), which is considered too static, by emphasizing that resource ownership alone is insufficient; organizations require high-level capabilities to continuously adapt and renew their resource base (Cavusgil & Deligonul, 2024), and has become a transformative foundation for understanding corporate strategy and advantage in the modern era.

Digital leadership

Digital leadership is a leadership style that leverages digital technology to guide organizational transformation in the midst of an era of disruption (Hossain et al., 2025). Research indicates that effective digital leadership can enhance green supply chain collaboration and drive sustainable innovation, ultimately improving overall supply chain performance (Atieh & Abushaega, 2025; Cheng et al., 2024). In the context of dynamic capabilities, digital leadership functions as a "seizing" capability that translates technological and environmental opportunities into concrete decisions and actions, thereby accelerating the achievement of sustainable supply chain innovation and performance improvement (Teece, 2018).

Organizational Learning

In dynamic capabilities theory, transforming capabilities refer to an organization's ability to reorganize and develop internal competencies to remain relevant in the face of environmental changes (Teece, 2018). Organizational learning plays a crucial role as the foundation of transforming capabilities because, through the learning process, companies can adapt their routines, processes, and resources to adopt green innovations and enhance the performance of sustainable supply chains (Atieh & Abushaega, 2025). Research also indicates that green organizational learning capability serves as a key mediator between analytical capability and green innovation, reinforcing the transformation of resources into sustainable competitive elements (Al Koliby et al., 2025). Thus, organizational learning enables organizations not only to respond to green opportunities but also to continuously reconfigure internal competencies so that environmental innovation becomes an integral part of their long-term structure and performance.

Environmental awareness

Environmental awareness is a key foundation of sensing capabilities within dynamic capabilities theory—that is, an organization's ability to detect and respond to external environmental signals related to sustainability issues (Jin et al., 2024). Organizations with high levels of environmental awareness tend to recognize regulatory pressures and market demands for green products or services more quickly, thereby triggering the emergence of green supply chain innovation (GSCI) in the form of product, process, and supply chain collaboration innovations (Y. Feng et al., 2022). Empirical research indicates that environmental awareness not only drives the emergence of GSCI but also accelerates the realization of its benefits in sustainable supply chain performance, as organizations sensitive to environmental issues are more effective in prioritizing, allocating resources, and capitalizing on green opportunities to achieve measurable outcomes across environmental and economic dimensions (Cheng et al., 2024).

Stakeholder theory

Stakeholder theory, popularized by (Edward Freeman John McVea et al., 1984), emphasizes that companies are not only accountable to shareholders but also to various stakeholders—such as the government, customers, suppliers, the community, and employees—who can influence or be influenced by the company's activities. An organization's success is determined by its ability to strategically manage the relationships and interests of all stakeholders. This theory serves as an ethical and managerial framework that requires companies to create shared value through collaboration with stakeholders, rather than merely pursuing maximum profit (Edward Freeman John McVea et al., 2018).

Pressure from various stakeholders drives companies to adopt green innovations in order to maintain their legitimacy and competitiveness. Stakeholder pressure significantly influences green dynamic capabilities, which in turn enhance green innovation and have a positive impact on corporate performance (Singh et al., 2022). Other research also confirms that stakeholder pressure, both internal and external, increases a company's commitment to implementing sustainable supply chain management practices, which directly improve the company's environmental, social, and operational performance (Siems et al., 2023).

Green supply chain performance

Green supply chain performance (GSCP) refers to the ability of a supply network to achieve balanced outcomes across the three dimensions of sustainability—economic, environmental, and social—through integrated management practices or the triple bottom line (Kumar et al., 2023). Measurement indicators include cost and operational efficiency, service reliability, emission and waste reduction, efficient energy use, as well as social impacts such as workplace safety and community well-being (Sehnem et al., 2019). Empirical research indicates that the achievement of GSCP is influenced by a combination of internal and external factors, with companies that integrate sustainable supply chain management practices and adopt technology tending to demonstrate improved environmental and economic performance (Lerman et al., 2022; Mangla et al., 2020). Recent studies emphasize the importance of a structured measurement framework to capture the multidimensional aspects of GSCP in a valid and reliable manner, as differences in characteristics across industries require contextual adjustments so that measurement results can be used for continuous improvement and strategic decision-making (Deng et al., 2024).

