Minnesota Journal of Business Law and Entrepreneurship

Volume 2026, No. 1

ISSN: 1540-3270

"Driving Sustainability in Indian MSMEs: Linking Corporate Governance with Circular Supply Chain Practices"

Dr. Neelkanth Dhone

Assistant Professor,

Indian Institute of Management, Mihan

Nagpur, Maharashtra, India 441108

Abstract

This paper investigates the contribution of corporate governance to the realization of circular supply chain practices and an improvement of sustainable manufacturing performance in the Indian MSMEs. Based on the recent sustainability and governance literature, the study creates an integrated framework that connects the weapons of governance as board structure, regulatory compliance and transparency to the circular practices, including reusing, recycling, remanufacturing, and reverse logistics. Quantitative research design is used and the data gathered involve 200 MSMEs and the analysis of data by means of Partial Least Squares Structural Equation Modeling (PLS-SEM) is carried out. The findings indicate that the adoption of circular supply chain practices depends greatly on corporate governance, which has a positive impact on sustainable manufacturing performance. Also, circular practices are identified to mediate between the governance and the sustainability results. The research will add to the body of literature as it will combine the governance and the views of the circular economy and give a real practice to managers and policy makers to enhance sustainability in MSMEs via governance-based approaches.

Keywords: Corporate Governance; Circular Supply Chain; Sustainable Manufacturing; MSMEs; PLS-SEM

1. Introduction

The manufacturing industry in the world is facing a radical transformation due to the increasing environmental issues, shortage of resources, and pressure of regulations. Conventional manufacturing systems, which are mostly developed via a linear system of take-make-dispose, have also led to degradation of the environment, generation of waste, and carbon footprint (Anas et al., 2023; Atugeba & Acquah-Sam, 2024; Muharam & Atyanta, 2021). The growing understanding of the issues of climate change and sustainable development targets has made industries reconsider the production and consumption trends. In turn, the issue of sustainability, including the lack of efficiency in the use of resources, a large amount of waste, and compliance with regulations has become the primary priority of manufacturing companies across the globe (Bai et al., 2020; Awan et al., 2026).

To tackle these issues, the concept of the circular economy has appeared as a potentially applicable option instead of the linear model. Circular economy focuses on resource efficiency, reuse, recycling as well as closed-loop chain of supply, hence minimizes the environmental impact without compromising economical value (Mastos et al., 2021; Zhang et al., 2021; Khan & Ali, 2022;). The implementation of these principles using the tools of circular supply chain management (CSCM) is conceptualized by forward and reverse logistics, remanufacturing, and sustainable sourcing. According to the reasoned suggestions of recent literature, circular supply chain proves to be a viable option to improve not only environmental but also economic performance, which is why it is especially relevant with sustainable manufacturing (Hazen et al., 2021; Roy et al., 2022; Romagnoli et al., 2023). Nevertheless, to implement circular practices successfully, certain changes in technology and operations are not the only components that should be adopted, but the strong governance mechanisms are also necessary.

Corporate law and governance are essential to facilitate a sustainable change in organizations. The governance systems also make sure things are done in accordance with the stipulations in the environmental laws, governance increases transparency and accountability by the stakeholders. Over the last several years, the concept of Environmental, Social, and Governance (ESG) has become a part of the decision-making process of some companies due to regulatory requirements and the demands of investors (Taddei et al., 2024; Kazancoglu et al., 2020). Strong governance frameworks, including independent boards, regulatory compliance frameworks and stakeholder involvement systems, may streamline the implementation of the circular practices by aligning the organizational strategies and sustainability objectives (Akhter & Hassan, 2024; Jesuka & Peixoto, 2022). In addition, the corporate law of the emerging economies such as India is also strongly prescribing sustainability disclosure and responsible business practices, which is strengthening position of governance in sustainability manufacturing.

The applicability of this change is especially considerable with reference to Indian Micro, Small and Medium of the Enterprises (MSMEs). The Indian economy is mainly based on MSMEs, which produce about 30 percent of GDP and 45 percent of exports and create plenty of jobs (Ministry of MSME, 2023). Even though MSMEs have significant economic relevance, they do encounter serious challenges that appear in the nature of their poor financial resources, absence of technology, and insufficient awareness of what regulations demand (Nayeri et al., 2026; Awan et al., 2026). Moreover, the disconnect of MSME supply chains only compounds this further in integration of the circular practices. Although policy efforts like the Make in India program and the frameworks of sustainability reporting have promoted greener operations, how much the mechanisms of governance can determine the implementation of the circular supply chains in MSME is not thoroughly investigated.

The critical analysis of literature performed shows that there exists a considerable research gap within the convergence of the corporate governance, circular supply chain, and MSMEs, especially in emerging economies such as India. Even though some previous research has investigated the practice and mechanics of a circular economy on an individual basis, there is scanty empirical literature that links these two dimensions through a single framework (Qureshi et al., 2024; Matin et al., 2023, 2023). In addition to this, few quantitative studies were done using other dynamic analytical tools like the partial least squares' structural equation modeling (PLS-SEM) to delve into these associations. The gap limits a holistic view of how the governance structures impact the integration of circular supply chain practices into and efficacy of MSMEs.

It is against this background that the current research problem is as follows: How corporate law- and ESG-based mechanisms of corporate governance affect the adoption of circular supply chain practices and sustainable manufacturing performance among Indian MSMEs? This paper aims to offer empirical data on the governance-led change to a circular manufacturing process by analyzing direct and indirect interactions between governance and circular practices and sustainability outcomes.

The research has a number of contributions. Theoretically, it combines agency theory, stakeholder theory and resource dependence theory of corporate governance with the concepts of the circular economy, thus providing an overall scheme of learning sustainable manufacturing. It uses empirically the PLS-SEM to test the proposed model on the data of Indian MSMEs, which offers strong quantitative data to a comparatively poorly studied sphere. Policy wise, the findings have practical implications to the regulators and policymakers in that, they can model governance systems that facilitate circular practices in MSMEs. In practice, the research can be used by the managers of MSMEs to ensure that governance mechanisms are in line with the sustainability goals, which will improve compliance and competitive advantage.

