

Do Green Environmental Management Systems Improve Sustainable Performance of mechanical industry? The Moderating Influence of Green Organization Culture

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ABSTRACT

The research objective was to test how external institutional factors improves the environmental management systems which leads to improved sustainable performance through increasing mechanical operational efficiency. The moderating role of green organizational culture was also tested. To get this objective, a self-administered questionnaire data was collected from employees of manufacturing companies using convenient sampling technique. Hypothesis results showed that all institutional factors have a positive and significant impact on the environmental management system. In other words, an environmental management system also positively and significantly influences the mechanical operational efficiency. Furthermore, mechanical operational efficiency also positively and significantly influences sustainable performance. Further moderating results showed that green organizational culture positively and significantly moderated the relationship between environmental management system and sustainable performance. The study with its findings contributed that companies should focus on institutional factors because institutional pressures enhance environmental management systems, which improve mechanical operational efficiency and sustainable performance, while green organizational culture strengthens this relationship. Practically, the findings contributed that organizations should adopt effective environmental management systems and foster a strong green culture to achieve higher operational efficiency and long-term sustainability.

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1. Introduction

In the current dynamic environment, sustainability has become a central point for manufacturing companies due to rising environmental degradation and resource scarcity (Giovannoni & Fabietti, 2013). Due to this, companies are required to change their traditional production system to sustainable and resource-efficient models that balance economic growth with ecological responsibility (Bresciani et al., 2023). Prior study also emphasized that sustainability-oriented transformation is no longer optional but has become a critical determinant of long-term industrial survival and competitiveness (Depino-Besada et al., 2026). Within this evolving context, Environmental Management Systems (EMS), particularly ISO 14001-certified frameworks, have gained prominence as structured managerial mechanisms that enable organizations to systematically integrate environmental objectives into operational planning, production processes, and strategic decision-making (Fayyaz et al., 2025). These studies strongly suggested that companies that are adopting EMS frameworks demonstrate improved environmental compliance and enhanced resource efficiency, which increases the company's sustainable performance (Irhoma et al., 2014). Further, the Resource-Based View (RBV) suggests that companies achieve sustainable competitive advantages through valuable and unique internal resources and capabilities (Barney & Arikan, 2005). Under the domain of the RBV theory, EMS could be explained as a company's strategic capability that helps companies to improve internal processes, reduce waste, enhance coordination, and strengthen environmental management practice, which helps to

increase the company's sustainability (Fayyaz et al., 2025).

Literature supported that adoption of EMS could be explained by institutional theory, which suggests that companies are affected not only by internal factors but also by external factors (Mishra et al., 2025). According to this theory, organizations adopted some practices not only to enhance efficiency but also to attain legitimacy and acceptance from their stakeholders (Alhamdi & Al-Kahtani, 2025). Literature supported that three various practices effects to the environmental practices in the manufacturing industry (Depino-Besada et al., 2026). Firstly, coercive pressure comes from government regulations, environmental laws, and regulatory agencies that require firms to comply with environmental standards (Basri et al., 2025). Secondly, normative pressures which is being arises from professional associations, industry standards, customers, investors, and society's expectations regarding environmental responsibility (Marculetiu et al., 2026). Thirdly, mimetic pressures occur when the companies copy those competitors that are being successful in the uncertain conditions (Depino-Besada et al., 2026). Various empirical studies also indicated that these pressures always encourage to the manufacturing companies to adopt EMS in order to improve their environmental image and remain competitive (Althabahi et al., 2025; Marculetiu et al., 2026). When the company's EMS is improved, then the company's sustainability is also increased (Mishra et al., 2025).

As, it is highlighted that EMS significantly improves the sustainability when external factors are controlled. It is also identified that improvement in the implementations of EMS increases the company's mechanical operational efficiency (Fayyaz et al., 2025). In manufacturing companies, operational efficiency refers to the firm's ability to maximize production output through using minimal resources such as energy, materials, labor, and machine time (Alhamdi & Al-Kahtani, 2025). EMS encourages firms to monitor resource consumption, improve maintenance activities, reduce machine downtime, and optimize production processes (Mishra et al., 2025). Literature also supported that EMS improvement significantly contributes to higher mechanical operational efficiency, which can ultimately enhance sustainable performance (Alzoubi et al., 2024). Sustainable performance refers to an organization's ability to achieve environmental, economic, and operational objectives simultaneously (Bresciani et al., 2023).

Another important factor also increase the effectiveness of EMS to improve sustainability is the green organizational culture (Abbas & Khan, 2023). Green organizational culture refers to the shared values, beliefs, and behaviors within an organization that support environmental protection and sustainability (Aggarwal & Agarwala, 2023). As the EMS provided formal guidelines to the employees, the green organizational culture here encourages employees to actively participate in environmental initiatives and adopt environmentally responsible behaviors (Al-Alawneh et al., 2024). Companies with a strong green culture often experience greater employee commitment, better communication, and a higher level of support for sustainability programs (Aggarwal & Agarwala, 2023). Another study also enforced that strong green culture helps employees implement environmental practices more effectively and strengthens the impact of EMS on operational efficiency and sustainable performance (Einhorn et al., 2024). Therefore, this study used green organization culture moderating variables to improve the EMS, which leads to improved operational efficiency, and this improves the sustainable performance.