Hypothesis Development

Digital Leadership on Green Supply Chain Innovation

Digital leadership (DL) empowers manufacturing organizations to build the digital capabilities needed to identify sustainability opportunities and design more environmentally friendly supply chain solutions (Tagscherer & Carbon, 2023). With effective digital leadership, top management can direct investments toward information technology, data analytics, and digital supply chain integration that foster collaboration among suppliers, manufacturers, and distributors, thereby accelerating the implementation of green innovations such as waste reduction, energy optimization, and the development of sustainable products (Cheng et al., 2024; Yang & Liu, 2024). Studies in the Indonesian context also confirm that leadership dimensions have a positive impact on the performance and innovation of the manufacturing sector (Purwanto et al., 2021). Based on this empirical evidence, the following hypothesis is formulated:

H1: Digital leadership has a positive impact on green supply chain innovation

Environmental Awareness on Green Supply Chain Innovation

Companies with high environmental awareness (EA) tend to prioritize sustainability initiatives, allocate resources to green programs, and implement training and knowledge-sharing that foster environmentally conscious innovation (Wu et al., 2024). Cross-sector research confirms that the implementation of green supply chain management and environmentally conscious integration facilitates the emergence of green innovation through transformations in procurement policies, product design, and collaboration with suppliers (Abu Seman et al., 2019; Sun & Sun, 2021). Corporate leaders' environmental awareness serves as a strategic catalyst that strengthens the influence of digital capabilities and organizational resources on green innovation, indicating that environmental awareness not only has a direct impact but also enhances the effectiveness of internal capabilities in generating environmentally friendly supply chain innovations (Cheng et al., 2024). Based on the above discussion, the following hypothesis is formulated:

H2: Environmental awareness has a positive impact on green supply chain innovation

Organizational Learning on Green Supply Chain Innovation

Organizational learning (OL) enhances a company's capacity to collect, distribute, and apply sustainable knowledge, which in turn spurs the emergence of innovative practices and processes within environmentally conscious supply chains (Zhang et al., 2018). Internal capabilities serve as a mediator that strengthens the influence of resources on green supply chain innovation, explaining the mechanism by which organizational learning impacts sustainable supply chain innovation (Y. Feng et al., 2022; Qiao et al., 2023). Based on the above discussion, the following hypothesis is formulated:

H3: Organizational learning has a positive effect on green supply chain innovation

Stakeholder Pressure on Green Supply Chain Innovation

Stakeholder pressure (SP) drives the development of dynamic capabilities and cross-organizational learning that accelerate green innovation (Y. Feng et al., 2022; Li et al., 2025). Studies on companies in Indonesia and developing countries confirm this positive relationship, both directly and through improvements in internal capabilities such as green HR management and supply chain collaboration (Dzikriansyah et al., 2023). Based on this literature review, the following hypothesis is formulated:

H4: Stakeholder pressure has a positive effect on green supply chain innovation

Green Supply Chain Innovation on Sustainable Supply Chain Performance

Green supply chain innovations enhance sustainability performance by reducing environmental impact while improving efficiency and competitiveness. Research shows that companies implementing green supply chain innovations experience reduced emissions, cost savings, and improved market reputation (Atieh & Abushaega, 2025). Developing internal capabilities and green innovation processes has been shown to lead to higher performance outcomes (Li et al., 2025). Studies on sustainable supply chain integration also confirm that green innovation positively contributes to a company's profitability and operational capabilities, particularly when supported by R&D investment and external collaboration (Junaid et al., 2022). Based on this literature review, the following hypothesis is formulated:

H5: Green supply chain innovation has a positive effect on sustainable supply chain performance

Green Supply Chain Innovation Between Digital Leadership and Sustainable Supply Chain Performance.

Green supply chain innovation serves as a mediator linking digital leadership to green supply chain performance. Digital leadership drives the adoption of technology and data-driven decisions that facilitate the development of environmentally friendly processes and products. Empirical studies demonstrate that digital leadership significantly influences the Green Supply Chain Innovation (GSCI), which in turn enhances sustainable supply chain performance (Atieh & Abushaega, 2025). A meta-analysis confirms that internal capabilities influence environmental performance through green innovation as the primary transformation pathway (Li et al., 2025). Theoretically, Dynamic Capabilities Theory and the Natural Resource-Based View explain that digital leadership is a dynamic capability that enables organizations to identify and capitalize on green opportunities, generating IRPH that ultimately improves supply chain performance (Özgül & Zehir, 2023). Based on this literature review, the following hypothesis is formulated:

H6: Green supply chain innovation mediates the relationship between digital leadership and sustainable supply chain performance.