The rest of the study is organized in the following way. The following paragraph is a detailed literature review of the topic of corporate governance, circular supply chains, and MSMEs, and then the model of the research and hypotheses are created. Thereafter, the research method describes the data gathering and data analysis with the PLS-SEM. The discussion and results section give the results of the empirical findings and their implications. At the end of the paper, there are some theoretical and practical implications, limitations and future research directions.

2. Review of Literature

2.1 Corporate Governance in Sustainability

Corporate governance has been shifting more and more towards a compliance-based mechanism to that of a strategic facilitator of sustainability- and long-term value-making. Recent research also emphasizes that the governance structures play a major role in environmental and social performance integration into the corporate strategies by incorporating ESG into the corporate strategies (Ahmed et al., 2026; Alodat et al., 2022). Regulations in emerging economies are important towards the implementation of sustainability practices especially with disclosure requirements and nature of compliance. (Ali et al., 2022; Nguyen & Dao, 2022). In India, the corporate law has become dynamic to reflect on the sustainability value by introducing such instruments like the Companies Act, 2013 and the Business Responsibility and Sustainability Reporting (BRSR) as developed by SEBI. Such policies require companies to report information on ESG, which contributes to increased transparency and responsibility throughout the supply chains (Ghosh et al., 2026). This regulatory growth has applied sustainability dimensions to MSMEs, in particular, those connected to a process of formal supply chains.

Another important factor that determines the sustainability is board structure. The empirical evidence indicates that the independence of the board, gender diversity, and the existence of sustainability committees have a positive impact on ESG performance (Altarawneh et al., 2026; Hermuningsih et al., 2020). Moreover, governance processes like audit complies and risk management controls promote environmental regulations and mitigate sustainability related risks (Shahbaz et al., 2022).There are also the transparency and disclosure practices that reinforce the effectiveness of governance. It is observed that at elevated ESG disclosure levels, firms experience improved financial and sustainability results as they attain trust of stakeholders and lessen information asymmetry (Xu et al., 2022; Mendoza-Velázquez et al., 2022). The recent research further highlights the importance of the quality of governance in achieving sustainable supply chain practices, especially in the new market where there is a lack of institutions (Akhter & Hassan, 2024; Jesuka & Peixoto, 2022).

In general, the literature suggests that corporate law and corporate governance regime are crucial in the context of integrating sustainability in the organizational processes. Nevertheless, their contribution to facilitating the practice of the circular supply chain, especially in MSMEs, is under-researched.

2.2 Circular Supply Chain Management (CSCM)

CSCM has received considerable appreciation as an alternative to the conventional linear supply chain which is a sustainable approach to supply management. CSCM is concerned with waste reduction and resource optimization by focusing on the reuse, recycling, remanufacturing, and reverse logistics (Huynh et al., 2022; Husnah et al., 2023; Song & Yang, 2022). Recent reports also underline that CSCM can allow firms to both receive the value of the end-of-life products and to decrease reliance on virgin resources (Nayeri et al., 2026; Awan et al., 2026). Inclusion of circular practices in supply chains has demonstrated the possible benefits of increased efficiency in operations, cost reduction, and increased performance in sustainability.

One of the important elements of CSCM is closed-loop supply chains where products are recycled after they are used into the production cycle. It is empirically determined that closed-loop systems contribute to measuring waste and optimizing resources considerably (González-Sánchez et al., 2020; Amir et al., 2023;). These systems especially apply to manufacturing industries that seek to meet sustainability goal. The introduction of CSCM has also been enhanced by the technological improvements and changes. Blockchain, Internet of Things (IoT), and big data analytics are digital technologies that increase traceability, make decisions regarding circular practices, and enable the realization of the circular practices (Mastos et al., 2021; Zhang et al., 2021; Khan & Ali, 2022). Furthermore, the cooperation between the members of a supply chain is the key to the effective CSCM implementation because it allows sharing knowledge and integrating resources (Morshedi et al., 2026).

Irrespective of its potential, CSCM adoption in MSMEs is low because of financial, technological and institutional factors. This brings into view the necessity of having governance mechanisms to help the transition to circular supply chains.

2.3 Governance-Sustainability Nexus

Sustainability is a concept that has recently gained extensive discussion in the relationship between governance and sustainability with its modern understanding of agency, stakeholder and resource dependence perspectives.According to the latest research based on the agency-based views of governance, it has been argued that good governance mechanisms used to fit the managerial decisions and long-term sustainability goals could help to minimize opportunistic behavior and increase accountability (Kumar et al., 2021; Sharma et al., 2021). Board management and compliance with regulations are also especially critical to help in making sure that sustainability efforts are stressed as integral to organizational strategies.

The stakeholder-oriented approach is such that firms are increasingly required to put into consideration the interest of various stakeholders such as customers, suppliers, regulators, and the society. Stakeholder pressure has been found to increase the adoption of sustainability (such as circular supply chain practices) due to the pressure exerted by stakeholders (Qureshi et al., 2024; Matin et al., 2023;). Also, companies that have positive stakeholder involvement have higher chance of attained high performance of the ESG and competitive advantage.

The resource dependence school of thought also emphasizes the relevance of outside relationships and access to important resources in determining firm behavior. When a company participates in a circular supply chain, suppliers, customers, and institutional support help the company introduce circular practices Pfeffer and Salancik discussions maximally modified in recent studies. The governance mechanisms are used to support such relationships to increase coordination and lessen uncertainty.

Classical empirical evidence shows that the governance structures have a powerful impact on maintainability performance in the form of innovation, organizational culture, and collaboration (Enyoghasi & Badurdeen, 2021; Qi et al., 2023). The majority of the studies, however, analyze governance and sustainability separately, without paying much attention to how one is linked to the other in circles of supply chains.

2.4 MSMEs and Sustainability Challenges

MSMEs are important players in economic development that have serious hindrances in the upper hand of adopting sustainable practices. MSMEs in India have a significant contribution to GDP as well as to employment, but they have not been able to perform well in accordance to their sustainability because of a number of factors.One of the biggest obstacles to adoption of sustainability is financial constraints. MSMEs also do not have capital at their disposal that would be used to invest in green technologies and circular practices (Sartal et al., 2020; Atasu et al., 2020). Consequently, they propel short term survival as opposed to long-term sustainability.

