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Developing a Model of Green Supply Chain Management Practices with Emphasis on the Behavioral Perspective to Improve Performance

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A B S T R A C T

In the modern era, attention to performance considering the environmental impacts of industrial activities has become one of the most important priorities for organizations and governments. Green Supply Chain Management (GSCM), as an innovative approach within supply chain management, plays a pivotal role in reducing negative environmental effects and enhancing organizational performance. This study presents a comprehensive model of green supply chain management practices, analyzing the role of behavioral perspectives in improving performance. In the first phase, a qualitative research design and content analysis method were employed to identify effective behavioral practices of green supply chain management aimed at improving performance through a systematic review of relevant articles. In the next phase, a quantitative approach utilizing the Delphi method was conducted to validate the identified behavioral practices of green supply chain management that contribute to performance enhancement. Finally, the Interpretive Structural Modeling (ISM) method was applied to classify the effective behavioral practices of green supply chain management for performance improvement, and the causal and dependent relationships among these behavioral factors were determined. The findings indicate that factors such as training and empowerment of members, risk-taking, top management support, government legitimization, corporate social responsibility, beliefs and values, as well as commitment and acceptance of the green supply chain, have the strongest direct impacts.

Keywords: *Green supply chain management, performance, corporate social responsibility.*

1. Introduction

In the contemporary era of accelerating global competition, environmental degradation, and resource scarcity, organizations are under increasing pressure to adopt sustainable operational models that integrate environmental considerations into their core business strategies. The concept of Green Supply Chain Management (GSCM) has

emerged as a crucial response to these challenges, aiming to minimize negative environmental impacts while maintaining organizational efficiency and profitability (El Mokadem & Khalaf, 2025). GSCM combines traditional supply chain practices with sustainability principles to ensure environmental responsibility across all stages of production, distribution, and consumption (Mahar et al., 2025). The growing awareness of ecological sustainability, institutional regulations, and consumer demand for eco-friendly products have led firms across various sectors to shift toward greener practices that enhance both environmental and financial performance (Niromand et al., 2025).

Organizations worldwide recognize that environmental sustainability is not only a moral obligation but also a strategic asset that can drive competitiveness, innovation, and stakeholder trust (Paluš et al., 2024). By integrating GSCM principles, companies can reduce waste, optimize resource utilization, and improve their overall operational effectiveness. According to (Huang et al., 2024), GSCM practices contribute to the triple bottom line of sustainability—enhancing economic, environmental, and social performance simultaneously. This triple focus supports the broader goal of sustainable development, in which organizations act responsibly toward the environment while securing long-term profitability and social well-being.

However, effective implementation of GSCM is not merely a technical challenge but also a behavioral and organizational one. The success of green initiatives depends heavily on the attitudes, commitment, and behavioral engagement of individuals and teams across the supply chain (Nureen et al., 2022). Behavioral factors such as green leadership, risk-taking, motivation, and cultural readiness significantly shape the effectiveness of GSCM strategies (Aghighi & Soleimani Ranjbar, 2021). In particular, promoting environmental awareness, fostering collaboration, and developing a culture of sustainability are essential to transform individual and collective behaviors into coherent green actions (Ajalli et al., 2021).

Behavioral perspectives emphasize the role of managerial commitment, employee empowerment, and stakeholder collaboration in achieving GSCM objectives. Studies show that the alignment of behavioral drivers with green operational practices can create a synergistic effect that improves both environmental and business performance (Ramezani & Haji Aghajani, 2023). For instance, when employees are motivated through training and incentives, they are more likely to engage in eco-innovative practices, reduce waste, and participate in continuous improvement efforts that enhance sustainability outcomes (Huma et al., 2023). Moreover, the active involvement of leadership in promoting environmental responsibility provides the strategic vision and resource allocation necessary for GSCM success (Mahmoudi Meymand et al., 2021).

From an institutional perspective, governmental regulations, non-governmental organization (NGO) pressures, and social expectations have become powerful external drivers of GSCM adoption (Zarei Sodani & Mohammadi Nafchi, 2024). Governments play a pivotal role in legitimizing green practices through policies, incentives, and regulatory frameworks that encourage sustainable operations (Sepasi & Bashir Khodaparasti, 2022). NGOs and environmental groups also contribute by holding corporations accountable and promoting transparency in environmental reporting. The interplay between these external institutional pressures and internal behavioral readiness defines how effectively organizations can transition toward sustainable supply chain systems (Niromand et al., 2025).

Moreover, corporate social responsibility (CSR) is closely intertwined with GSCM practices, providing a moral and strategic foundation for environmental stewardship. CSR initiatives not only enhance a company's reputation but also foster a sense of ethical accountability among employees and stakeholders (Karimi Ghadousi et al., 2021). According to (Mousa et al., 2024), CSR-driven organizations often exhibit higher adaptability to environmental changes, as their internal cultures are aligned with long-term sustainability objectives. This alignment helps integrate behavioral green practices such as leadership support, risk-taking, and continuous learning into organizational routines, strengthening the overall sustainability performance of the supply chain.

The behavioral dimensions of GSCM are increasingly recognized as the missing link between policy adoption and performance realization. While technical practices—such as green purchasing, waste minimization, and eco-design—are vital, their impact remains limited unless supported by a strong behavioral foundation (Nureen et al., 2022). As (Hemmati Noedoust Gilani & Khosh Tinet, 2024) explains, behavioral elements like communication, motivation, and environmental commitment act as catalysts that transform green policies into consistent operational practices. This perspective suggests that sustainable transformation requires a balance between technical mechanisms and human engagement.

The integration of green knowledge and organizational learning further reinforces behavioral engagement in GSCM. Knowledge transfer and innovation diffusion within supply chains enhance adaptive capacity and foster continuous improvement in environmental performance (Tahmasbi Roshan & Arab Kalmeri, 2024). In small and medium-sized enterprises (SMEs), where resource constraints often limit the adoption of advanced technologies, behavioral and cultural factors play an even more prominent role in enabling green initiatives (Taheri Nia et al., 2021). Employee empowerment, training, and participation in decision-making processes ensure that sustainability is embedded not only in procedures but also in organizational mindsets (Huma et al., 2023).

In recent years, the relationship between GSCM and organizational performance has attracted substantial academic and managerial interest. Studies have shown that GSCM practices positively influence various dimensions of performance, including operational efficiency, market competitiveness, and innovation capability (El Mokadem & Khalaf, 2025). In particular, the behavioral aspects of GSCM, such as trust, collaboration, and shared environmental values, enhance communication and coordination across the supply chain, leading to more agile and resilient systems (Mahar et al., 2025). Similarly, (Ghayour Baghbani et al., 2024) found that internal green practices—supported by environmental collaboration and green human resource management—significantly improve financial and environmental performance among firms listed on the Tehran Stock Exchange.