Green Supply Chain Innovation Between Environmental Awareness and Sustainable Supply Chain Performance

Green supply chain innovation serves as a mechanism that transforms an organization's environmental awareness into improved green supply chain performance (Atieh & Abushaega, 2025). Studies of manufacturing firms confirm a consistent pattern in which sustainable practices and environmental pressures shape internal processes that trigger innovation, which in turn enhances various dimensions of performance (Li et al., 2025). Meta-analyses reinforce the role of green innovation as a mediator that transforms external pressures or awareness into measurable performance outcomes, demonstrating a positive relationship between external drivers and green innovation that impacts firm outcomes (Gurler et al., 2025). Based on this literature review, the following hypothesis is formulated:

H7: Green supply chain innovation mediates the relationship between environmental awareness and sustainable supply chain performance

Green Supply Chain Innovations Between Organizational Learning and Sustainable Supply Chain Performance

Organizations with active learning are better able to develop supply chain innovations such as eco-friendly product design, efficient production processes, reverse logistics, and emission-reduction technologies. These innovations act as mechanisms that translate learning capabilities into tangible performance improvements in emission reduction, resource efficiency, and environmental compliance (Tu & Wu, 2021). Empirical evidence and meta-analyses indicate that the relationship between organizational learning and sustainability performance is generally indirect (M. Feng et al., 2018; Kanan et al., 2023). Based on this literature review, the following hypothesis is formulated:

H8: Green supply chain innovations mediate the relationship between organizational learning and sustainable supply chain performance.

Green Supply Chain Innovation Between Stakeholder Pressure and Sustainable Supply Chain Performance

Pressure from the government, customers, investors, and the public is driving companies to adopt green practices and technologies; however, the impact on performance is generally indirect. A meta-analysis reveals a positive relationship between stakeholder pressure and green innovation, with green innovation serving as a channel linking external pressure to environmental and operational performance outcomes (Gurler et al., 2025). Research confirms that sustainable supply chain management practices mediate the relationship between stakeholder pressure and performance improvements, implying that IRPH functions as a mediating channel between external demands and sustainability outcomes (Li et al., 2025). The study in emerging markets also demonstrates the pattern of stakeholder pressure → green innovation → performance, thereby establishing green innovation as a significant mediator (Singh et al., 2022). Based on this literature review, the following hypothesis is formulated:

H9: Green supply chain innovation mediates the relationship between stakeholder pressure and sustainable supply chain performance.

METHODOLOGY

Method is a method of work that can be used to obtain something. While the research method can be interpreted as a work procedure in the research process, both in searching for data or disclosing existing phenomena (Zulkarnaen, W., et al., 2020). This study employs a quantitative approach to determine the relationships among variables. The questionnaire items were adapted from validated measurement scales developed by Atieh and Abushaega (2025) for Digital Leadership, Environmental Awareness, Organizational Learning, Green Supply Chain Innovation, and Sustainable Supply Chain Performance, while Stakeholder Pressure items were adapted from Li et al. (2025). Minor wording modifications were made to improve clarity and ensure compatibility with the Indonesian manufacturing context without altering the conceptual meaning of the constructs.

Since the original instruments were developed in English, the questionnaire was translated into Bahasa Indonesia using a translation and back-translation procedure. The translated version was independently reviewed by bilingual academics in Universitas Trisakti with expertise in supply chain management to ensure semantic equivalence between the original and translated versions. All items in this study were measured using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

It targets population of this study consisted of employees working in supply chain-related functions within manufacturing companies listed on the Indonesia Stock Exchange (IDX). Respondents were required to occupy positions directly involved in supply chain decision-making or operational activities, including procurement, purchasing, logistics, warehouse management, inventory management, production planning, demand planning, transportation, and supply chain management. Eligible respondents were required to have worked in their current position for at least one year to ensure sufficient knowledge of their company's supply chain practices. Respondents who were not employed in manufacturing companies or whose responsibilities were unrelated to supply chain activities were excluded from the study.