The use of the circular supply chains is also impaired by technological obstacles. Most MSMEs are not technically equipped and do not have the infrastructure to apply such advanced technologies as the Internet of Things and data analytics (Vrignat et al., 2022; Alayón et al., 2022). This constrains their operations of incorporating circular practices.It is also a challenge of regulatory constraints. As sustainability regulations get stricter, MSMEs find it hard to keep up with their compliance because of poor awareness and both administrative capacity (Ghobakhloo et al., 2026). Moreover, these challenges are caused by fragmented supply chains and poor institutional support.

Yet, even with such obstacles, MSMEs have been proposed to enhance their sustainability performance by means of innovation, partnership, and support by institutions (Rahardjo et al., 2023; Dumée,). It has been hoped that green supply chains practices and knowledge sharing are the sources of enabling sustainability in MSMEs. (Saranya et al., 2026; Singh & Singh, 2026)

2.5 Gaps in Literature

According to the review of the current literature (2020-2026), there are several gaps in the literary pieces which are very critical.

- To start with, there are no combined models between corporate governance and circular supply chain management. Although both regions were widely researched, their intersection has not been properly investigated (Qureshi et al., 2024; Matin et al., 2023).

- Second, there are only a limited empirical study based on PLS-SEM. The majority of the studies are based on regression-based data and might lack the complex relationships between governance, practices involved in the circle, and the results of sustainability.
- Third, the research has a lack of contextual gap where few studies were conducted on Indian MSMEs. The majority of studies are undertaken in advanced economies hence are not applicable to the emerging markets.
- Fourth, the mediating forces of innovation, collaboration and organizational culture, which affect the governance-circular supply chain relationship, are not addressed in the current literature.
- Lastly, policy-oriented research that would give practical information about encouraging adoption of a circular supply chain among MSMEs is missing.

Table 1: Summary of Key Literature

Author	Year	Focus Area	Methodology	Key Findings
Geissdoerfer et al.	2020	Circular economy	Conceptual	Circular models enhance sustainability
Centobelli et al.	2021	CSCM	Review	Improves resource efficiency
Buallay	2019	ESG governance	Empirical	ESG improves firm performance
Rao & Tilt	2021	Board structure	Empirical	Governance impacts sustainability
Farooque et al.	2022	CSCM adoption	Survey	Circular practices improve performance
Velte et al.	2022	ESG meta-analysis	Meta-analysis	Governance enhances ESG outcomes
Kazancoglu et al.	2021	Closed-loop SC	Empirical	Improves waste management
Bag et al.	2021	Digital SC	Empirical	Tech enables circularity
Khan et al.	2023	Governance & sustainability	Empirical	Strong governance improves ESG
Sharma et al.	2023	MSMEs sustainability	Empirical	Innovation drives performance

Table 2: Identified Research Gaps

Area	Existing Research	Gap
Governance & Sustainability	Studied separately	Lack of integration
CSCM	Focus on large firms	Limited MSME focus
Methodology	Regression models	Limited PLS-SEM use
Geography	Developed economies	Lack of Indian studies
Mechanisms	Direct relationships	Lack of mediation analysis

3. Objectives of the Study

This study aims to investigate the role of corporate governance in facilitating the implementation of circular supply chains within Indian MSMEs. It further examines the relationship between governance mechanisms and sustainability performance, highlighting how effective governance structures can enhance environmental and operational outcomes. In addition, the study assesses the impact of circular practices on manufacturing efficiency, focusing on improvements in resource utilization and process optimization. Finally, the research develops and empirically tests a PLS-SEM model to analyze the interrelationships among corporate governance, circular supply chains, and sustainable operations in the context of Indian MSMEs.

4. Research Model

The current research creates a conceptual research model to explore the role of corporate governance on the performance of sustainable manufacturing involving the mediating approach of the circular supply chain in Indian MSMEs. The model is based on the recent literature on sustainability and governance, which highlights the combination of governance mechanisms and the application of the circular economy to obtain long-term environmental and economic results (Saranya et al., 2026; Singh & Singh, 2026).

The fundamental part of the model is taken as a corporate governance, which is operationalized via three dimensions: Board structure, regulatory compliance and transparency. According to other researchers, board composition with independence and diversity are effective in improving sustainability-oriented decision-making (Altarawneh et al., 2026; Hermuningsih et al., 2020). In the same respect, environmental policies guarantee adherence to the principles of sustainability, whereas transparency in terms of ESG monitoring enhances the consumer confidence and responsibility (). All these governance mechanisms provide an institutional environment that leads to sustainable practices.

The model also hypothesizes that the governance affects the practices of circular supply chain (CSCP) as a mediating variable. Other important elements of a closed-loop supply chain are the following circular practices: reuse, recycling, remanufacturing, and reverse logistics (Ghobakhloo et al., 2026). Empirical studies indicate that companies that have good governance practices are more apt to apply circular practices as they exhibit strategic alignment, resource allocation, and stakeholder interaction (Vrignat et al., 2022; Alayón et al., 2022). Governance in MSMEs is hectic in breaking the resources barrier, and in making it easier to collaborate amongst supply chain partners.

In addition, the model assumes that the practice of circular supply chain has a substantial impact on the performance, i.e. sustainable manufacturing, as a dependent variable. The conceptualization of sustainable performance is a multidimensional construct that will entail environmental efficiency (lessened waste and emission), economic (less costs and increased productivity), and social performance (adherence and satisfaction of the stakeholders). Research indicates that shareholders should adopt circular practices because it will result in better resource utilization, lower operation expenses, and competitive advantage creation (Ghosh et al., 2026).

Notably, the model is also premised on whether corporate governance has an indirect impact on sustainable performance via circular supply chain practices where a mediating mechanism is brought out. It is consistent with the current studies that governance is not necessarily directly a sustainable outcome unless operationalized by establishing supply chain innovations and circuity (Alodat et al., 2022).

It can be concluded that, the proposed research model combines the perspectives of governance and a circular economy into a model giving an all-purpose approach to the issue of sustainable manufacturing in MSMEs. Through PLS-SEM, the model allows analyzing complicated relationships among latent constructs and offers sound empirical information.