Another essential behavioral driver of GSCM effectiveness is leadership commitment. Leaders play a transformative role in integrating sustainability goals into organizational vision, guiding teams through the process of change, and fostering accountability for environmental outcomes (Ramezani & Haji Aghajani, 2023). Leadership engagement ensures that green initiatives are not perceived as peripheral projects but as core components of strategic management. Similarly, (Huang et al., 2024) demonstrated that leadership-driven green culture enhances the organization's ability to achieve triple bottom line performance through innovation and adaptive learning.

Environmental collaboration among supply chain partners also serves as a crucial behavioral mechanism for improving sustainability outcomes. Through collaboration, organizations can share knowledge, develop joint green solutions, and reduce redundancies that contribute to environmental degradation (Ajalli et al., 2021). This cooperative behavior not only minimizes ecological risks but also enhances mutual trust and inter-organizational commitment. Moreover, behavioral constructs such as risk-taking and flexibility enable firms to experiment with new technologies and processes, thereby fostering innovation in green supply chain strategies (Mousa et al., 2024).

Empirical evidence further highlights the moderating influence of institutional pressure and economic uncertainty on the success of behavioral GSCM practices. For instance, (Zarei Sodani & Mohammadi Nafchi, 2024) emphasized that macroeconomic volatility affects managerial decision-making in sustainability initiatives. Similarly, institutional constraints may either facilitate or hinder behavioral adaptation, depending on the degree of regulatory enforcement and market incentives (Niromand et al., 2025). These findings underscore the need for adaptive green cultures capable of responding dynamically to contextual changes.

From a performance standpoint, the link between behavioral GSCM and organizational competitiveness is increasingly evident. Firms that embed behavioral green initiatives—such as training, empowerment, and reward systems—within their management structures often outperform those that rely solely on technological interventions (Paluš et al., 2024). Behavioral mechanisms not only strengthen employee engagement and morale but also create a sustainable organizational identity centered on environmental responsibility. According to (Maaz & Ahmad, 2022), supply chain performance directly enhances customer satisfaction and overall organizational performance, which are themselves dependent on the behavioral cohesion of the supply chain network.

Behavioral factors are also instrumental in achieving the social dimension of sustainability, which includes stakeholder well-being, community engagement, and ethical governance. Social responsibility practices, when integrated with GSCM, encourage organizations to move beyond compliance and toward proactive environmental citizenship (Karimi Ghadousi et al., 2021). This human-centered approach ensures that sustainability is not reduced to metrics or certifications but is embodied in the everyday behaviors and values of the organization's members (Mousa et al., 2024).

Despite the growing recognition of behavioral factors in GSCM, many organizations still struggle to operationalize these dimensions systematically. Cultural resistance, lack of environmental awareness, and insufficient top management support remain significant barriers to behavioral

transformation (Mahmoudi Meymand et al., 2021). Therefore, understanding how behavioral mechanisms interact with green supply chain practices to enhance performance remains a critical research priority. (Niromand et al., 2025) and (El Mokadem & Khalaf, 2025) both highlight that sustainable performance is best achieved when behavioral and technical dimensions are integrated into a coherent strategic model.

In the Iranian industrial context, where manufacturing sectors such as ceramics, steel, and agriculture play a vital economic role, the behavioral dimensions of GSCM are particularly relevant. Studies indicate that empowering employees, strengthening leadership commitment, and promoting green culture can help overcome institutional and resource-based limitations (Ghayour Baghbani et al., 2024; Hemmati Noedoust Gilani & Khosh Tinet, 2024). Similarly, fostering inter-organizational trust and knowledge-sharing mechanisms can improve coordination across the supply chain, leading to both environmental and financial benefits (Yazdani & Landran Esfahani, 2023).

Building on this literature, it becomes evident that behavioral approaches to GSCM—including training, empowerment, green teamwork, and leadership support—serve as essential levers for achieving sustainable organizational performance. When aligned with institutional frameworks, corporate social responsibility, and green innovation, these behavioral practices can transform supply chains into dynamic systems capable of balancing economic growth with environmental stewardship (Mahar et al., 2025; Tahmasbi Roshan & Arab Kalmeri, 2024).

Therefore, the present study aims to develop a comprehensive model of behavioral practices in Green Supply Chain Management (GSCM) to enhance organizational performance.

2. Methods and Materials

بلهFrom the perspective of research philosophy, this study adopts an interpretivist paradigm and is developmental in purpose. In terms of research approach, it follows an inductive reasoning process, and in terms of nature, it is an exploratory–analytical study. From the methodological perspective of data collection, the research employs a mixed-method design, combining library-based and field research. The study aims to develop a model of green supply chain management (GSCM) practices with an emphasis on the behavioral perspective to enhance performance. To achieve this objective, the study was conducted in four distinct phases, each designed according to specific research goals, as follows:

Step 1: Identifying effective behavioral practices of green supply chain management.

Step 2: Localizing effective behavioral practices of green supply chain management for performance improvement.

Step 3: Developing and structuring the model of effective behavioral practices of green supply chain management for performance enhancement.

Step 4: Examining the causal and dependent relationships among effective behavioral practices of green supply chain management for performance improvement.

Since the study was conducted in four steps, the statistical population and sampling method differed at each stage. In the first step, as documents and literature were analyzed, the statistical population comprised published articles available in academic databases. In the remaining steps, the population included academic and industry experts.

In the meta-synthesis phase, valid domestic and international databases were reviewed, including Noormags, Jihad Daneshgahi Database, Humanities Portal, Magiran, and international sources such as Google Scholar, ERIC, ScienceDirect, ResearchGate, Elsevier, and Springer. Out of 402 related articles, 50 final articles were selected for in-depth analysis.

In the first step, the population included all articles related to behavioral aspects of effective green supply chain management practices. To gather information, 112 Persian articles were retrieved from the SID database, 131 international articles from Emerald (published between 2015 and 2023), and 159 international articles from ScienceDirect (published between 2015 and 2023), totaling 402 articles.

In the second step, aimed at localizing and contextualizing behavioral GSCM practices for performance improvement, the population included academic faculty members and industry experts with expertise in supply chain management and industrial performance improvement. The experts selected for the Delphi panel consisted of 12 specialists—including professionals from the tile and ceramic industry and university professors—with over 10 years of experience, relevant industrial expertise, and at least a master's degree. The selection was conducted using a purposeful sampling method.

In the third step, which aimed to develop and structure the model of behavioral GSCM practices for performance improvement, the same expert group from the second step was utilized. In the fourth step, to examine the causal and dependent relationships among behavioral GSCM practices,

the study again engaged academic and industrial experts familiar with supply chain management and performance improvement in the tile and ceramic industry.

The sampling method in the first step was judgmental sampling. All behavioral articles were reviewed, and 27 articles were selected as the representative sample. In the second, third, and fourth steps, the population consisted of experts who needed complete mastery of the research topic. Steps two and three involved 12 experts, while 13 experts participated in step four.

In the meta-synthesis phase, a library-based method and review of domestic and international research were conducted using valid databases such as Google Scholar, ERIC, ScienceDirect, ResearchGate, Elsevier, and domestic sources including Noormags, Jihad Daneshgahi Database, and the Humanities Portal. Articles published between 2013 and 2023 were extracted. The chosen time frame was due to the high volume of research related to digital transformation in education. In this phase, note-taking tools and Microsoft Excel software were used for data organization.