Along with the significant advancement in the sustainability and EMS literature, still prior studies have various gaps. Firstly, prior studies have majorly focused on individual effects of institutional pressures while having limited attention on the combined effect of coercive, normative, and mimetic pressures into a unified analytical framework. This fragmented approach limits the understanding of how combined institutional forces collectively influence EMS adoption in manufacturing industries (Liu et al., 2022; Lutfi et al., 2024; Qutub et al., 2026; Rashid & Rasheed, 2025; Sukoco et al., 2022). Secondly, the EMS has been studied in the prior literature as an outcome of institutional pressures, while prior studies have paid limited attention on how EMS played a bridging role in linking external environmental pressures with sustainable performance outcomes (Chen et al., 2026; Opatha et al., 2026; Van et al., 2026). Thirdly, in prior literature, the moderating role of green organizational culture remains underdeveloped in empirical research. Studies suggested that organizational culture is a critical factor in shaping environmental behavior to boost companies' sustainable performance (Canbul Yaroğlu, 2026; Gao et al., 2026). Companies with a strong green culture often experience greater employee commitment, better communication, and a higher level of support for sustainability programs (Gao et al., 2026). It is also highlighted in the prior studies that cultural and behavioral dynamics are often more influential in developing contexts than formal regulatory mechanisms. Therefore, this study used the green organizational culture as a moderating variable. Lastly, most of the existing studies have tended to treat sustainability outcomes in a fragmented manner, focusing either on environmental or financial performance, while neglecting the role of mechanical operational efficiency as a direct and measurable pathway toward sustainability (Ionaşcu et al., 2026).

To address previously discussed gaps, this study developed a comprehensive model which is based on institutional and resource-based view theory, where institutional theory explains the external environmental forces which helps to improve the EMS adoption, while RBV theory explains how EMS functions as a strategic internal capability that enhances operational efficiency and sustainability performance. By combining these two theories, study objective was

to test how external institutional factors improve the EMS systems, which leads to improving the sustainable through increasing Mechanical operational efficiency. The moderating role of green organizational culture was also tested. Practically, this study emphasized that EMS should be strategically integrated into core operational processes rather than treated as a compliance obligation. Organizations should invest in digital and technological solutions such as predictive maintenance systems, energy monitoring tools, and process optimization technologies to enhance mechanical operational efficiency. This integration enables firms to simultaneously achieve environmental compliance and operational excellence.

2. Literature Review and Hypothesis Development

2.1 Normative Pressure and Environmental Management System

Normative pressures is rooted in the institutional theory and reflects socially constructed expectations which is being emerging from professional associations (Liu et al., 2022; Lutfi et al., 2024). Greenwood and Meyer (2008) further defined that normative pressure comes from things like groups and academic communities and it is based on what people think is normal. It is further explained that companies try to fit in with what's normally expected of them so they can be seen as legitimate and professional. When we talk about taking care of the environment normative pressure is influenced by things like ESG reporting and ISO 14001 certification. These things help define what is okay for companies to do for the environment (Phan & Baird, 2015). On the other hand, empirical studies highlighted that companies which are embedded in strong professional networks are more likely to implement formal EMS frameworks because of benchmarking effects and professional legitimacy concerns (Delmas & Toffel, 2004). Furthermore, other study also shown that normative pressures significantly improve the EMS through compelling organizations to adopt structured environmental governance systems (Okeke, 2025). Further studies also indicated that firms adopting EMS often do so to align with industry best practices rather than purely regulatory requirements. However, critical literature highlights a paradox in normative pressure. While it encourages EMS adoption, it may also lead to “ceremonial conformity,” where organizations formally adopt environmental systems without fully integrating them into operational processes (Ruiz-Blanco et al., 2026). This decoupling is especially evident in emerging economies where institutional enforcement is weak, and firms prioritize symbolic legitimacy over substantive environmental performance. Nevertheless, normative pressure remains a powerful driver of EMS diffusion due to its role in shaping professional identity and organizational legitimacy. Based on prior studies, a hypothesis is formulated below,

H1: Normative pressure has a significant positive effect on Environmental Management System.

2.2 Coercive Pressure and Environmental Management System

Coercive pressures consist of formal institutions frameworks like as environmental regulations, legal enforcement mechanisms, and various other mandatory compliances (Quartey et al., 2025). It is one of the more powerful form of the institutional influence as it being backed from legal authority (Quartey et al., 2025). Other studies defined that it is manifested through carbon taxation policies, emission control laws, mandatory environmental audits, and sustainability disclosure regulations (Khurshid et al., 2025). An empirical study also found that coercive pressure strongly influences EMS adoption across both developed and emerging economies (Kadir et al., 2025). Other study also found that coercive pressures significantly increases the EMS through applying environmental compliance laws, and government inspection (Zhang et al., 2025). These findings suggest that coercive pressure acts as a primary external driver of structured environmental compliance. Despite its effectiveness, coercive pressure has limitations highlighted in recent literature. For example, study argued that it often results in “compliance-based behavior,” where firms meet minimum legal requirements without pursuing innovation or sustainability leadership (Okeke, 2025). This may lead to incremental rather than transformational environmental improvement. Though, in the manufacturing sector, coercive pressures remain a dominant driver for the EMS implementations due to its mandatory nature and enforceability. These prior studies identified that coercive pressures is a significant predictor of improving the EMS and accordingly hypothesis is,

H2: Coercive pressure has a significant positive effect on the environmental management system.