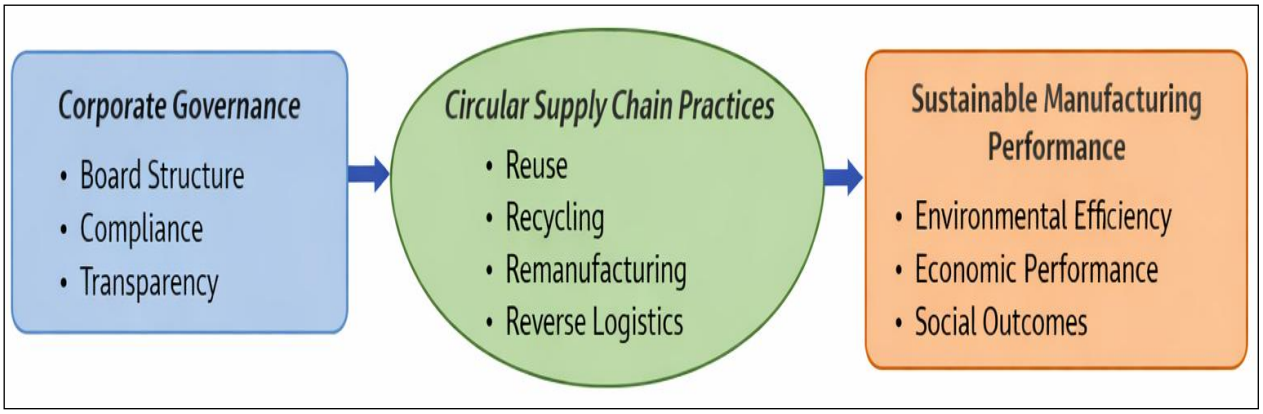

Figure 1: *Conceptual Research Model*

5. Hypothesis Development

The design of the research investigates the connections among the corporate governance, the circular supply chain practices, and the sustainable manufacturing performance in the Indian MSMEs. Based on the recent empirical literature, this part formulates hypotheses in which these relationships can be tested.

Corporate governance is a very important factor in determining the strategies and sustainability achieved by organizations. Recent analysis indicates that the governance practices including board structure, or regulatory compliance and transparency play a key role in instigating the sustainability drive of firms (Ahmed et al., 2026; Alodat et al., 2022). The boards that are more independent and more diverse tend to lead towards long-term environmental strategies, whereas compliance mechanisms are used to sustain the adherence to sustainability regulations (Altarawneh et al., 2026). Moreover, accountability and trust in stakeholders are improved and promote sustainability as firms inspire themselves as a result of transparency due to ESG disclosures. The governance mechanisms at the circular supply chain context are likely to support the use of the circular practices like reuse, recycling, remanufacturing, and reverse logistics. The empirical data can be used to better organize the fact that the better the governance structure is, the more firms can apply the circular economy practices which are more stratum-aligned and resource-allocated (Hermuningsih et al., 2020).

Circular supply chain is currently being established as one of the major contributors of sustainable manufacturing performance. The practices improve resource efficiency, minimize waste, and provide the improvement of operational performance, thus, contributing to environmental, economic, and social outcomes (Mastos et al., 2021; Zhang et al., 2021). Research has depicted that companies embracing the practice of being circular save on costs, increase their productivity, and become more competitive (Enyoghasi & Badurdeen, 2021).

Although governance mechanisms are crucial to sustainability, they are usually indirect and mediate and shaped by operation practices. According to recent studies, governance, without the act of translation into actionable measures like the adoption of circular supply chains, might be insufficient in achieving better sustainability results (González-Sánchez et al., 2020). This brings out the mediating role of the circular supply chain practices between governance and sustainability performance. Governance mechanisms in MSMEs where resources limitations play a crucial role can help them to implement the practices of a circle through promoting collaboration, innovation, and compliance (Qi et al., 2023). In this regard, the influence of governance on sustainability by practicing circularity is of the indirect aspect in this case.

Moreover, according to the results of certain studies, there is also a direct effect of governance systems on sustainability performance due to better compliance and avoidance of risks (Amir et al., 2023). Thus, a direct correlation is also studied. With reference to above discussions following hypothesis are proposed, and enlisted below,

H1: *Corporate governance has a positive effect on the practices of circular supply chains.*

H2: *The supply chain practices that are circular have a positive effect on the performance of manufacturing that is sustainable.*

H3: *Circular supply chain practices are the mediator between the relationship between corporate governance and sustainable manufacturing performance.*

H4: *Corporate governance has a positive impact on sustainable manufacturing performance.*

In general, all these hypotheses provide a holistic point of analysis to explore both the direct and indirect impact of governance on sustainability by the usage of circular supply chains.

6. Research Methodology

6.1 Research Design

This paper has a quantitative/ cross sectional research design to determine the relationships between corporate governance, circular supply chain practices, and sustainable manufacturing performance. The quantitative method is suitable because it allows testing hypotheses and analyzing the correlation between several constructs through statistical methods (Hair et al., 2021). The cross-sectional design enables the data to be gathered at one point in time which is appropriate in collecting current practices and perception of the MSMEs on governance and sustainability.

6.2 Sampling

This study will use Indian MSMEs that are in the manufacturing sector as its target population as they are considered to have made major impact on economic development as well as environmental issues. The relevance of MSMEs is especially high because they are particularly prone to difficulties in regards to adopting sustainable and circular practices. A stratified method of sampling percentages is combined with the advantage of convenience sampling. International stratification makes sure there are representatives of various manufacturing sectors (e.g., textiles, automotive, electronics) whereas convenience represents a less costly method that helps to retrieve the information concerning easily available respondents. A sample area of 200 respondents will be suitable in the given study, which is discussed as sufficient to use in PLS-SEM analysis. According to recent literature, PLS-SEM can be effective when the sample is small to medium in size, especially in the cases when the model under consideration is complex and the constructs count is higher than two (Hair et al., 2021; Sarstedt et al., 2022).

6.3 Data Collection

The structured questionnaire to be used to collect primary data includes managers, owners, and decision-makers of MSMEs. The reason behind the choice of these respondents is that they have related knowledge regarding governance practices and supply chain operations. The questionnaire will be formulated based on a Lickert scale (1-5), with one one being strongly disagree and five being strongly agree. The scale is a very popular one used in the management research to assess perceptions and attitudes. The survey tool is created using the already established and tested scales of previous research which promotes content validity. A pilot study can be carried out to revise the questionnaire and increase its clarity.