During the research process, to identify the sequence of behavioral dimensions in Interpretive Structural Modeling (ISM), a field study using a questionnaire was conducted to gather expert opinions. For the Delphi process, data were also collected via field surveys and questionnaires based on expert judgments.

To ensure validity and reliability of instruments at each step, the following measures were implemented. In the first step, as the tool was library-based, Lincoln and Guba's (1985) qualitative validation framework was used, applying the four criteria of credibility, dependability, transferability, and confirmability. Initially, ten articles were analyzed and documented in each dimension, which were then reviewed and validated by supervisors and advisors.

In the second step, although quantitative in nature, the study remained expert-oriented; thus, the same validation approach as step one was employed. In steps three and four, the research tool was a pairwise comparison questionnaire. The consistency of expert responses was evaluated through the consistency index (CI). If the inconsistency ratio exceeded 0.1, the comparisons were revised. Because the questionnaire compared all factors pairwise—ensuring comprehensive coverage without subjective bias—reliability assessment was deemed unnecessary.

The data analysis methods varied by research step. In the first step, the qualitative content analysis approach was used, emphasizing accuracy in coding and multi-researcher consensus to ensure reliability of extracted codes. After open coding, duplicate codes were eliminated, and unique open codes were retained. During selective coding, consensus among researchers ensured that redundant and low-significance codes were removed, and related axial codes were consolidated. The final codes were entered into NVivo software to verify the coding structure.

In the second step, the Delphi method was applied. Delphi relies on the expert intuition of specialists who, after expressing their views on a given issue, reach consensus through iteration. Although subjective, this collective expert judgment is typically more valid than individual opinions, yielding more objective and reliable outcomes.

The third step employed Interpretive Structural Modeling (ISM), a method used to assess the influence of each variable on others and to establish a hierarchical structure of relationships. ISM provides a comprehensive framework for examining interrelationships and developing a conceptual model to achieve the overall research objectives.

In the fourth step, cross-impact analysis was conducted using MICMAC software. Structural analysis, which examines relationships among variables across a wide scope, is one of the most widely used futures studies methods, and MICMAC is recognized as one of the best tools for structural dependency and driving power analysis.

3. Findings and Results

Step One: Identifying Effective Behavioral Practices of Green Supply Chain Management

Initially, effective behavioral practices of green supply chain management were identified through the review of both international and domestic studies, followed by qualitative analysis to establish a preliminary conceptual framework for the researcher. A total of 44 articles related to behavioral dimensions were reviewed, from which 27 articles were selected as the sample for detailed analysis. Table 1 presents the extracted behavioral practices of green supply chain management derived from the qualitative analysis of the reviewed articles.

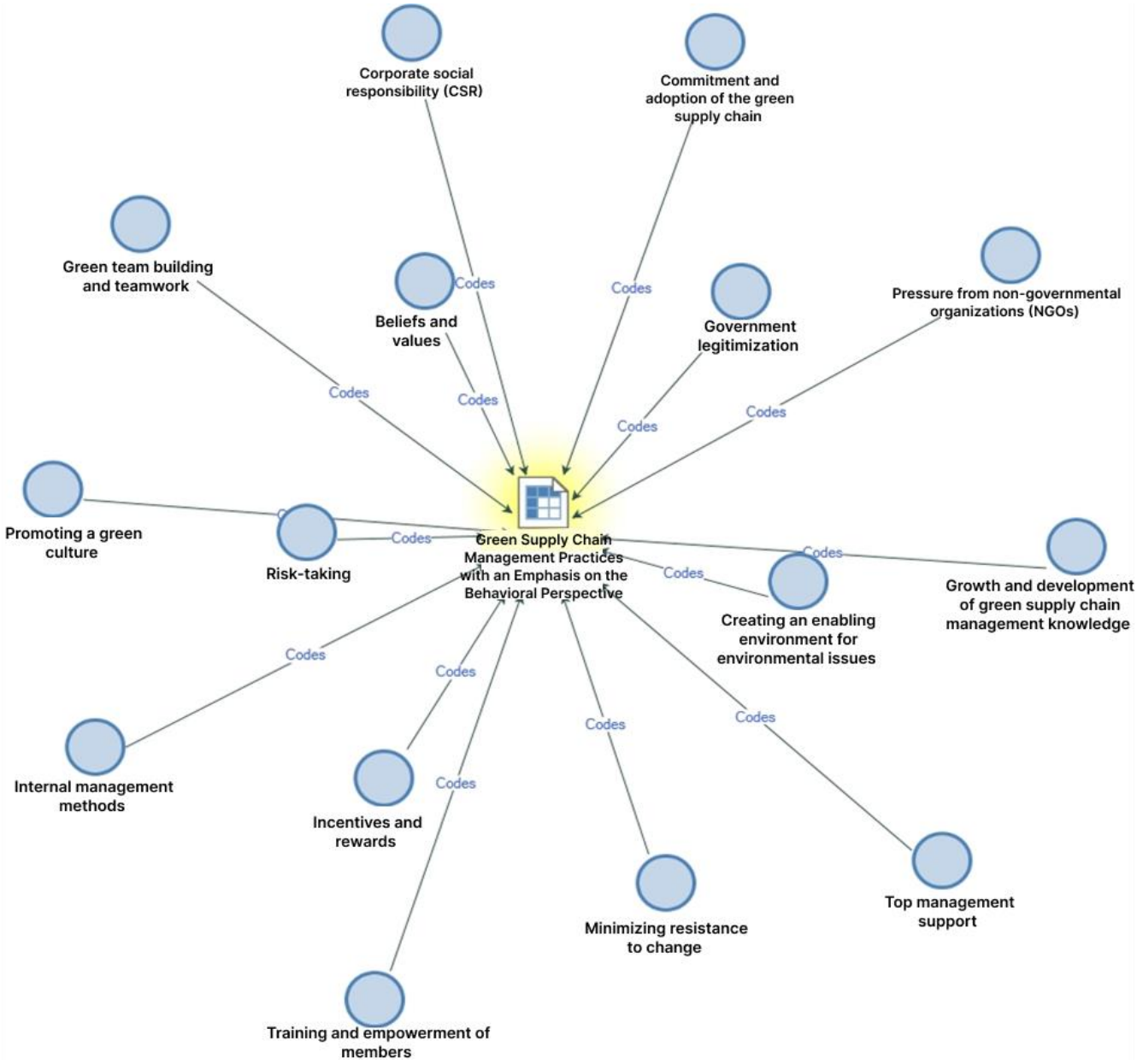
Table 1

Identification of Effective Behavioral Practices of Green Supply Chain Management Extracted from International and Domestic Articles

No.	Practices	No.	Practices
1	Training and empowerment of members	9	Commitment and adoption of the green supply chain
2	Green team building and teamwork	10	Pressure from non-governmental organizations (NGOs)
3	Minimizing resistance to change	11	Government legitimization
4	Growth and development of green supply chain management knowledge	12	Corporate social responsibility (CSR)
5	Incentives and rewards	13	Internal management methods
6	Top management support	14	Risk-taking
7	Creating an enabling environment for environmental issues	15	Beliefs and values
8	Promoting a green culture		