2.3 Mimetic Pressure and Environmental Management System (EMS)

Mimetic pressure is being raised when the companies successfully imitate the competitors practices in various uncertainties (Ruiz-Blanco et al., 2026). This is enforced by institutional theory where argued that companies often follow successful companies in reducing ambiguity and gaining legitimacy in various uncertain environments (Galleli & Amaral, 2026). This is the reason, it has been observed in the literature that EMS adoption is being effected through the imitation of ISO-certified firms or environmentally high-performing competitors (Ruiz-Blanco et al., 2026). It is also found empirically that mimetic pressures is significant predictor in diffusion of EMS across industries. For

instance, it has been found that companies have stronger EMS systems when they have better competitors, gaining reputational benefits, cost savings, or market advantages from sustainability practices (Zhang & Hope, 2026). Other studies also found that mimetic pressures significantly improve the EMS through following the large multinational corporations, which often set sustainability standards that smaller firms imitate to maintain supplier relationships and market access to competitors (Ruiz-Blanco et al., 2026). This creates cascading adoption effects across industries and geographical regions. However, recent literature highlights that mimetic adoption may not always lead to effective implementation. Some organizations engage in “superficial imitation,” where EMS is adopted structurally but not functionally integrated into operations (Quartey et al., 2025). This results in decoupling between formal systems and actual environmental performance. Along with the limitation of mimetic pressure is being remained a key mechanism for improving the EMS diffusion, especially in those industries which are competitive and globally effected industries and accordingly hypothesis is,

H3: Mimetic pressure has a significant positive effect on environmental management system.

2.4 Environmental Management System and Mechanical Operational Efficiency

EMS consisted of a structured framework which was designed for integrating the environmental objectives in the company's operations which are being focused on the continuous improvement, pollution prevention, and resource efficiency (Alajmi et al., 2025a). The ISO-14001 based EMS system significantly emphasizes on the monitoring through the systematic way which directly effects to the companies operational efficiency (Alajmi et al., 2025b). Empirical study found that EMS adoption reduces production waste, improves energy efficiency, and enhances machine utilization through better monitoring and preventive maintenance systems (Albeshri et al., 2025). Other study found that EMS implementation is associated with reduced downtime, improved equipment reliability, and enhanced process standardization, all of which contribute directly to mechanical operational efficiency (Djerbi, 2025). The RBV theory is also representing that EMS enhances organizational capabilities and operational routines which helps to increase the companies operational efficiency (Bernabeu-Santisteban et al., 2025). Moreover, lean manufacturing and green operational system accompanied the EMS system through aligning environmental and efficiency objectives, leading to integrated performance improvements (Djerbi, 2025). These prior studies highlighted that EMS significantly increases the company's mechanical operational efficiency which leads to improved sustainable performance and accordingly hypothesis is,

H4: Environmental Management System has a significant positive effect on mechanical operational efficiency.

2.5 Moderating Role of Green Organizational Culture

The relationship between EMS and mechanical operational efficiency is not on one direction which shown mixed results, which is highlighting to test the relationship with moderating effect. For this purpose, green organizational culture refers to the shared values, beliefs, and behaviors within an organization that support environmental protection and sustainability (Aggarwal & Agarwala, 2023). As the EMS provided formal guidelines to the employees and here green organizational culture encourages employees to actively participate in environmental initiatives and adopt environmentally responsible behaviors (Al-Alawneh et al., 2024). Companies with a strong green culture often experience greater employee commitment, better communication, and a higher level of support for sustainability programs (Iqbal et al., 2025). Other study also enforced that strong green culture helps employees implement environmental practices more effectively and strengthens the impact of EMS on operational efficiency and sustainable performance (Einhorn et al., 2024). Other recent study also highlighted that green organization culture positively and significantly increases the EMS through raising environmental awareness, and collective responsibility (Alhemimah et al., 2025) which significantly increases the operational efficiency. In other study also highlighted that companies with the green culture is being able to successfully implement the EMS frameworks and achieve higher sustainability performance outcomes (Fayyaz et al., 2025; Iqbal et al., 2025). Other study also indicated that green organizational culture acts as a moderating force that strengthens the relationship between EMS and operational efficiency by ensuring consistent behavioral alignment across organizational levels (Martínez-Falcó et al., 2025). Other study also highlighted that green organizational culture helps to increase the EMS in those organizations which are more concentration on improving their operational efficiency (Martínez-Falcó et al., 2025). These prior studies highlighted that green organizational culture can be significant moderating variable and accordingly, the hypothesis is,

H5 Green organizational culture moderates the relationship between Environmental Management System and mechanical operational efficiency.

2.6 Mechanical Operational Efficiency and Sustainable Performance

Mechanical efficiency representing the better utilization of the machinery, and various operational resources along with minimum waste, and minimum consumption of energy (Manan et al., 2025). This is the reason, it has become a

key driver of industrial productivity and operational excellence. Within operations management literature, efficiency is not only a cost-reduction mechanism but also a sustainability enabler because it reduces resource intensity per unit of output (Opoku & Li, 2025). An empirical study also confirmed that higher mechanical operational efficiency significantly improves sustainable performance through reducing environmental burden and increasing resource productivity (Opoku & Li, 2025). Furthermore, better production system also decreases the energy consumption, carbon emissions, and industrial waste generation, thereby directly contributing to environmental sustainability goals (Elrayah & Keong, 2023). In manufacturing sectors, lean and energy-efficient systems have been shown to improve both economic and environmental performance simultaneously, strengthening the triple bottom line framework (Ali et al., 2023). From a sustainability transition perspective, operational efficiency acts as a mediating mechanism between environmental management practices and sustainable performance outcomes. In this regards, other empirical study also suggested that operational efficiency is not being only a sufficient unless it is aligned with the strategic sustainability orientation and organizational environmental culture (Bueno et al., 2024). These studies shown that mechanical efficiency translates into sustainable performance only when embedded within structured environmental systems such as EMS. Therefore, operational efficiency plays a bridging role between environmental management and sustainability sustainable performance and accordingly hypothesis is,

H6: Mechanical operational efficiency significantly improve the sustainable performance.