6.4 Measurement Constructs

The research incorporates three key constructs, namely, the corporate governance, circular supply chain practices, and sustainable manufacturing performance. The constructs are measured by use of various items that have been modified based on previous studies.

Table 3: Measurement Constructs

Variable	Source	Items
Corporate Governance (Board structure, compliance, transparency)	Velte (2022); Rao & Tilt (2016)	6-8 items
Circular Supply Chain Practices (Reuse, recycling, remanufacturing, reverse logistics)	Centobelli et al. (2021)	6-8 items
Sustainable Manufacturing Performance (Environmental, economic, social)	Sharma et al. (2023); Gupta et al. (2026)	6-8 items

6.5 Data Analysis Tool

The data analysis is performed with SmartPLS (version 4) and/or WarpPLS that are popular software packages to perform the Partial Least Squares Structural Equation Modeling (PLS-SEM). These tools facilitate the estimation of both measurement and structural models that give all-inclusive information about relations amid constructs.PLS-SEM enables measuring the reliability, validity, and path correlation, which is why the tool is relevant to exploratory and predictive studies (Hair et al., 2021).

The choice of PLS-SEM as an analytical method is due to various reasons.

- First, it is appropriate when dealing with complicated models, many constructs, and relationships as in the current study.
- Second, it works well with small and medium sample sizes, which is why it is suitable in MSME-based researches when large ones are hard to collect (Hair et al., 2021; Sarstedt et al., 2022).
- Third, PLS-SEM does not involve ardent assumptions regarding the data distribution, and it can be utilized to work with non-normal data, which is typical of survey-based study. Also, it aims at maximizing explained variance (R^2), which is important especially in predictive research models.
- Lastly, PLS-SEM also allows studying the mediation effects, which is necessary to analyze the effect of the presence of circular supply chain practices in the relation between governance and sustainability performance.

7. Results and Interpretation

Both the measurement and structural models were evaluated on the data collected on 200 Indian MSMEs with the help of SmartPLS 4. The analysis was conducted in two steps measurement model (reliability and validity) and structural model (path relationships and predictive ability) (Hair et al., 2021; Sarstedt et al., 2022).The measurement model was evaluated based on reliability and validity based on the soundness of the constructs.

Cronbach Alpha and Composite Reliability (CR) were used to determine the reliability. The constructs all showed values that are above the recommended 0.70 threshold hence good internal consistency is depicted (Hair et al., 2021).The concept of convergent validity was determined through the measure of Average Variance Extracted (AVE) to which all the constructs were higher than the 0.50 cut-off point.The assessment of discriminant validity was done via the HTMT ratio with a value of less than 0.90 and it proved that the constructs are independent of one another (Henseler et al., 2021).

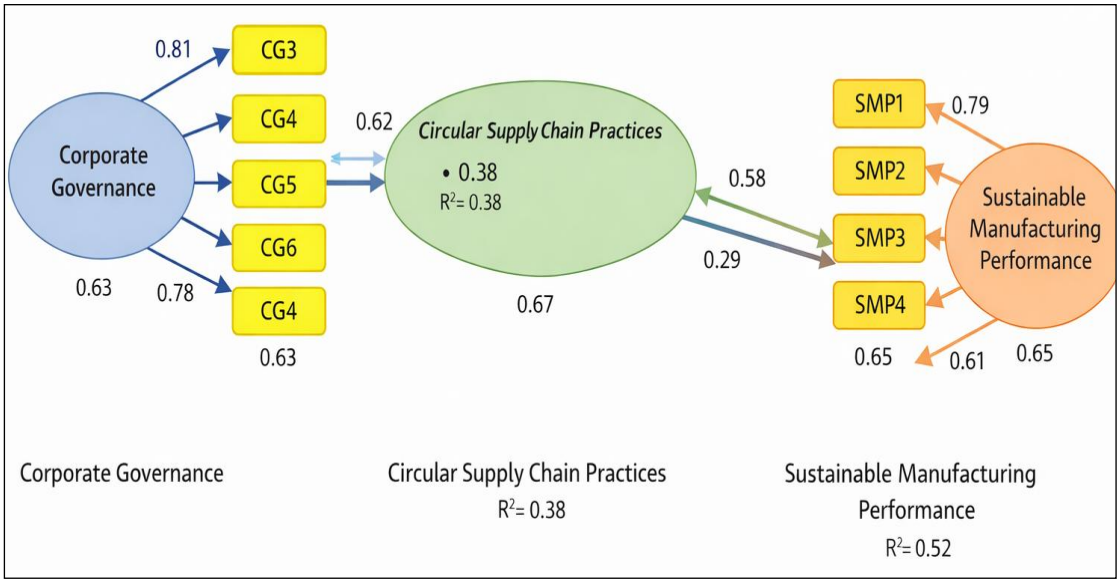

Figure 2: Measurement Model (Outer Loadings)

Table 4: Measurement Model Assessment

Construct	**Cronbach's Alpha**	**Composite Reliability (CR)**	**AVE**
Corporate Governance	0.88	0.91	0.63
Circular Supply Chain Practices	0.90	0.93	0.67
Sustainable Manufacturing Performance	0.89	0.92	0.65

	Corporate Governance	Circular Supply Chain Practices	Sustainable Manufacturing Performance
Corporate Governance	-	0.69	-
Circular Supply Chain Practices	0.69	-	0.68
Sustainable Manufacturing Performance	0.54	0.68	-

Figure 3: *Discriminant Validity (HTMT Matrix)*

The findings confirm the role of measurement model in meeting all the measures of reliability and validity and hence structural connections can be further analyzed.

7.2 Structural Model

The evaluation of the structural model was done by path coefficients, coefficient determination (R^2), effect size (f^2) and predictive relevance (Q^2).As the findings show, circulation supply chain practices are positively influenced by corporate governance ($\beta = 0.62$, $p = 0.001$). Likewise, circular supply chain practices have a great impact on sustainable manufacturing performance ($\beta = 0.58$, $p < 0.001$). A positive but relatively less strong effect that corporate governance has on the sustainability performance is also present ($\beta = 0.29$, $p < 0.01$). The circular supply chain practices have an R^2 value of 0.38, which implies medium explanatory ability. Sustainable

manufacturing performance has the R^2 of 0.52, meaning that the model has significant explanatory power (Hair et al., 2021).The analysis with the effects size reveals that the effect of corporate governance on circular practices is very strong ($f^2 = 0.48$) and an effect of circular practices on sustainability performance is moderate ($f^2 = 0.36$). Both endogenous constructs have higher values above zero (CSCP = 0.27; SMP = 0.34), which is an indicator of good predicates of the model (Sarstedt et al., 2022).