Purposive sampling was employed because the research examined organizational capabilities and green supply chain practices that require respondents possessing specific professional knowledge and practical experience. Probability sampling was considered impractical because a comprehensive sampling frame of supply chain professionals in Indonesian listed manufacturing companies was unavailable.

Data were collected through an online questionnaire distributed via Google Forms using LinkedIn, WhatsApp, Instagram, and professional networks, complemented by face-to-face distribution. Although online distribution enabled broader geographical coverage and improved response efficiency, it may introduce self-selection bias because participation was voluntary and limited to respondents with internet access.

. The sample size in this study follows the recommendation from (Hair et al., 2019) , which suggests a minimum sample size of 5 to 10 times the number of variable indicators. There are 25 indicators in this study, so the recommended sample size is between 125 and 250 respondents. In this study, the number of respondents was 151. In addition to the minimum sample size recommendation proposed by Hair et al. (2019), an *a priori* statistical power analysis was conducted using G*Power 3.1 (Faul & Lang, 2009.) . Recommendation for a medium effect size ($f^2 = 0.15$), with a significance level of $\alpha = 0.05$, statistical power of 0.80, and four predictors for the endogenous construct Green Supply Chain Innovation, the minimum required sample size was 85 respondents. As this study collected valid responses from 151 respondents, the sample size exceeded the minimum statistical requirement, indicating adequate statistical power for estimating the proposed PLS-SEM model (Hair et al., 2019).

This study used Partial Least Squares Structural Equation Modeling (PLS-SEM) via SmartPLS v.4.1.1.6 software to analyze the data. SmartPLS 4 was configured using a path weighting scheme with a maximum of 300 iterations and a stopping criterion of 10^{-7}. Bootstrapping was performed using 5,000 subsamples to test the significance of the model paths. Since PLS-SEM is suitable for exploratory research, robust in handling complex models with mediating effects, and capable of accommodating smaller sample sizes and non-normal data distributions, this method was selected as the appropriate approach. This analysis comprises two main stages conducted sequentially: model measurement evaluation (validity and reliability) and structural model evaluation (hypothesis testing and path analysis) (Hair, Risher, et al., 2019).

RESULTS AND DISCUSSION

Results

Respondent Characteristics

Based on the data collected, the composition of respondents was as follows: by gender, 73.7% were male and 26.3% were female. Furthermore, by highest level of education, 2% had a high school diploma or equivalent, 10.5% held a diploma, 13.8% held a master's degree, and 73.7% held a bachelor's degree. Furthermore, by age, 52.6% were 18–30 years old, 30.3% were 31–40 years old, 11.2% were 41–50 years old, and 5.9% were over 50 years old. Then, by field/division: supply chain 33.6%, procurement 33.6%, logistics 13.2%, warehousing 12.5%, and others 7.3%. Next, by position/title: staff 57.9%, supervisor 27.6%, manager 12.5%, and executive 2%. Finally, based on years of work experience: 1–5 years (46.7%), 6–10 years (21.1%), 11–15 years (15.8%), and >15 years.

Model Measurement Results

We used PLS-SEM to analyze the reliability and validity of the measurement model through a series of tests conducted in SmartPLS 4. The measurement model was evaluated by examining indicator reliability, internal consistency reliability, convergent validity, and discriminant validity following the recommendations of Hair et al. (2021). Indicator reliability was assessed using outer loadings, where all measurement items exhibited loading values greater than the recommended threshold of 0.70, indicating that each indicator adequately represented its corresponding construct. Internal consistency reliability was evaluated using Cronbach's alpha and Composite Reliability (CR). As presented in Table 1, Cronbach's alpha values ranged from 0.702 to 0.840, while Composite Reliability values ranged from 0.834 to 0.887, exceeding the recommended threshold of 0.70 and confirming satisfactory internal consistency. Convergent validity was assessed using the Average Variance Extracted (AVE), with all constructs demonstrating AVE values between 0.564 and 0.626, surpassing the minimum criterion of 0.50 and indicating that each construct explained more than half of the variance of its indicators. Discriminant validity was subsequently evaluated using the Heterotrait–Monotrait Ratio (HTMT), and all HTMT values were below the conservative threshold of 0.85, confirming adequate discriminant validity among the constructs. In addition, collinearity among predictor constructs was assessed using the Variance Inflation Factor (VIF), with values ranging from 1.000 to 1.769, well below the recommended cut-off value of 3.30, indicating that multicollinearity was not a concern. Overall, these results demonstrate that the measurement model possesses satisfactory reliability and validity and is therefore appropriate for subsequent structural model analysis.