3. Research Methodology

The study adopted a quantitative research approach where empirical tested the association among institutional pressures, EMS, mechanical operational efficiency, green organizational culture, and sustainable performance. A quantitative research approach provides objective, reliable, and statistically measurable results that can be generalized to a larger population (Mehrad & Zangeneh, 2019). The data was collected from employees of banking sector using a self-administered survey instrument. Therefore, a cross-sectional research design is most appropriate for the current study, where data were collected at one time. The cross-sectional research design was used because it enables researchers to collect data from a large population at a single point in time, making it a cost-effective and efficient approach for examining relationships among variables (Hunziker & Blankenagel, 2021).

The study target population was the employees of manufacturing companies, where a total of 500 questionnaires were distributed among manufacturing company employees using a convenience sampling technique. The convenient sampling technique was employed due to accessibility, time constraints, and organizational limitations (Golzar et al., 2022). Moreover, this approach was selected due to its practicality in accessing manufacturing employees across different organizations and geographical locations. As questionnaires were distributed among 500 employees, and out of these, 350 valid responses were returned, yielding a response rate of 70%, which is considered adequate for multivariate analysis and structural equation modeling (SEM) (Bhattacharya & Bera, 2023). The questionnaire was distributed using structured questionnaires, which were adopted from previously validated scales in sustainability and operations management literature. The questionnaire consisted of two sections: demographic information and measurement items using a five-point Likert scale.

3.1 Survey Instrument and Conceptual Framework

The study construct was taken from previous studies where these constructs were used to test the study objective. For instance, coercive pressure was measured by four items adapted to evaluate the influence of regulatory requirements, government regulations, and external compliance pressures on the adoption of environmental management accounting. Normative Pressure was measured by four items adapted to evaluate the influence of stakeholder expectations, consumer environmental awareness, and industry norms on the implementation of environmental management accounting. Mimetic Pressure was measured by four items adapted to evaluate the influence of leading competitors and industry practices on the adoption of environmental management accounting. These items were taken from the study of Latif et al. (2020). Furthermore, the environmental management system comprised six items that were adapted to evaluate the organization's ability to manage environmental information, identify environmental costs, and integrate environmental accounting practices into organizational operations. These items were also taken from Latif et al. (2020). On the other hand, green organizational culture was measured by eight items which were adapted to evaluate the organization's environmental values, employee participation, green decision-making, and commitment toward sustainable practices and these items were adopted from Kurniasih et al. (2026). Additionally, mechanical operational efficiency was comprised of eight items adapted to evaluate the role of technological integration in improving mechanical processes, reducing operational inefficiencies, and enhancing resource utilization and these items were taken from (González-Mohino et al., 2024). Lastly, sustainable performance where environmental performance has been used as a dimension of sustainable performance, and it was measured by

six items adapted to evaluate the organization's environmental performance, including waste reduction, reduced use of harmful materials, prevention of environmental accidents, compliance with environmental standards, minimization of environmental impacts, and regular environmental audits and instrument was taken from Afum et al. (2020). Each item was measured on 5 point ranked scale and variables are predicted in Figure.1 below,

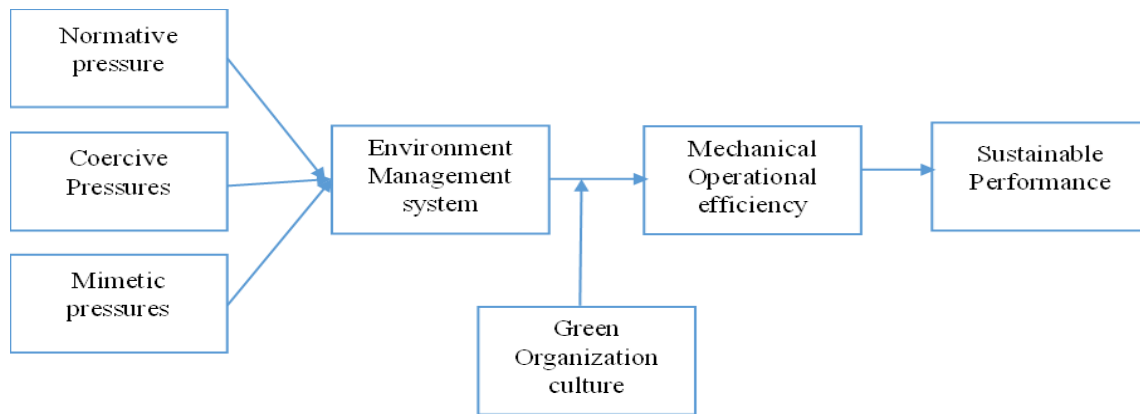


Figure 1: Research Framework

3.2 Data Analysis Technique

Data were analyzed using Smart PLS (Partial Least Squares Structural Equation Modeling (PLS-SEM)). The analysis included a measurement model which shown the construct validity and reliability. Second is the structural model, which shown the hypothesis results using 5000 resampling techniques.