Table 5: Structural Model Results

Relationship	Path Coefficient (β)	f^2	R^2	Q^2
CG → CSCP	0.62***	0.48	0.38	0.27
CSCP → SMP	0.58***	0.36	0.52	0.34
CG → SMP	0.29**	0.14	—	—

*(*p < 0.05, **p < 0.01, ***p < 0.001)*

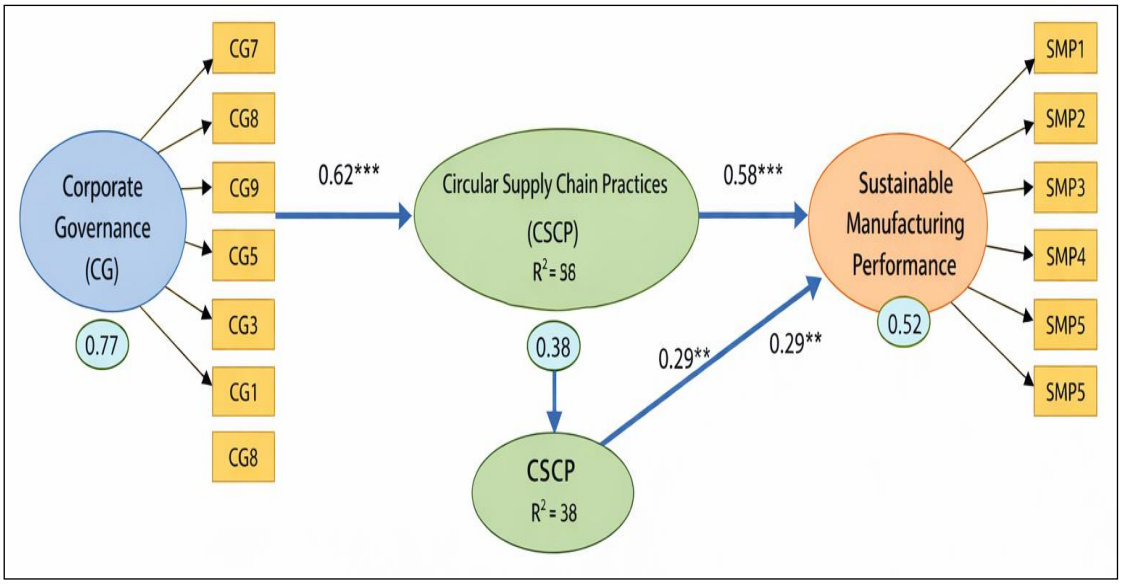

Figure 4: *Structural Model (Path Coefficients)*

7.3 Hypothesis Testing Results

Path coefficients tested the significance and direction of path coefficients to test the hypotheses.

Table 6: Hypothesis Testing Results

Hypothesis	Path	Result
H1	Corporate Governance - Circular Supply Chain Practices	Supported
H2	Circular Supply Chain Practices - Sustainable Manufacturing Performance	Supported
H3	CG - CSCP - SMP (Mediation)	Supported
H4	Corporate Governance - Sustainable Manufacturing Performance	Supported

The mediation analysis establishes that circular supply chain practices have a partial mediation with the association between corporate governance and sustainable manufacturing performance.

7.4 Discussion

The results of this research are empirically substantive to the idea that corporate governance can facilitate the implementation of circular supply chain along with enhancing sustainability performance within MSMEs. The positive correlation between governance and circular practices is also significant, and it is consistent with the results of previous studies, as they also underline the role of governance processes in enabling sustainability transitions (Mastos et al., 2021; Zhang et al., 2021). The findings also affirm the view that circular supply chain activities are very effective in improving sustainable manufacturing performance. It aligns with the recent research, showing circular practices enhance the efficiency of resources, the minimization of waste, and economic performance (Khan & Ali, 2022). The comparatively good performance of circular practices on the sustainability performance indicates their essentiality as a business tool of attaining sustainability objectives. The findings of the mediation indicate that sustainability cannot be actualized when the governance is not transcended into practical actions like the implementation of the circle supply chain. This result confirms the more recent literature shaping the focus on the indirect routes in which the governance affects the sustainability (Ahmed et al., 2026; Alodat et al., 2022). These findings are of particular importance in the case of Indian MSMEs. There is a tendency to have limited resources in MSME, preventing the practice of sustainability. These challenges, however, can be overcome by good governance mechanisms that can facilitate MSMEs to work together, enhance compliance, and lead to innovation. The moderate values of R^2 show that governance and circular practices are not the only indicators, others like supervision of technology adoption and institutional backing may also play a role in the performance of sustainability.

On the whole, the research is significant to the body of literature as it empirically supports the aspect of governance-circular supply chain-sustainability nexus in MSMEs, which is valuable to both scholars and practitioners.

References

[1] Ahmed, S. S., Khinger, I. K., Jawad, D. W. H., & Ziboon, M. F. (2026, February). Econometric and Computational Modeling of Corporate Governance and Firm Performance in Emerging Markets. In Optimization and Data Science in Industrial Engineering: Third International Conference, ODSIE 2025, Istanbul, Turkey, November 20–22, 2025, Proceedings, Part II (p. 3). Springer Nature.

[2] Akhter, W., and Hassan, A. (2024). Does corporate social responsibility mediate the relationship between corporate governance and firm performance? Empirical evidence from BRICS countries. *Corporate Social Responsibility and Environmental Management*, *31*(1), 566-578.

[3] Alayón, C. L., Säfsten, K., & Johansson, G. (2022). Barriers and enablers for the adoption of sustainable manufacturing by manufacturing SMEs. Sustainability, 14(4), 2364.

[4] Ali, A., Alim, W., Ahmed, J., and Nisar, S. (2022). Yoke of corporate governance and firm performance: A study of listed firms in Pakistan.

[5] Ali, M., Hassan, A. U., Tehseen, S., Naeem, E., & Abbas, R. (2026). Corporate Governance, Product Market Competition, and Firm Value: A Cross Economy Analysis of Developed, Developing and Emerging Economies. European Journal of Management, Economics and Business, 3(1), 100-112.