The structural model was evaluated by examining collinearity, explanatory power, effect size, model fit, predictive performance, and hypothesis significance. The coefficient of determination (R^2) indicated that Digital Leadership, Environmental Awareness, Organizational Learning, and Stakeholder Pressure jointly explained 57.6% of the variance in Green Supply Chain Innovation ($R^2 = 0.576$), while Green Supply Chain Innovation explained 50.1% of the variance in Sustainable Supply Chain Performance ($R^2 = 0.501$). According to Hair et al. (2021), both values indicate moderate explanatory power. The effect size (f^2) analysis revealed that Digital Leadership ($f^2 = 0.163$) exerted a medium effect on Green Supply Chain Innovation, whereas Environmental Awareness ($f^2 = 0.148$) demonstrated a small-to-medium effect. Stakeholder Pressure exhibited a small effect ($f^2 = 0.083$), while Organizational Learning had a negligible effect ($f^2 = 0.012$). Green Supply Chain Innovation showed a very large effect on Sustainable Supply Chain Performance ($f^2 = 1.003$), highlighting its dominant contribution to the structural model. Model fit was assessed using the Standardized Root Mean Square Residual (SRMR), where the saturated model produced an SRMR value of 0.069, indicating an acceptable model fit because it was below the recommended threshold of 0.08. Furthermore, the model's predictive performance was assessed using the PLS-Predict procedure. The positive Q^2predict values obtained for Green Supply Chain Innovation (0.512) and Sustainable Supply Chain Performance (0.570) indicate that the model possesses satisfactory out-of-sample predictive capability. Finally, hypothesis testing was conducted using bootstrapping with 5,000 subsamples and bias-corrected 95% confidence intervals. Significant relationships were identified when the confidence intervals did not include zero, whereas the relationship between Organizational Learning and Green Supply Chain Innovation remained statistically insignificant because its confidence interval crossed zero. Collectively, these findings confirm that the proposed structural model demonstrates adequate explanatory and predictive capabilities for evaluating the hypothesized relationships.

Hypothesis Testing

As shown in Table 3, The findings indicate that three out of four hypotheses predicting antecedents of Green Supply Chain Innovation (GSCI) were supported. Digital Leadership (DL) had a positive and significant effect on GSCI ($\beta = 0.347$, $t = 3.814$, $p < 0.001$), providing support for H1. Similarly, Environmental Awareness (EA) positively and significantly influenced GSCI ($\beta = 0.333$, $t = 2.937$, $p = 0.002$), supporting H2. Stockholder Pressure (SP) also demonstrated a significant positive effect on GSCI ($\beta = 0.201$, $t = 2.745$, $p = 0.003$), thus H4 was supported.

However, Organizational Learning (OL) did not show a statistically significant effect on GSCI ($\beta = 0.093$, $t = 0.964$, $p = 0.168$), leading to the rejection of H3. Although the path coefficient is positive, the t-statistic falls below the threshold of 1.96 and the p-value exceeds the 0.05 significance level, indicating insufficient evidence to support this relationship.

Regarding the outcome variable, GSCI had a strong and highly significant positive effect on Green Supply Chain Performance (GSCP) ($\beta = 0.708$, $t = 10.125$, $p < 0.001$), confirming H5. This represents the strongest relationship in the model, suggesting that GSCI is a critical driver of green supply chain performance.

Mediation Analysis

To examine whether Green Supply Chain Innovation (GSCI) mediates the relationship between the predictor variables and Green Supply Chain Performance (GSCP), this study assessed the total indirect effects using bootstrapping with 5,000 subsamples in SmartPLS 4. Mediation is indicated when the indirect path running through GSCI is statistically significant. Output results shown in Table 4.

The results reveal that GSCI meaningfully carried the influence of most predictors through to performance outcomes. Digital Leadership (DL) demonstrated a significant indirect effect on GSCP through GSCI ($\beta = 0.246$, $t = 3.835$, $p < 0.001$), suggesting that the positive impact of digital leadership on supply chain performance is largely channeled through how well green practices are integrated across the supply chain. This confirms the mediating role of GSCI in the DL–GSCP relationship.