4. Demographic Profile of Respondents

Respondents' demographic profile showed that most of the respondents are males, 245, which is representing (70.0%) compared to females at 105 (30.0%), indicating a clear gender imbalance that reflects the traditionally male-dominated structure of the manufacturing sector. In terms of age distribution, the largest group falls within 31–40 years with 140 respondents (40.0%), followed by 20–30 years with 110 respondents (31.4%), 41–50 years with 75 respondents (21.4%), and above 50 years with 25 respondents (7.2%). This suggests that the sector is mainly driven by early to mid-career professionals who are actively engaged in operational and managerial responsibilities. Regarding educational background, most respondents hold a Master's degree with 160 individuals (45.7%), followed by Bachelor's degree holders at 120 (34.3%), and MPhil/PhD qualifications at 70 (20.0%), indicating a relatively well-educated workforce with a strong presence of postgraduate qualifications, which is important for technical decision-making and process improvement in manufacturing environments. Finally, experience levels show that 140 respondents (40.0%) have 6–10 years of experience, 130 respondents (37.1%) have 1–5 years, and 80 respondents (22.9%) have more than 10 years of experience, highlighting a workforce that is moderately experienced, combining both fresh operational perspectives and practical industry knowledge. Demographic results are Table.1.

Table 1: Demographic Characteristics (n = 350)

Variable	Category	Frequency	Percentage
Gender	Male	245	70.0%
	Female	105	30.0%
Age	20–30 years	110	31.4%
	31–40 years	140	40.0%
	41–50 years	75	21.4%
	Above 50	25	7.2%
Education	Bachelor	120	34.3%
	Master	160	45.7%
	MPhil/PhD	70	20.0%
Experience	1–5 years	130	37.1%
	6–10 years	140	40.0%
	Above 10 years	80	22.9%

5. Measurement Model

Measurement model comprises in two validity criteria's convergent and discriminant validity which are discussed below,

5.1 Convergent Validity

To test the validity and reliability, measurement model is integral for the research construct before testing the study hypothesis in two validity criteria. Convergent validity which shown that whether the measurement items are properly represented the respected construct using factor loadings, Cronbach Alpha, Composite Reliability, and Average Variance Extracted values (Fornell & Larcker, 1981). The convergent validity results indicate that all constructs achieved acceptable reliability and validity levels according to the recommendations of Hair et al. (2017). For the factor loadings all values should be greater than 0.70, indicating strong item reliability (Hair et al., 2017). Cronbach Alpha values greater than 0.70 which is demonstrating high internal consistency reliability among the measurement items (Holmbeck & Devine, 2009). In the same vein, composite reliability should also be greater than 0.70, confirming strong construct reliability (Bagozzi & Yi, 1988). Furthermore, AVE values above 0.5, exceeding the minimum acceptable value Fornell and Larcker (1981). These findings confirm that the constructs possess adequate convergent validity and that the measurement items effectively represent their respective latent variables and results are predicted in Table.2.

Table 2: Convergent Validity Results

Construct	Cronbach's Alpha	Composite Reliability (CR)	AVE
Normative Pressure (NP)	0.882	0.913	0.722
Coercive Pressure (CP)	0.863	0.902	0.701
Mimetic Pressure (MP)	0.874	0.913	0.733
EMS	0.843	0.874	0.754
Green Org. Culture (GOC)	0.832	0.893	0.745
Mechanical Efficiency (ME)	0.883	0.912	0.716
Sustainable Performance (SP)	0.812	0.882	0.764