Figure 1

Thematic Network



Step Two: Localization of Effective Behavioral Practices of Green Supply Chain Management for Performance Improvement

To localize the effective behavioral practices of green supply chain management for performance improvement, the researcher consulted industry and academic experts. Using the Delphi method, these factors were adapted to the context of the tile and ceramic industry, the focus sector of the present study. A structured questionnaire was distributed to experts containing the core question: *"Which behavioral practices of green supply chain management are effective for improving performance?"*

The 15 factors identified in the previous step were presented in the questionnaire for evaluation. To determine the degree of consensus among experts, Kendall's coefficient of concordance (W) was applied. This coefficient measures the level of agreement among multiple sets of rankings provided by *N* individuals and is especially useful in assessing inter-rater reliability in expert-based studies. A Kendall's W value equal to or greater than 0.5 was considered the threshold for acceptable consensus among participants.

According to the final results of the Delphi process, experts achieved consensus on all 15 factors, and there was no need for additional Delphi rounds. However, factors with a mean score below 3 were removed at this stage. Based on the results, 3 factors were eliminated, and the remaining 12 factors were confirmed as effective behavioral practices of green supply chain management for performance improvement, as presented in Table 2.

Table 2

Effective Behavioral Practices of Green Supply Chain Management for Performance Improvement

No.	Final Practices
1	Training and empowerment of members
2	Green team building and teamwork
3	Risk-taking
4	Incentives and rewards
5	Top management support
6	Growth and development of green supply chain management knowledge
7	Promoting a green culture
8	Commitment and adoption of the green supply chain
9	Government legitimization
10	Corporate social responsibility (CSR)
11	Pressure from non-governmental organizations (NGOs)
12	Beliefs and values

Step Three: Development and Hierarchical Structuring of Effective Behavioral Green Supply Chain Management Practices for Performance Improvement

To develop the model and hierarchical structure of effective behavioral green supply chain management (GSCM) practices aimed at performance improvement, the researcher consulted a panel of experts. The experts were provided with questionnaires corresponding to each dimension to determine the hierarchical positioning of the identified behavioral practices from the previous phase.

To achieve this goal, a pairwise comparison questionnaire consisting of the 12 identified factors was used. Respondents were asked to assess the relationships between each pair of factors and specify whether the relationship was nonexistent, unidirectional, or bidirectional.

Based on the results presented in Table 3, the interpretive structural model (ISM) identified the following hierarchical structure:

- Level 1 (Most Dependent Factors): Green team building and teamwork, growth and development of green supply chain management knowledge, promotion of green culture, and commitment and adoption of the green supply chain were identified as the most influenced practices in behavioral GSCM for performance improvement in the tile and ceramic industry.
- Level 2: Training and empowerment of members, risk-taking, incentives and rewards, top management support, and corporate social responsibility (CSR) were classified as intermediate factors.
- Level 3: Pressure from non-governmental organizations (NGOs) and beliefs and values were positioned as moderately influencing factors.
- Level 4 (Most Influential Factor): Government legitimization was identified as the most influential

behavioral GSCM practice impacting performance improvement in the tile and ceramic industry.

Table 3

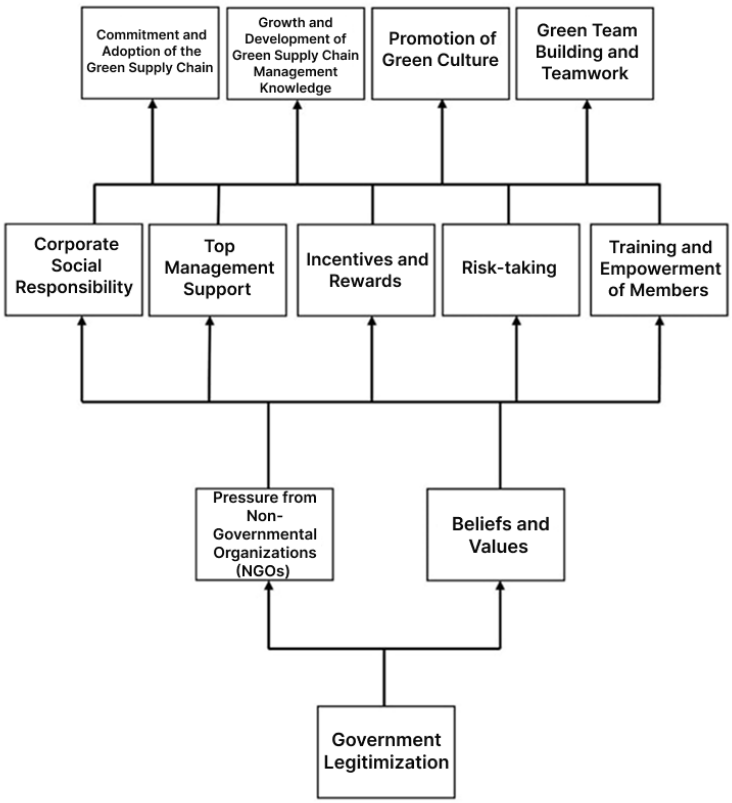
Determination of Model Levels

Symbol	Factors	Reachability Set	Antecedent Set	Intersection Set	Level
C1	Training and empowerment of members	1,2,3,4,5,6,7,8,10,11,12	1,2,3,5,6,7,8,9,10,11,12	1,2,3,5,6,7,8,10,11,12	2nd
C2	Green team building and teamwork	1,2,3,4,5,6,8,10,12	1,2,3,4,5,6,7,8,9,10,11,12	1,2,3,4,5,6,8,10,12	1st
C3	Risk-taking	1,2,3,4,5,6,7,8,10,11,12	1,2,3,4,6,7,8,9,10,11,12	1,2,3,4,6,7,8,10,11,12	2nd
C4	Growth and development of green supply chain management knowledge	2,3,4,5,12	1,2,3,4,5,6,7,8,9,10,11,12	2,3,4,5,12	1st
C5	Promotion of green culture	1,2,4,5,6,7,8,10,11,12	1,2,3,4,5,6,7,8,9,10,11,12	1,2,4,5,6,7,8,10,11,12	1st
C6	Incentives and rewards	1,2,3,4,5,6,8,10,12	1,2,3,5,6,7,8,9,10,11,12	1,2,3,5,6,8,10,12	2nd
C7	Pressure from NGOs	1,2,3,4,5,6,7,8,10,12	1,3,5,7,8	1,3,5,7,8	3rd
C8	Top management support	1,2,3,4,5,6,7,8,10,11,12	1,2,3,5,6,7,8,9,10,11,12	1,2,3,5,6,7,8,10,11,12	2nd
C9	Government legitimization	1,2,3,4,5,6,8,9,10,11,12	9	9	4th
C10	Corporate social responsibility	1,2,3,4,5,6,8,10,11,12	1,2,3,5,6,7,8,9,10,11,12	1,2,3,5,6,8,10,11,12	2nd
C11	Beliefs and values	1,2,3,4,5,6,8,10,11,12	1,3,5,8,9,10,11	1,3,5,8,10,11	3rd
C12	Commitment and adoption of the green supply chain	1,2,3,4,5,6,8,10,12	1,2,3,4,5,6,7,8,9,10,11,12	1,2,3,4,5,6,8,10,12	1st

According to the established levels, the final interpretive structural model is illustrated in Figure 2, representing the hierarchical positioning and interrelationships of behavioral factors contributing to performance improvement in the GSCM framework.