A similar pattern emerged for Environmental Awareness (EA), which showed a significant indirect effect of 0.235 ($t = 2.790$, $p = 0.003$). Stakeholder Pressure (SP) also produced a significant indirect effect on GSCP via GSCI ($\beta = 0.142$, $t = 2.429$, $p = 0.008$). Once again, Organizational Learning (OL) stood apart from the rest. Its indirect effect on GSCP through GSCI was not statistically significant (β = 0.066, t = 0.913, p = 0.181), which is consistent with the earlier direct path finding.

Discussion

The research findings demonstrate that digital leadership has a positive and significant impact on green supply chain innovation (β = 0.347, t = 3.814, p = 0.000). This aligns with the theory of dynamic capabilities, which states that digitally savvy leaders play a crucial role in identifying opportunities arising from environmental changes and guiding the company to respond with rapid and adaptive innovation (Cavusgil & Deligonul, 2024; Teece, 2018). Digital leadership is not merely about adopting technology or digital systems within the supply chain, but also about strengthening the company’s ability to manage resources and processes flexibly to enhance its sustainability performance (Teece, 2018). Digital leaders also serve as change agents who facilitate experimentation and exploration of innovative green practices (Cavusgil & Deligonul, 2024).

The results of the hypothesis test demonstrate that environmental awareness has a positive and significant effect on green supply chain innovation (β = 0.333, t = 2.937, p = 0.002). This implies that the greater a company’s understanding of and concern for environmental issues, the stronger its motivation to innovate in an environmentally friendly manner throughout its supply chain. Company’s environmental commitment is the primary driver of green innovation, which ultimately improves environmental performance through sustainable supply chain practices (Abu Seman et al., 2019). Companies with high environmental awareness will be more proactive in seeking ways to reduce negative environmental impacts, adopting greener processes, and building collaborations with like-minded supply chain partners. Top management’s environmental awareness strengthens the link between a company’s internal capabilities and green innovation, as environmental values embedded in strategic decisions facilitate the integration of sustainability goals into daily operations (Cheng et al., 2024). Raising awareness through training and the internalization of sustainability values significantly improves green innovation performance (Wu et al., 2024).

The research findings indicate that organizational learning does not have a significant effect on green supply chain innovation (β = 0.093, t = 0.964, p = 0.168). This means that a company’s ability to gather and disseminate knowledge alone does not automatically lead to green innovation in its supply chain. Organizational learning will only drive green innovation if supported by a strong proactive attitude toward the environment (Zhang et al., 2018). Organizational learning in the context of green supply chain innovation requires cross-organizational learning mechanisms and digital technology support so that knowledge can be fully internalized and effectively applied (Qiao et al., 2023). Main challenge lies not in a lack of knowledge, but in companies' ability to transform that learning into coordinated innovative practices across the entire supply chain network (Y. Feng et al., 2022).

Based on the hypothesis test, it was proven that stakeholder pressure has a positive and significant effect on green supply chain innovation ($\beta = 0.021$, $t = 2.745$, $p = 0.003$). This means that pressure from external parties such as the government, customers, investors, and business partners is a key factor driving companies to adopt and develop green innovations in their supply chains. Green supply chain innovation often emerges as a result of regulatory pressure, customer demands, and the expectations of business partners who seek more sustainable operational practices (Y. Feng et al., 2022). This stakeholder pressure acts as an external disciplinary mechanism that compels companies to no longer settle for conventional methods but to invest in innovations that can reduce environmental impacts while simultaneously enhancing the company's reputation and legitimacy Stakeholder pressure not only drives the adoption of sustainable practices but also strengthens the effectiveness of their implementation by compelling companies to consistently integrate green innovations into their supply chain strategies and operations (Li et al., 2025).

The research results indicate that green supply chain innovation has a positive and significant effect on sustainable supply chain performance ($\beta = 0.708$, $t = 10.125$, $p = 0.000$). This means that green innovation is the key to simultaneously improving economic, environmental, and social performance. Innovation-based sustainable supply chain practices can significantly improve corporate performance, particularly when companies consistently integrate environmental aspects into their operations and business strategies (Li et al., 2025). Green innovation in the supply chain demonstrates a company's dynamic ability to reorganize its resources, respond to environmental demands, and create sustainable value in the long term (Atieh & Abushaega, 2025).