[6] Alodat, A. Y., Salleh, Z., Hashim, H. A., & Sulong, F. (2022). Corporate governance and firm performance: empirical evidence from Jordan. *Journal of Financial Reporting and Accounting*, *20*(5), 866-896.

[7] Altarawneh, M., Farhan, N. H., & Alsamhi, M. H. (2026). The moderation effect of business environment factors on the impact of corporate governance and firm performance: empirical evidence from Middle East region. Cogent Business & Management, 13(1), 2604879.

[8] Amir, S., Salehi, N., Roci, M., Sweet, S., & Rashid, A. (2023). Towards circular economy: A guiding framework for circular supply chain implementation. Business strategy and the environment, 32(6), 2684-2701.

[9] Anas, M., Gulzar, I., Tabash, M. I., Ahmad, G., Yazdani, W., & Alam, M. F. (2023). Investigating the nexus between corporate governance and firm performance in India: Evidence from COVID-19. Journal of Risk and Financial Management, 16(7), 307.

[10] Atasu, A., Corbett, C. J., Huang, X., & Toktay, L. B. (2020). Sustainable operations management through the perspective of manufacturing & service operations management. Manufacturing & service operations management, 22(1), 146-157.

[11] Atugeba, I. L. A., & Acquah-Sam, E. (2024). Relationship between corporate governance and firm performance in Ghana: does compliance to national governance frameworks matter?. Cogent Economics & Finance, 12(1), 2347022.

[12] Awan, U., Shamim, S., & Hannola, L. (2026). Green Innovation and Low-Carbon Operations: The Role of Net-Zero Capabilities in Transition Towards Carbon Neutrality in Circular Supply Chains. Business Strategy and the Environment, 35(2), 2777-2791.

[13] Bag, S., & Rahman, M. S. (2023). The role of capabilities in shaping sustainable supply chain flexibility and enhancing circular economy-target performance: an empirical study. Supply Chain Management: An International Journal, 28(1), 162-178.

[14] Bai, C., Sarkis, J., Yin, F., & Dou, Y. (2020). Sustainable supply chain flexibility and its relationship to circular economy-target performance. International Journal of Production Research, 58(19), 5893-5910.

[15] Buallay, A. (2019). Is sustainability reporting (ESG) associated with performance? Evidence from the European banking sector. Management of Environmental Quality: An International Journal, 30(1), 98-115.

[16] Centobelli, P., Cerchione, R., Esposito, E., & Passaro, R. (2021). Determinants of the transition towards circular economy in SMEs: A sustainable supply chain management perspective. International Journal of Production Economics, 242, 108297.

[17] Dumée, L. F. (2022). Circular materials and circular design—review on challenges towards sustainable manufacturing and recycling. Circular economy and sustainability, 2(1), 9-23.

[18] Enyoghasi, C., & Badurdeen, F. (2021). Industry 4.0 for sustainable manufacturing: Opportunities at the product, process, and system levels. Resources, conservation and recycling, 166, 105362.

[19] Farooque, M., Zhang, A., Thürer, M., Qu, T., & Huisingh, D. (2019). Circular supply chain management: A definition and structured literature review. Journal of cleaner production, 228, 882-900.

[20] Geissdoerfer, M., Savaget, P., Bocken, N. M., & Hultink, E. J. (2017). The Circular Economy–A new sustainability paradigm?. Journal of cleaner production, 143, 757-768.

[21] Ghobakhloo, M., Fathi, M., Okwir, S., Al-Emran, M., & Ivanov, D. (2026). Adaptive social manufacturing: a human-centric, resilient, and sustainable framework for advancing Industry 5.0. International Journal of Production Research, 64(3), 1127-1160.

[22] Ghosh, S., Pareek, R., & Sahu, T. N. (2026). Do corporate governance and firm-specific characteristics affect the environmental sustainability of India? A panel data approach. International Journal of Business Innovation and Research, 39(2), 238-257.

[23] González-Sánchez, R., Settembre-Blundo, D., Ferrari, A. M., & García-Muiña, F. E. (2020). Main dimensions in the building of the circular supply chain: A literature review. Sustainability, 12(6), 2459.

[24] Gupta, S., Dhiman, A., Singla, A., & Saini, G. (2026). Responsible Artificial Intelligence and Green Innovation Impact on MSMEs' Sustainable Performance. Global Journal of Flexible Systems Management, 1-26.

[25] Hair Jr, J. F. (2021). Next-generation prediction metrics for composite-based PLS-SEM. Industrial Management & Data Systems, 121(1), 5-11.

[26] Hazen, B. T., Russo, I., Confente, I., & Pellathy, D. (2021). Supply chain management for circular economy: conceptual framework and research agenda. The International Journal of Logistics Management, 32(2), 510-537.

[27] Hermuningsih, S., Kusuma, H., & Cahyarifida, R. A. (2020). Corporate governance and firm performance: An empirical study from Indonesian manufacturing firms. *The Journal of Asian Finance, Economics and Business*, *7*(11), 827-834.

[28] Husnah, H., Aryati, A., Ramlawati, R., & Fahlevi, M. (2023). The relationship between corporate governance and firm performance: An empirical analysis of Indonesian companies. Journal of Economics and Business Letters, 3(3), 49-52.

[29] Huynh, Q. L., Hoque, M. E., Susanto, P., Watto, W. A., & Ashraf, M. (2022). Does financial leverage mediates corporate governance and firm performance? Sustainability, 14(20), 13545.

[30] Jesuka, D., & Peixoto, F. M. (2022). Corporate governance and firm performance: does sovereign rating matter?. *Corporate Governance: The International Journal of Business in Society*, *22*(2), 243-256.

[31] Kazancoglu, I., Kazancoglu, Y., Yarimoglu, E., & Kahraman, A. (2020). A conceptual framework for barriers of circular supply chains for sustainability in the textile industry. Sustainable development, 28(5), 1477-1492.

[32] Khan, F., & Ali, Y. (2022). Implementation of the circular supply chain management in the pharmaceutical industry. Environment, Development and Sustainability, 24(12), 13705-13731.

[33] Kumar, N., Kumar, G., & Singh, R. K. (2021). Big data analytics application for sustainable manufacturing operations: analysis of strategic factors. Clean Technologies and Environmental Policy, 23(3), 965-989.