Figure 2

Final Hierarchical Structuring of Behavioral Factors and the Final Model



Step Four: Cross-Impact Analysis of Effective Behavioral Green Supply Chain Management Practices for Performance Improvement

To achieve the goal of this step—analyzing the cross-impacts of effective behavioral green supply chain management practices for performance improvement—a pairwise comparison questionnaire was employed. Respondents were asked to determine the nature of relationships among the identified factors (directional, bidirectional, or absent).

Following the identification of the key factors in Step Two, the MICMAC (Matrice d'Impacts Croisés Multiplication Appliquée à un Classement) analysis method was used to examine the mutual influences among behavioral GSCM practices. The corresponding symbols for each factor as defined in the MICMAC software are shown in Table 4.

Table 4

Symbolization of Effective Behavioral Green Supply Chain Management Practices for Performance Improvement

No.	Effective Behavioral GSCM Practices for Performance Improvement	Software Symbol
1	Training and empowerment of members	M1
2	Green team building and teamwork	M2
3	Risk-taking	M3
4	Growth and development of green supply chain management knowledge	M4
5	Promotion of green culture	M5
6	Incentives and rewards	M6
7	Pressure from NGOs	M7
8	Top management support	M8
9	Government legitimization	M9
10	Corporate social responsibility (CSR)	M10
11	Beliefs and values	M11
12	Commitment and adoption of the green supply chain	M12

Table 5 presents the number of rows (influence) and columns (dependence) for each factor. The highest number of rows corresponds to government legitimization, while the lowest number of rows corresponds to promotion of green culture and commitment and adoption of the green supply chain. Conversely, the highest number of columns belongs to growth and development of green supply chain management knowledge, green team building and teamwork, and commitment and adoption of the green supply chain, while the lowest number of columns corresponds to government legitimization.

The total number of rows and columns equals 247, confirming the 12×12 square matrix structure of the cross-impact analysis in this research.

Table 5

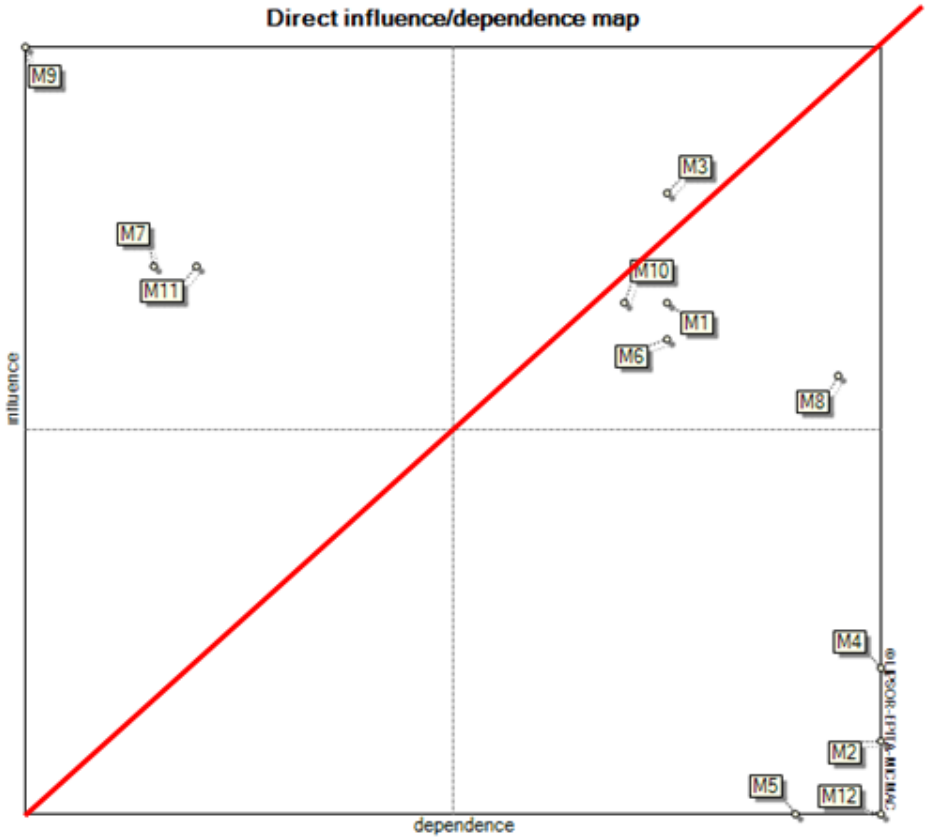
Quantitative Measures of Rows and Columns by Factor

No.	Factor	Row Total (Driving Power)	Column Total (Dependence Power)
1	Training and empowerment of members	24	22
2	Green team building and teamwork	12	27
3	Risk-taking	27	22
4	Growth and development of green supply chain management knowledge	14	27
5	Promotion of green culture	10	25
6	Incentives and rewards	23	22
7	Pressure from NGOs	25	10
8	Top management support	22	26
9	Government legitimization	31	7
10	Corporate social responsibility (CSR)	24	21
11	Beliefs and values	25	11
12	Commitment and adoption of the green supply chain	10	27
Total		247	247

The MICMAC software displays all variables within a conceptual diagram that illustrates the dispersion of variables across predefined regions based on their driving power (influence) and dependence power (influence received). According to the analysis and as shown in Figure 3, four types or categories of variables (direct relationships) can be identified and distinguished, as explained below. The distribution pattern of factors in Figure 3 indicates the system's stability status—that is, whether the system is stable or unstable. As shown in the figure, the system can be considered stable, meaning that, in terms of development, it has reached a certain level of predictive reliability regarding variable interrelations.