This study indicates that green supply chain innovation mediates the effect of digital leadership on sustainable supply chain performance ($\beta = 0.246$, $t = 3.835$, $p = 0.000$). This means that digital leadership does not directly improve sustainability performance but must first go through green innovation in the supply chain. Dynamic capabilities are key prerequisites for creating sustainable supply chain performance (Atieh & Abushaega, 2025). Digital leadership enables companies to reorganize their resources, enhance collaboration within the supply chain, and drive innovative, environmentally friendly solutions. The role of strategic leadership in creating competitive advantage is highly dependent on green and learning-based organizational capabilities (Özgül & Zehir, 2023).

The research findings demonstrate that green supply chain innovation mediates the effect of environmental awareness on sustainable supply chain performance ($\beta = 0.235$, t =

2.790, $p = 0.003$). This implies that environmental awareness alone does not directly improve performance; rather, it must first be translated into green innovations integrated into the supply chain. Dynamic capabilities based on environmental orientation will only impact sustainable performance if translated into operational and strategic innovations within the supply chain (Atieh & Abushaega, 2025). Thus, environmental awareness acts as an internal trigger that drives companies to adopt green supply chain innovations, which then become the primary mechanism for enhancing sustainable performance. Sustainability practices yield stronger performance impacts when companies are able to internalize environmental values into systematic and measurable supply chain innovations (Li et al., 2025). Environmental pressures and awareness consistently improve corporate performance through the green innovation pathway, although the magnitude of their impact varies across industries and regions (Gurler et al., 2025).

The results of the hypothesis test indicate that green supply chain innovation does not mediate the effect of organizational learning on sustainable supply chain performance ($\beta = 0.066$, $t = 0.913$, $p = 0.181$). This means that organizational learning has not yet been successfully transformed into green innovation that directly impacts performance. Improvements in sustainable performance only occur when green practices are successfully translated into measurable operational and environmental improvements; without a strong implementation mechanism, internal learning tends not to yield tangible performance impacts (M. Feng et al., 2018). The mediating role of green innovation is highly dependent on the extent to which organizational practices, including learning, are systematically integrated into the company's sustainability processes and policies (Kanan et al., 2023). Organizational learning will only enhance performance and competitive advantage if it drives practical, market-oriented green innovation (Tu & Wu, 2021).

The research findings demonstrate that green supply chain innovation mediates the effect of stakeholder pressure on sustainable supply chain performance ($\beta = 0.142$, $t = 2.429$, $p = 0.008$). This implies that pressure from external parties such as the government, customers, or investors does not automatically improve sustainability performance. Stakeholder pressure encourages companies to adopt more intensive sustainable supply chain practices and has a positive impact on performance when such pressure is addressed through structured innovation (Li et al., 2025). Stakeholder pressure improves corporate performance by strengthening green dynamic capabilities and green innovation as a strategic response to environmental and market demands (Singh et al., 2022). The relationship between stakeholder pressure and firm performance is largely mediated by green innovation, although the magnitude of the effect varies across industries and regions (Gurler et al., 2025).

CONCLUSIONS

This study aims to analyze how a company's dynamic capabilities and stakeholder pressure influence sustainable supply chain performance, with green supply chain innovation serving as the link, specifically among manufacturing companies in Indonesia. The results show that digital leadership, environmental awareness, and stakeholder pressure were found to drive green supply chain innovation, while organizational learning did not have a significant effect. This indicates that not all internal corporate capabilities automatically drive green supply chain innovation. Furthermore, green supply chain innovation was found to enhance sustainable supply chain performance and serves as a crucial bridge linking digital leadership, environmental awareness, and stakeholder pressure to sustainable supply chain performance. However, green supply chain innovation cannot bridge the relationship between organizational learning and sustainable supply chain performance. Overall, this study confirms that green supply chain innovation is a key mechanism that transforms internal capabilities and external pressures into sustainable supply chain performance, while enriching the application of Dynamic Capabilities Theory and Stakeholder Theory within the context of the manufacturing industry in developing countries.

This study has several limitations that should be noted. First, the relatively small sample size of 152 respondents means the study's findings cannot yet be generalized to the entire manufacturing sector or other industries in Indonesia. Second, this study employs a quantitative approach with a cross-sectional design (data collection at a single point in time), so it cannot capture how capabilities, innovation, and the performance of sustainable supply chains change over the long term. Third, the measurement of variables is based on respondents' perceptions via a questionnaire, which may introduce subjective bias even though the instrument has been tested for validity and reliability. Fourth, this study has not considered other contextual variables such as the intensity of environmental regulations, the level of digital technology adoption, or specific industry characteristics, which could actually influence the relationships between variables in the research model.