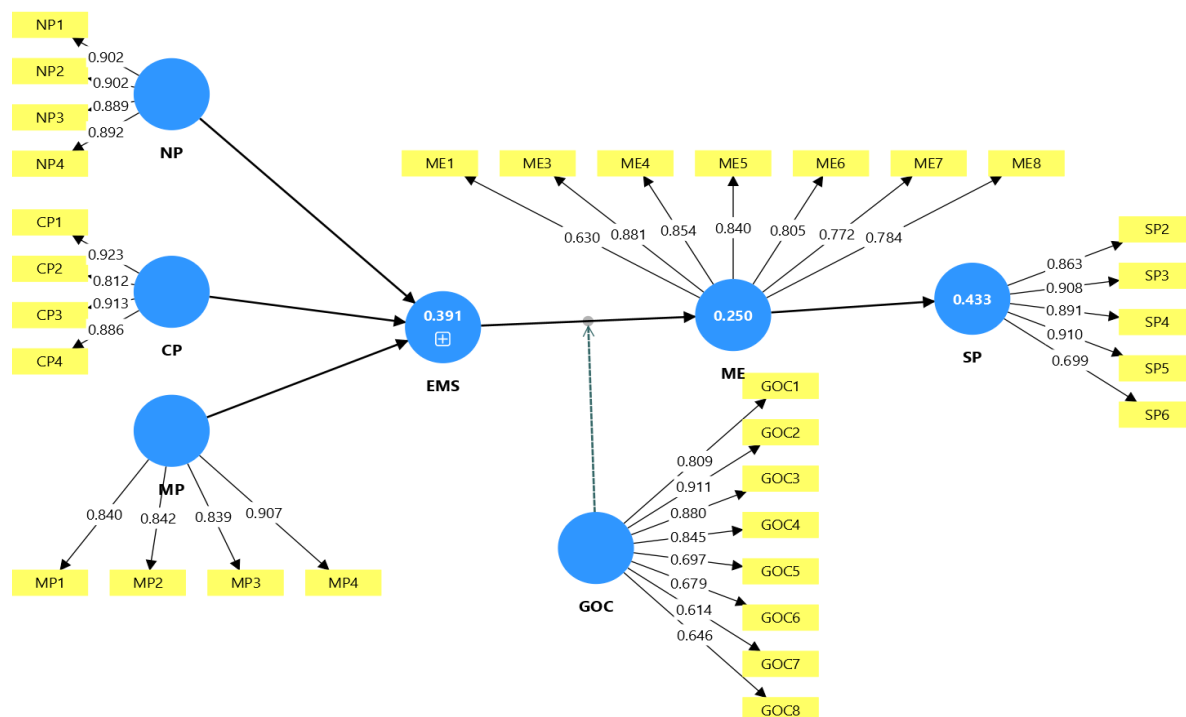


Figure 2: Outer Loadings

5.2 Discriminant Validity (HTMT Criterion)

After the convergent validity, discriminant validity represents the extent which indicated that construct is totally different from other constructs in the model (Fornell & Larcker, 1981). From the various constructs, Fornell and Larcker is one of the most important approach for the assessment of discriminant validity in the PLS-SEM (Hair et al., 2025) where AVE square root in diagonal values should be greater than from below values. The square root of the AVE values, presented in diagonal bold values, are greater than the correlation values among constructs, satisfying the discriminant validity criterion proposed by Fornell and Larcker (1981). These results indicate that the measurement model possesses satisfactory discriminant validity and that no significant multicollinearity issue exists among the latent variables (Henseler et al., 2015). Discriminant validity results are presented in Table.3.

Table 3: HTMT Results

Constructs	NP	CP	MP	EMS	GOC	ME	SP
NP	—						
CP	0.502	—					
MP	0.653	0.430	—				
EMS	0.460	0.632	0.605	—			
GOC	0.533	0.313	0.409	0.407	—		
ME	0.406	0.454	0.502	0.502	0.459	—	
SP	0.583	0.532	0.503	0.505	0.561	0.704	—

6. R Square and Model Fit

This section shown the R square values which are presented in Table.4 where overall model shown a good explanatory power in the manufacturing context. For EMS, the R² value of 0.391 indicates a moderate level of explanation, meaning the model explains 39% of the variation in EMS. For Mechanical Efficiency, the R² of 0.250 show a moderate-to-strong explanatory power, explaining 25% of the variation in efficiency outcomes. For SP, the R² of 0.433 which indicate a strong explanatory power, showing that 43.3% of the variation in sustainable performance is explained by the model.

Table 4: R² Square

Endogenous Variable	R ²	Interpretation
EMS	0.391	Moderate
ME	0.250	Moderate-Strong
SP	0.433	Strong

7. Hypothesis Testing Results

The structural model result indicated that normative pressure, coercive pressures, and mimetic pressures have a positive and significant influence on the environmental management system. Furthermore, environmental management system also positively and significantly influences the mechanical operational efficiency. In other perspectives, green organizational culture also positively moderates between environmental management system and mechanical operational efficiency. Lastly, mechanical operational efficiency also positively and significantly influences to sustainable performance. Above results is predicted in Table.5.

Table 5: Structural Model Results

Path	Beta (β)	T-Value	P-Value	Result
NP-> EMS	0.32	5.21	0.000	Supported
CP-> EMS	0.38	6.45	0.000	Supported
MP -> EMS	0.29	4.87	0.000	Supported
EMS ->ME	0.61	9.12	0.000	Supported
EMS × GOC -> ME	0.22	3.98	0.000	Supported
ME ->SP	0.55	8.76	0.000	Supported