Figure 3

Driving and Dependence Power of Variables (Direct Relationships)



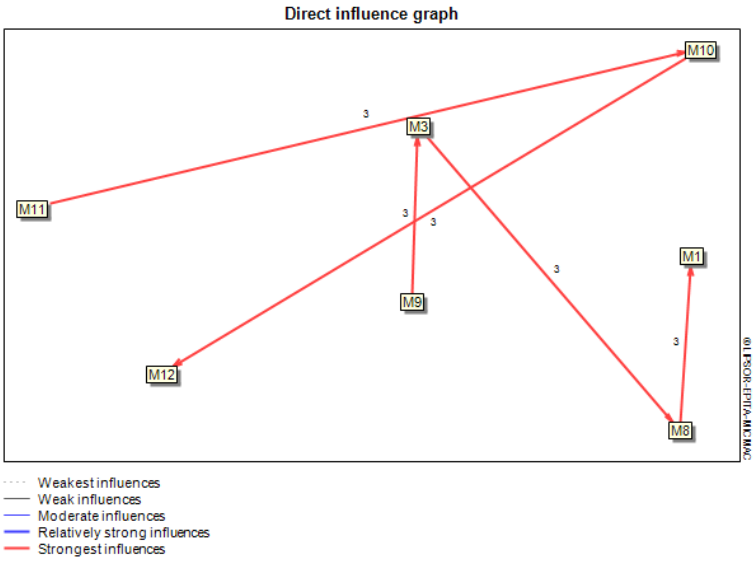
To analyze the cross-impacts of effective behavioral green supply chain management (GSCM) practices on performance improvement, all analyses—both direct and indirect relationships among factors—were conducted at three levels: 5%, 50%, and 100%, and relational diagrams were generated for each level to ensure high-precision and reliable interpretation.

It should be noted that the calculation of other threshold levels is also possible; however, due to the lack of comparable prior studies, this research was limited to the aforementioned three levels. The rationale behind selecting these specific levels is as follows:

- The 5% level identifies the strongest influencing factors at the minimum threshold of connectivity.
- The 50% level represents the average degree of connectivity, used to assess moderate to strong influencing factors.
- The 100% level captures all possible factors and interrelationships, providing a comprehensive view of the entire system.

Figure 4

Direct Influence at the 5% Level

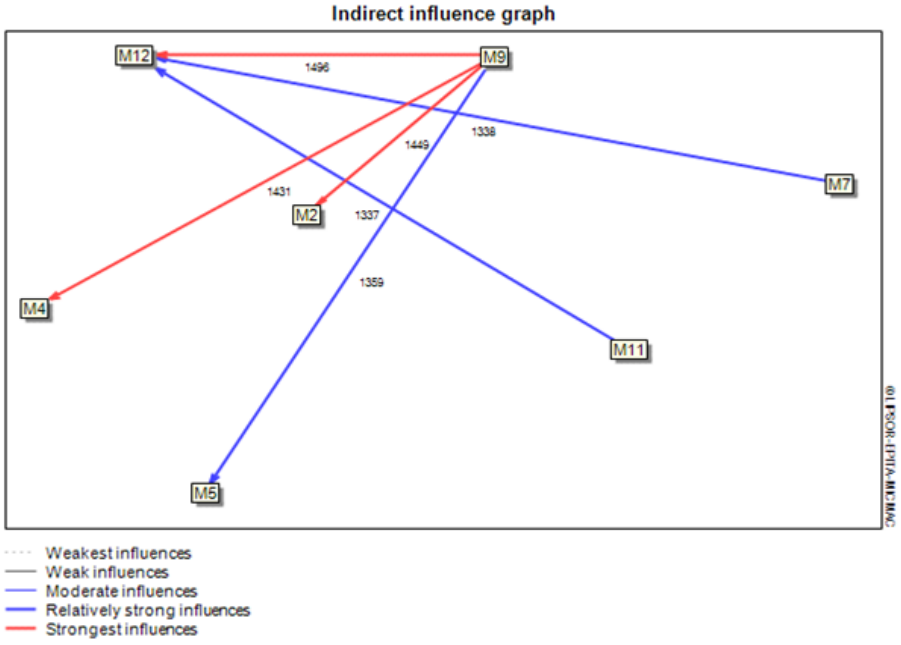


At the 5% level, analysis of direct and indirect influences among variables reveals the strongest possible relationships between them, with numerical indicators representing the degree of influence displayed above each link. The factors training and empowerment of members, risk-taking, top management support, government legitimization, corporate social responsibility (CSR), beliefs and values, and commitment and adoption of the green supply chain exhibit the strongest direct influences.

Additionally, the factors green team building and teamwork, growth and development of green supply chain management knowledge, promotion of green culture, pressure from non-governmental organizations (NGOs), government legitimization, beliefs and values, and commitment and adoption of the green supply chain show the strongest combined direct and indirect influences. The analytical results are illustrated in Figures 4 and 5.

Figure 5

Direct and Indirect Influence at the 5% Level



At the 50% level, analysis of direct and indirect influences among factors identifies moderate to strong relationships among all twelve recognized factors. The results indicate that all twelve behavioral GSCM factors are interconnected, demonstrating medium-to-high levels of influence and dependence. The analytical outcomes are illustrated in Figures 6 and 7.

Figure 6

Direct Influence at the 50% Level

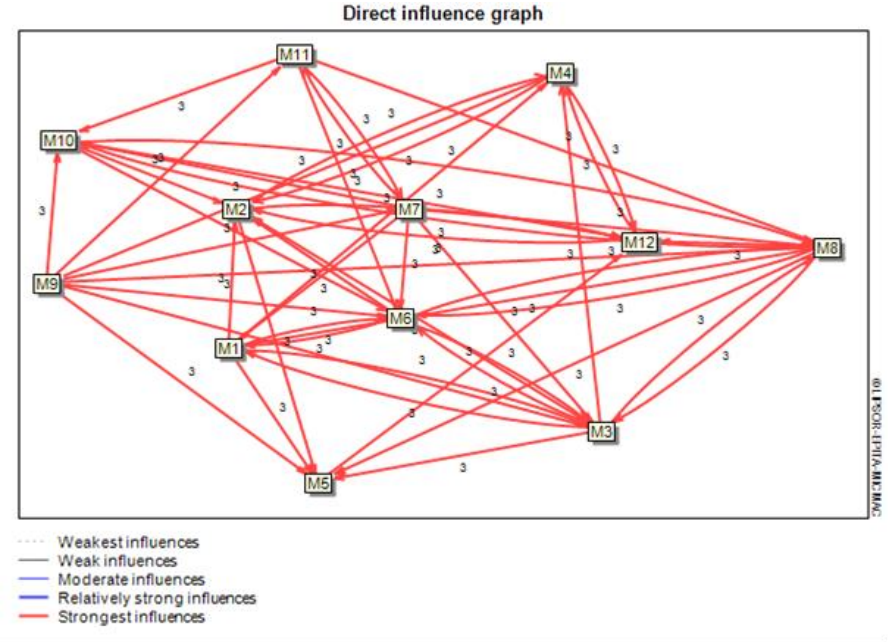
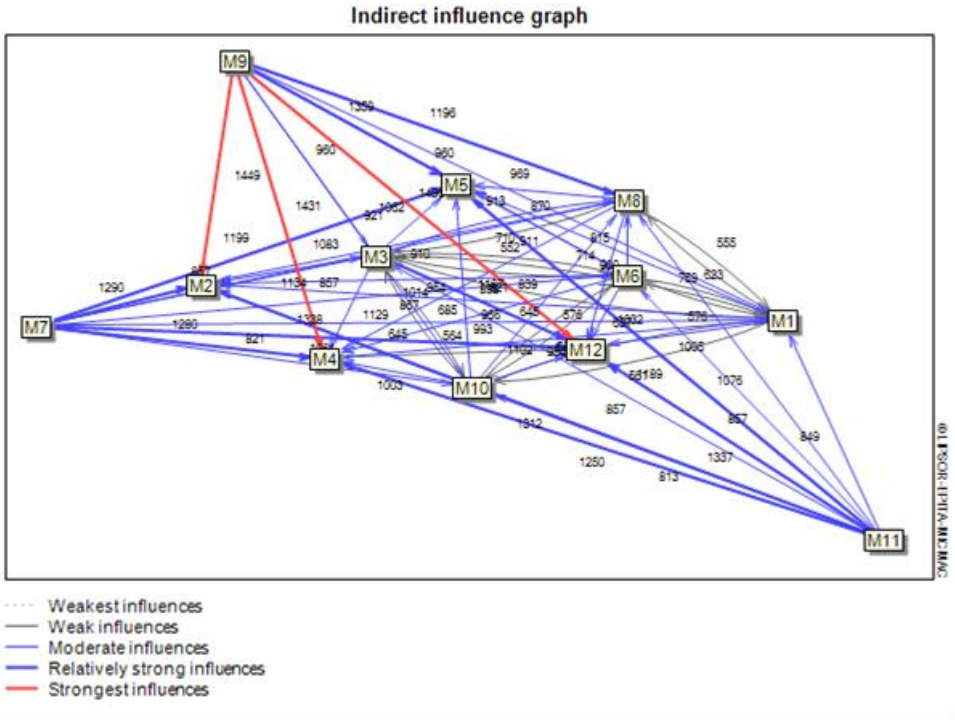