Given these limitations, future research is advised to increase the sample size and expand the scope to other industrial sectors so that the results can be more broadly generalized. Future studies could also employ a longitudinal design (collecting data periodically over a specific time frame) to examine how dynamic capabilities, green supply chain innovation, and sustainable performance evolve over time. Additionally, future researchers are advised to include additional moderator or mediator variables such as regulatory pressure, competitive intensity, digital capabilities, or cross-supply-chain collaboration to gain a more comprehensive understanding. A mixed-methods approach combining quantitative and qualitative methods could also be considered to delve deeper into how organizational learning can be transformed into green supply chain innovations that truly impact sustainable supply chain performance.

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FIGURE AND TABLE

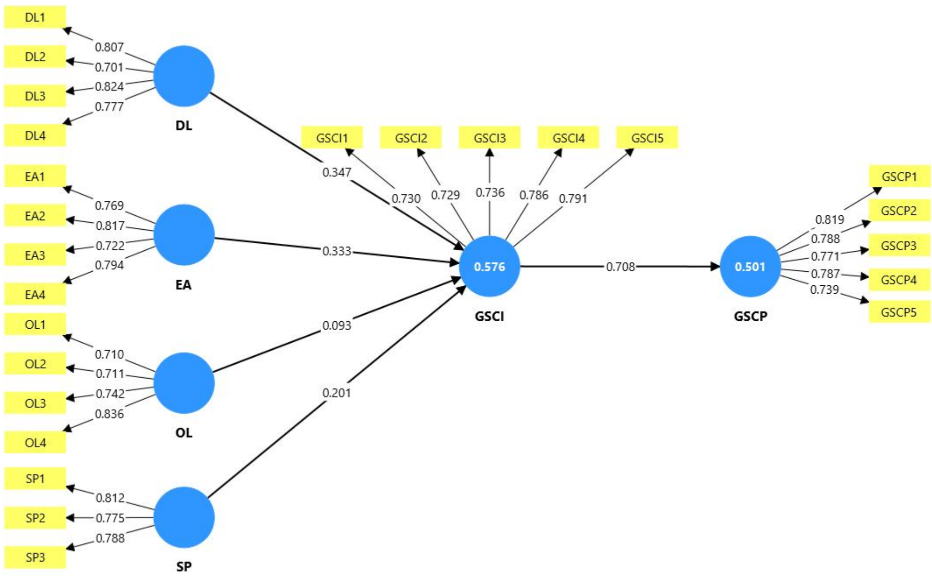

Figure 1. SmartPLS Structural Model

Table 1. Construct Validity and Reliability

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
DL	0.782	0.789	0.86	0.607
EA	0.78	0.782	0.858	0.603
GSCI	0.811	0.812	0.869	0.57
GSCP	0.84	0.842	0.887	0.61
OL	0.744	0.763	0.838	0.564
SP	0.702	0.702	0.834	0.626

Table 2. HTMT

	DL	EA	GSCI	GSCP	OL	SP
DL						
EA	0.746					
GSCI	0.815	0.806				
GSCP	0.808	0.817	0.854			
OL	0.721	0.752	0.683	0.836		
SP	0.393	0.353	0.557	0.614	0.446	

Table 3. Hypothesis Testing

	Original sample	Sample mean	Standard deviation	T statistics	P values
DL -> GSCI	0.347	0.339	0.091	3.814	0
EA -> GSCI	0.333	0.327	0.113	2.937	0.002
GSCI -> GSCP	0.708	0.712	0.07	10.125	0
OL -> GSCI	0.093	0.109	0.097	0.964	0.168
SP -> GSCI	0.201	0.202	0.073	2.745	0.003

Table 4. Results of Indirect Effect Hypothesis Test

	Original sample	Sample mean	Standard deviation	T statistics	P values
DL -> GSCP	0.246	0.240	0.064	3.835	0.000
EA -> GSCP	0.235	0.233	0.084	2.790	0.003
OL -> GSCP	0.066	0.080	0.072	0.913	0.181
SP -> GSCP	0.142	0.146	0.059	2.429	0.008