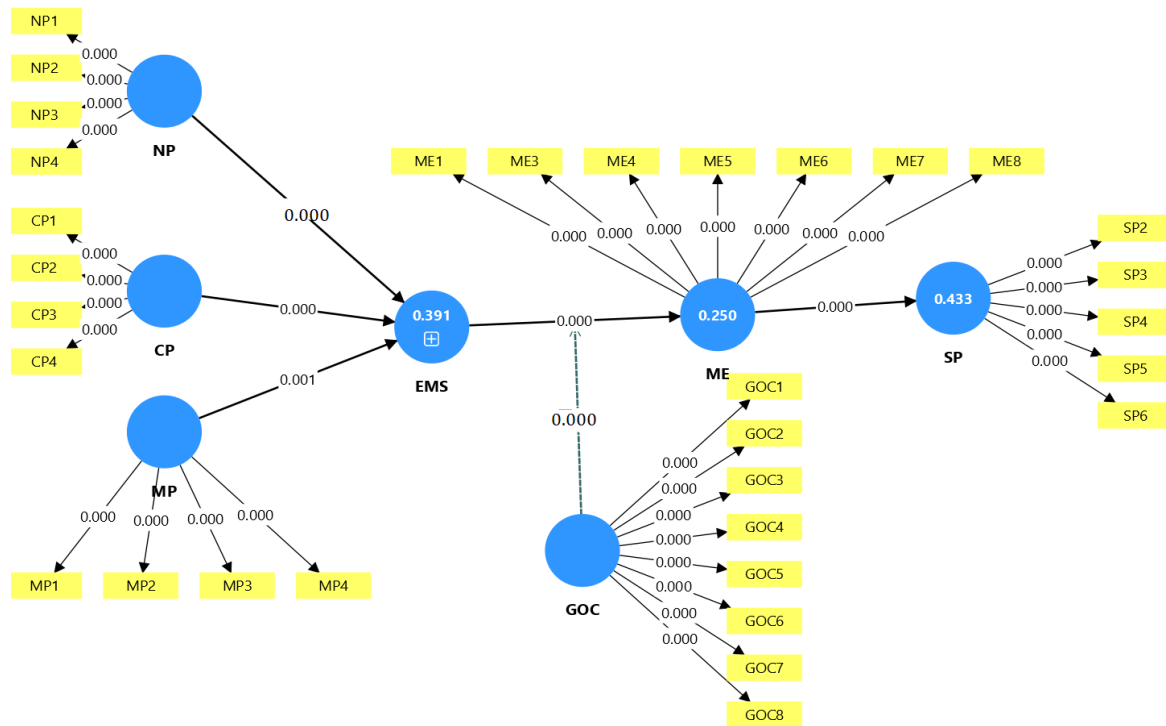


Figure 3: Path Model

8. Discussion

Findings indicated that normative pressures have positive and significant effect on ENS in manufacturing companies. These results highlighted that manufacturing companies are strongly influenced by professional norms, and ESG driven expectations when companies have stronger environmental management practices. It is explained that in the technological environment companies are increasingly embedded in the global sustainability network where the where ISO certification, environmental reporting frameworks, and stakeholder expectations define “acceptable” environmental behavior. In this regard, the EMS is not only a strategic decision but it is also a legitimacy behavior which is being drawn by social expectations (Galleli & Amaral, 2026). The study result supports the institutional theory, which shows that companies conform to normative pressures to achieve legitimacy and acceptance within their institutional environment (Ngo, 2023). This is also supported with the empirical studies where confirmed that ESG reporting frameworks and sustainability standards significantly influence EMS adoption in manufacturing industries (Ngo, 2023). Based on the above findings it is recommended that manufacturing companies should actively engage with professional bodies, ESG reporting systems, and international sustainability certifications to strengthen institutional legitimacy and improve environmental compliance performance.

Further result in second findings indicated that coercive pressure also has a positive and significant effect on the EMS adoption. These results show that the dominant role of regulatory institutions and government enforcement mechanisms helps increase EMS, as coercive forces compel companies to adopt structured EMS frameworks to avoid penalties, fines, and reputational risks, thereby increasing company performance. The results is aligned with the institutional theory, which is being identified that coercive pressure is the most powerful form of institutional influence due to its legal and mandatory nature (Ngo, 2023). The result is also supported with the environmental regulation where found that coercive pressures significantly accelerate the EMS (Ngo, 2023). Findings also supported with the further literature where found that excessive coercive pressure may lead to minimal compliance behavior rather than proactive sustainability innovation (Lee et al., 2022). Based on the results, it is suggested that policymakers should always strengthen environmental enforcement systems, and manufacturing companies should proactively invest in compliance technologies and environmental auditing systems to ensure continuous regulatory alignment and avoid reactive compliance behavior, which will increase the company’s competitive advantage.

Further findings showed that mimetic pressure also has a positive and significant effect on EMS adoption in manufacturing companies. These results show that manufacturing companies are able to reproduce competitors and

industry leaders when they observe improvements in sustainability performance, operational efficiency, or market reputation. The results is being supported with the institutional theory which explained that companies replicate successful peers for reducing the uncertainties and gaining legitimacy (Lee et al., 2022). The result is also supported with empirical studies where confirmed that companies sustainability practices diffuse through imitation mechanisms, particularly when multinational corporations impose environmental requirements on suppliers (Zhang et al., 2024). Further research also highlighted that mimetic adoption also increase the superficial implementations without internal capability development and these studies also found the significant impact of mimetic pressures on EMS (Djerbi, 2025). These findings argued that manufacturing companies should be properly adopt structured benchmark system which ensures that imitation is being supported with internal training, capability building, and process innovation to avoid symbolic EMS adoption which could increase company's sustainability and competitive advantage.

Further results showed that EMS also positively and significant effect on mechanical operational efficiency. The results shown that manufacturing companies has an effective EMS system which is increase the mechanical operational efficiency through increasing production efficiency, machine utilization, and resource optimization which are critical performance indicators. Because the EMS increase the operational efficiency through introducing a structured environmental monitoring, preventive maintenance systems, energy optimization strategies, and waste reduction mechanisms. The findings are in line with RBV theory where shown that MS enhances organizational capabilities and creates competitive advantage through improved operational routines (Depino-Besada et al., 2026). The findings are also in line with the empirical studies where found that EMS implementation improves production efficiency through integrating environmental control into operational systems (Jiao et al., 2023; Yasmeeen & Longsheng, 2025). Based on the study findings, it is suggested that manufacturing companies should properly integrated EMS into core production processes and adopt digital technologies such as IoT-based monitoring, predictive maintenance systems, and real-time energy tracking to maximize operational efficiency gains which could increase the company's sustainability.

Further findings highlighted that green organizational culture positively and significantly moderated between EMS and mechanical operational efficiency. This result shown that EMS is being more effective in those companies where employees share strong green environmental values, sustainability awareness, and green behavioral norms. Because green organizational culture enhances employee participation, reduces resistance to environmental change, and improves coordination in sustainability initiatives. The result is supported with the previous research where found that organizational culture plays a crucial role in shaping environmental behavior and sustainability (Aggarwal & Agarwala, 2023). The result is also supported with the prior studies where found the positive and significant moderating effect of green organization culture (Aggarwal & Agarwala, 2023). These findings argued that manufacturing companies should invest in building a strong green organizational culture through continuous training programs, sustainability awareness campaigns, leadership commitment, and employee reward systems that promote environmental sustainability which could leads to improve the company's market values. Lastly, it has been also found that mechanical operational efficiency has positive impact on sustainable performance. This result shown that improvements in production efficiency directly contribute to environmental, economic, and operational sustainability outcomes. The results is supported with the triple bottom line framework which emphasized that integration of operational efficiency increase the company's operational performance (Opoku & Li, 2025). Other empirical study also supported the view where found that lean and efficient manufacturing systems significantly improve sustainability outcomes through reducing environmental footprints and increasing productivity (González-Mohino et al., 2024). Based on the results, it is being argued that manufacturing companies should adopt stronger manufacturing practices, and continuously monitor operational performance to ensure that efficiency improves the sustainable performance of the companies.