Figure 7

Direct and Indirect Influence at the 50% Level



At the 100% level, analysis of direct and indirect influences shows that all twelve identified factors are interconnected according to the expert panel's assessment. This finding confirms that every factor identified by the experts constitutes an effective behavioral GSCM practice contributing to performance improvement. The analytical results are displayed in Figures 8 and 9.

Figure 8

Direct Influence at the 100% Level

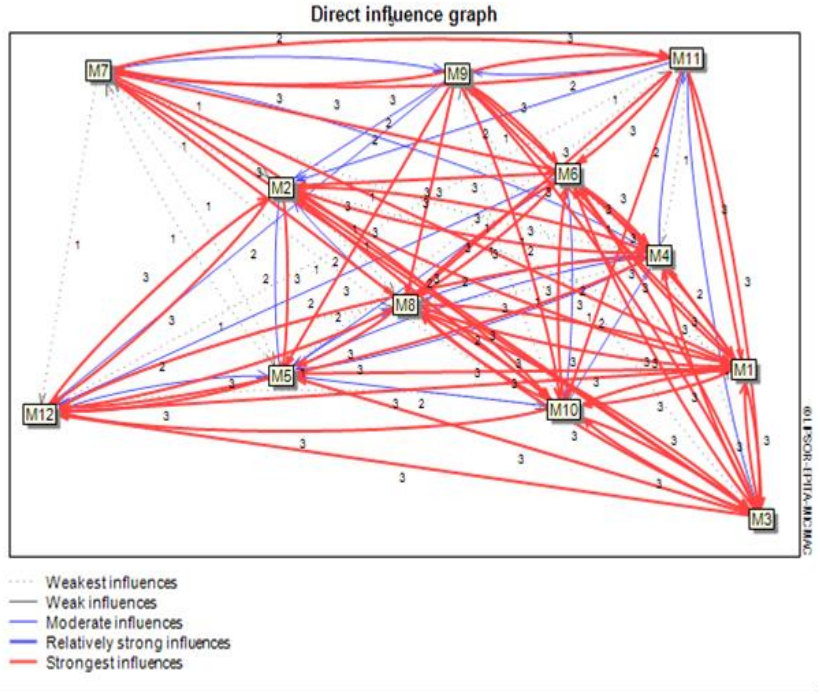
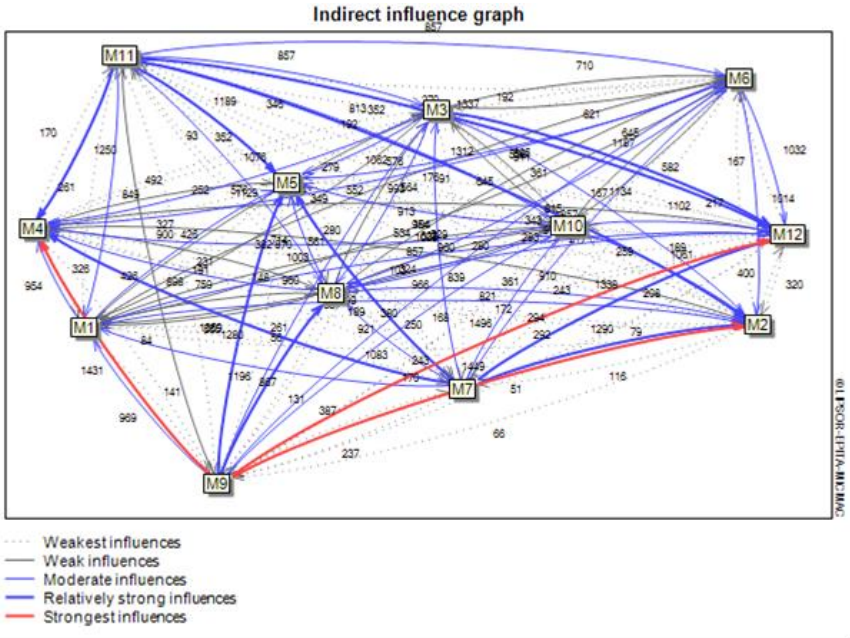


Figure 9

Direct and Indirect Influence at the 100% Level



4. Discussion and Conclusion

The present study sought to develop a comprehensive behavioral model of Green Supply Chain Management (GSCM) practices to improve organizational performance. The findings derived from the interpretive structural modeling (ISM) and MICMAC analysis identified twelve key behavioral actions that collectively shape green performance outcomes. These factors include training and empowerment of members, green team building, risk-taking, incentives and rewards, top management support, knowledge development in green supply chain management, promotion of green culture, commitment and adoption of the green chain, government legitimization, corporate social responsibility (CSR), pressure from non-governmental organizations (NGOs), and beliefs and values. The analysis revealed that behavioral drivers such as *government legitimization*, *top management support*, and *corporate social responsibility* have the strongest direct influence on the effectiveness of green supply chain practices, while factors such as *green culture*, *team building*, and *commitment to green adoption* are the most influenced outcomes within the behavioral dimension.

These findings emphasize that the behavioral dimension plays an instrumental role in achieving sustainable performance by bridging the gap between technical practices and organizational realities. The significant influence of government legitimization indicates that institutional mechanisms act as critical enablers of GSCM behavior, legitimizing sustainability initiatives within organizations (Zarei Sodani & Mohammadi Nafchi, 2024). This outcome aligns with prior studies highlighting the importance of governmental and institutional support in ensuring compliance, transparency, and environmental accountability across industries (Niromand et al., 2025; Sepasi & Bashir Khodaparasti, 2022). Specifically, regulatory enforcement and policy consistency create a supportive environment for firms to invest in behavioral training, employee empowerment, and CSR integration (El Mokadem & Khalaf, 2025). Moreover, public and institutional pressure encourages organizations to develop adaptive strategies that respond to evolving environmental standards (Mousa et al., 2024).