[34] Mastos, T. D., Nizamis, A., Terzi, S., Gkortzis, D., Papadopoulos, A., Tsagkalidis, N., ... & Tzovaras, D. (2021). Introducing an application of an industry 4.0 solution for circular supply chain management. Journal of Cleaner Production, 300, 126886.

[35] Matin, A., Islam, M. R., Wang, X., Huo, H., & Xu, G. (2023). AIoT for sustainable manufacturing: Overview, challenges, and opportunities. Internet of Things, 24, 100901.

[36] Mendoza-Velázquez, A., Ortuño-Barba, L. C., & Conde-Cortés, L. D. (2022). Corporate governance and firm performance in hybrid model countries. Review of Accounting and Finance, 21(1), 32-58.

[37] https://msme.gov.in/know-about-msme(accessed on 26th Oct 2025)

[38] Morshedi, M., Hargaden, V., Papakostas, N., & Ghadimi, P. (2026). The Adoption of Digital Technologies in Circular Supply Chains: From Theoretical Developments to Practical Applications. Logistics, 10(1), 18.

[39] Muharam, H., & Atyanta, N. L. (2021). The effect of corporate governance on firm performance. Indicators: Journal of Economic and Business, 3(2), 132-142.

[40] Nayeri, S., Sazvar, Z., & Tirkolaee, E. B. (2026). Industry 5.0-driven circular supply chain network design: A novel multi-stage decision-making method. Renewable and Sustainable Energy Reviews, 226, 116420.

[41] Nguyen, N. P. A., & Dao, T. T. B. (2022). Liquidity, corporate governance and firm performance: A meta-analysis. Cogent Business & Management, 9(1), 2137960.

[42] Nurzianti, R., Rahmaddian, T., & Hadi, M. Y. (2026). The Impact of Corporate Governance Mechanisms on Strategic Risk Management and Firm Performance. Journal Management & Economics Review (JUMPER), 3(7), 367-382.

[43] Pfeffer, J., & Salancik, G. R. (1977). Organization design: The case for a coalitional model of organizations. Organizational dynamics, 6(2), 15-29.

[44] Qi, Q., Xu, Z., & Rani, P. (2023). Big data analytics challenges to implementing the intelligent Industrial Internet of Things (IIoT) systems in sustainable manufacturing operations. Technological Forecasting and Social Change, 190, 122401.

[45] Qureshi, K. M., Mewada, B. G., Kaur, S., Khan, A., Al-Qahtani, M. M., & Qureshi, M. R. N. M. (2024). Investigating industry 4.0 technologies in logistics 4.0 usage towards sustainable manufacturing supply chain. Heliyon, 10(10).

[46] Rahardjo, B., Wang, F. K., Yeh, R. H., & Chen, Y. P. (2023). Lean manufacturing in industry 4.0: a smart and sustainable manufacturing system. Machines, 11(1), 72.

[47] Rao, K., & Tilt, C. (2016). Board composition and corporate social responsibility: The role of diversity, gender, strategy and decision making. Journal of business ethics, 138(2), 327-347.

[48] Romagnoli, S., Tarabu', C., Maleki Vishkaei, B., & De Giovanni, P. (2023). The impact of digital technologies and sustainable practices on circular supply chain management. Logistics, 7(1), 1.

[49] Roy, T., Garza-Reyes, J. A., Kumar, V., Kumar, A., & Agrawal, R. (2022). Redesigning traditional linear supply chains into circular supply chains–A study into its challenges. Sustainable Production and Consumption, 31, 113-126.

[50] Saranya, S., Harris, K. D., & Rao, P. B. (2026). AI-Powered Sustainable Manufacturing in Industry 5.0—A Multi-technology Approach for Smart and Resilient Factories. In *Advances in Mechanical Engineering and Material Sciences* (pp. 172-177). CRC Press.

[51] Sarstedt, M., Hair, J. F., Pick, M., Liengaard, B. D., Radomir, L., & Ringle, C. M. (2022). Progress in partial least squares structural equation modeling use in marketing research in the last decade. Psychology & Marketing, 39(5), 1035-1064.

[52] Sartal, A., Bellas, R., Mejías, A. M., & García-Collado, A. (2020). The sustainable manufacturing concept, evolution and opportunities within Industry 4.0: A literature review. Advances in Mechanical Engineering, 12(5), 1687814020925232.

[53] Sharma, K., Aswal, C., & Paul, J. (2023). Factors affecting green purchase behavior: A systematic literature review. Business Strategy and the Environment, 32(4), 2078-2092.

[54] Sharma, R., Jabbour, C. J. C., & Lopes de Sousa Jabbour, A. B. (2021). Sustainable manufacturing and industry 4.0: what we know and what we don't. Journal of Enterprise Information Management, 34(1), 230-266.

[55] Singh, N. K., & Singh, Y. (2026). Green Synthesis: Pathways to Sustainable Manufacturing. Green Manufacturing with Artificial Intelligence Applications, 1.

[56] Song, X., & Yang, B. (2022). Oil price uncertainty, corporate governance and firm performance. International Review of Economics & Finance, 80, 469-487.

[57] Taddei, E., Sassanelli, C., Rosa, P., & Terzi, S. (2024). Circular supply chains theoretical gaps and practical barriers: A model to support approaching firms in the era of industry 4.0. Computers & Industrial Engineering, 190, 110049.

[58] Velte, P. (2022). Does sustainable corporate governance have an impact on materiality disclosure quality in integrated reporting? International evidence. Sustainable Development, 30(6), 1655-1670.

[59] Vrignat, P., Kratz, F., & Avila, M. (2022). Sustainable manufacturing, maintenance policies, prognostics and health management: A literature review. Reliability Engineering & System Safety, 218, 108140.

[60] Xu, E. G., Graves, C., Shan, Y. G., & Yang, J. W. (2022). The mediating role of corporate social responsibility in corporate governance and firm performance. Journal of cleaner production, 375, 134165.

[61] Zhang, A., Wang, J. X., Farooque, M., Wang, Y., & Choi, T. M. (2021). Multi-dimensional circular supply chain management: A comparative review of the state-of-the-art practices and research. Transportation Research Part E: Logistics and Transportation Review, 155, 102509.