9. Theoretical Implications

Theoretically, study results contributed with the institutional theory through empirically validating the role of normative, coercive, and mimetic pressures in shaping EMS adoption in manufacturing firms. Study with these effects contributed that coercive pressure is the most effective driver which is being followed through normative and mimetic pressures, through extending the institutional theory in the context of environmental sustainability in emerging manufacturing environment. The study also contributed with respect to RBV theory through establishing that EMS significantly enhances mechanical operational efficiency, which further leads to improved sustainable performance. The study with EMS significant effect on operational mechanical efficiency contributed that EMS functions as a strategic organizational capability rather than a compliance mechanism, thus extending RBV logic into environmental management literature. This study has contributed by linking environmental systems with operational capabilities and long-term sustainability outcomes in manufacturing contexts. Lastly, study also contributed with the moderating role

of green organization culture which has significant moderating effect in strengthening the EMS–mechanical efficiency relationship. The findings have contributed by highlighting that environmental culture acts as a behavioral mechanism that enhances the effectiveness of formal environmental systems. This study has contributed by integrating cultural dimensions into EMS effectiveness models, which has often been underexplored in prior sustainability research. Fourthly, this study has contributed to institutional diffusion theory by explaining how mimetic pressure facilitates EMS adoption through imitation of successful competitors. The findings have contributed by showing that EMS diffusion in manufacturing is not only regulatory-driven but also shaped by competitive learning and benchmarking behavior. This study has contributed by expanding understanding of how institutional mechanisms interact in shaping environmental practices. Fifthly, this study has contributed to sustainability performance literature by empirically validating the role of mechanical operational efficiency as a direct determinant of sustainable performance. The findings have contributed by confirming that operational efficiency acts as a bridge between environmental management systems and sustainability outcomes. This study has contributed by strengthening the integration of operational management theory with sustainability performance frameworks.

10. Practical Implications

Firstly, this study has contributed practical insights for manufacturing managers by highlighting the importance of institutional pressures in driving EMS adoption. The findings have contributed by showing that firms should actively respond to regulatory requirements, industry standards, and stakeholder expectations to improve environmental compliance. This study has contributed by suggesting that managers should prioritize alignment with ESG frameworks and ISO standards to enhance legitimacy and competitiveness. Secondly, this study has contributed practical guidance for policymakers and regulatory bodies by demonstrating the strong impact of coercive pressure on EMS implementation. The findings have contributed by indicating that strict environmental regulations, monitoring systems, and enforcement mechanisms are essential for improving corporate environmental behavior. This study has contributed by recommending that governments strengthen environmental compliance systems to ensure sustainable industrial development. Thirdly, this study has contributed practical direction for manufacturing firms regarding benchmarking strategies by showing the importance of mimetic pressure in EMS adoption. The findings have contributed by suggesting that organizations should learn from industry leaders and adopt best practices in environmental management systems. This study has contributed by emphasizing that imitation should be combined with internal capability development to avoid superficial EMS implementation. Fourthly, this study has contributed managerial implications for operational improvement strategies by confirming the strong impact of EMS on mechanical operational efficiency. The findings have contributed by indicating that EMS should be integrated into core production and maintenance systems to improve productivity and reduce operational waste. This study has contributed by recommending investment in digital monitoring systems, predictive maintenance, and energy-efficient technologies.

Fifthly, this study has contributed organizational development insights by emphasizing the moderating role of green organizational culture. The findings have contributed by showing that environmental culture enhances EMS effectiveness and ensures successful implementation across organizational levels. This study has contributed by suggesting that firms should develop employee training programs, sustainability awareness campaigns, and leadership-driven green initiatives to strengthen environmental performance. Sixthly, this study has contributed strategic sustainability implications by demonstrating that mechanical operational efficiency directly improves sustainable performance. The findings have contributed by highlighting that lean manufacturing, resource optimization, and energy efficiency strategies are essential for long-term sustainability. This study has contributed by recommending that manufacturing firms adopt continuous improvement practices to achieve balanced economic and environmental performance.

11. Limitations and Future Directions

Study still has various limitations which needs to be focused in future study. For instance, study has mainly focused on cross sectional research design where data collected on one time while the environmental factors and sustainable performance is changed with the in different time frames. Therefore, future research should be focused on longitudinal research design to highlight the variation in results. Further, research was mainly focused on indirect effect of institutional factors while ignored the direct effect on sustainable performance which not cleared the before and after effects, therefore, further research could be explored on effect of institutional factors on sustainable performance also. Lastly, study only focused on quantitative research approach where data collected on using self-administered questionnaires while ignored the interview-based data collection. Therefore, future research could be conducted on

using mixed method approach to increase the generalizability of results.

12. Conclusion

The study aimed to test how external institutional factors improves the environmental management systems which leads to improve the sustainable performance through increasing mechanical operational efficiency. The moderating role of green organizational culture was also tested. The structural model result indicated that normative pressure, coercive pressures, and mimetic pressures have a positive and significant influence on the environmental management system. Furthermore, environmental management system also positively and significantly influences the mechanical operational efficiency. In other perspectives, green organizational culture also positively moderates between environmental management system and mechanical operational efficiency. Lastly, mechanical operational efficiency also positively and significantly influences to sustainable performance. The study with its findings contributed that companies should focus on institutional factors because institutional pressures enhance environmental management systems, which improve mechanical operational efficiency and sustainable performance, while green organizational culture strengthens this relationship. Practically, findings contributed that organizations should adopt effective environmental management systems and foster a strong green culture to achieve higher operational efficiency and long-term sustainability. Research limitations and to address in future study was also discussed in the current study.

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