The study also found that top management support is a foundational behavioral driver that influences nearly all other factors. Leadership commitment ensures that environmental objectives are embedded within strategic decision-making and daily operations. This finding corroborates with the work of (Ramezani & Haji Aghajani, 2023), who emphasized that leadership engagement enhances employees' green motivation and operational collaboration. Similarly, (Mahmoudi Meymand et al., 2021) reported that managerial trust and relational governance promote long-term environmental and financial performance, suggesting that leadership behavior directly affects the organizational climate for sustainability. The results demonstrate that when top executives actively endorse and model green values, employees are more likely to adopt environmentally responsible behavior, participate in collaborative problem-solving, and support organizational transformation (Huma et al., 2023).

Corporate social responsibility (CSR) emerged as another highly influential factor, mediating the relationship between leadership behavior and environmental performance. CSR initiatives cultivate a culture of moral responsibility, organizational trust, and stakeholder engagement, which collectively strengthen the behavioral foundation of GSCM (Karimi Ghadousi et al., 2021). This result aligns with (Mousa et al., 2024), who highlighted that CSR, when integrated into supply chain policies, enhances environmental performance through adaptive green culture and competitive pressure. In this sense, CSR not only strengthens the ethical framework of environmental action but also enhances the firm's reputation and stakeholder loyalty, serving as a behavioral motivator for sustainable performance.

The study identified training and empowerment of members as a vital enabler of green behavior, reinforcing the role of human capital in implementing sustainability. Employees equipped with green skills, environmental awareness, and decision-making autonomy are more likely to innovate and participate in eco-friendly initiatives (Aghighi & Soleimani Ranjbar, 2021). This finding is consistent with (Hemmati Noedoust Gilani & Khosh Tinet, 2024), who found that supply chain performance improves when green human resource management (GHRM) practices are aligned with learning and organizational development. The results support the idea that empowerment promotes behavioral change by increasing competence, motivation, and accountability. Furthermore, (Niromand et al., 2025) noted that environmental orientation and organizational learning are critical for sustainable performance, suggesting that capacity-building through behavioral engagement strengthens both environmental and economic outcomes.

Another major finding concerns risk-taking as a behavioral determinant of green innovation and performance. Firms that encourage calculated risk-taking and experimentation tend to adopt new technologies, explore eco-design opportunities, and develop adaptive responses to environmental challenges. This result corresponds with (Mahar et al., 2025), who reported that green innovation and sustainability transformation require managerial openness to uncertainty and proactive risk management. Similarly, (Tahmasbi Roshan & Arab Kalmeri, 2024) demonstrated that knowledge and technology transfer influence green innovation through behavioral flexibility and willingness to adopt change. Therefore, the behavioral capability of taking environmental risks, supported by strong leadership and training, is essential for driving continuous improvement within GSCM.

Incentives and rewards were also identified as important motivators for promoting green behaviors across the organization. This result supports the argument of (Ajalli et al., 2021), who found that reward systems increase the effectiveness of green collaboration and sustainability performance. The provision of green incentives not only reinforces desirable behavior but also signals organizational commitment to sustainability goals. Moreover, reward systems help institutionalize green values, making them part of employees' intrinsic motivation and organizational identity.

The promotion of green culture and team building appeared as highly dependent factors that reflect the maturity of an organization's behavioral transformation. Cultural reinforcement, including the normalization of environmental values and shared beliefs, supports long-term behavioral consistency (Nureen et al., 2022). As shown in (Paluš et al., 2024), the integration of green culture across functional and managerial levels strengthens competitiveness and creates synergy among supply chain members. In this study, green culture was found to emerge from a combination of training, leadership support, and CSR-driven ethics, illustrating that behavioral change is cumulative and systemic. Similarly, teamwork enhances collective learning, trust, and cooperative innovation, ensuring that environmental goals are pursued through group collaboration rather than individual action (Maaz & Ahmad, 2022).

The commitment and adoption of the green chain were found to be key behavioral outcomes of the overall system, signifying the culmination of managerial and cultural efforts. When employees and managers internalize green values, sustainability transitions from a policy to a shared organizational mindset (El Mokadem & Khalaf, 2025). This commitment reflects the organization's readiness to institutionalize green operations as a permanent strategic orientation rather than a temporary initiative. Moreover, such behavioral adoption ensures continuity in sustainable performance even when external pressures fluctuate (Yazdani & Landran Esfahani, 2023).

The results also underscored the importance of knowledge growth and environmental learning as facilitators of behavioral improvement. The relationship between learning and performance is well-established in prior research, where knowledge dissemination enhances adaptability and innovation (Hemmati Noedoust Gilani & Khosh Tinet, 2024; Tahmasbi Roshan & Arab Kalmeri, 2024). By developing knowledge management systems focused on environmental learning, organizations can bridge the gap between behavioral intention and operational execution. This process leads to the integration of sustainability principles across all supply chain functions, from procurement to logistics and waste management.

External pressures, particularly from NGOs and institutional stakeholders, were found to indirectly drive internal behavioral alignment. These actors influence firms through social legitimacy mechanisms, pushing them to adopt transparent and accountable environmental practices (Zarei Sodani & Mohammadi Nafchi, 2024). This finding is consistent with (Niromand et al., 2025), who found that institutional pressures moderate the relationship between green innovation and sustainable performance. Additionally, (Mousa et al., 2024) highlighted the role of competitive and regulatory pressures in shaping adaptive green culture. Therefore, the findings of this study affirm that while behavioral GSCM factors are internal by nature, they are strongly influenced by external legitimacy structures and social expectations.

The structural analysis through MICMAC further clarified the system dynamics among behavioral factors. Government legitimization emerged as the most influential driver, reflecting the systemic nature of institutional guidance in shaping behavioral change. In contrast, green culture and green commitment were the most dependent variables, suggesting that behavioral transformation is the final stage of a gradual learning process. The interdependence among the twelve factors demonstrates that sustainable performance is not the product of isolated initiatives but rather a network of mutually reinforcing behavioral and institutional actions (El Mokadem & Khalaf, 2025; Paluš et al., 2024).

Comparing these findings with previous literature reveals a consistent pattern: behavioral integration is a decisive factor in the success of GSCM strategies. (Aghighi & Soleimani Ranjbar, 2021) demonstrated that the combination of technical and behavioral practices significantly improves environmental and economic performance. Likewise, (Niromand et al., 2025) and (Huang et al., 2024) confirmed that behavioral engagement through leadership and culture is essential for achieving the triple bottom line. In the Iranian industrial context, similar studies by (Ghayour Baghbani et al., 2024) and (Hemmati Noedoust Gilani & Khosh Tinet, 2024) reported that behavioral alignment in human resource management and organizational learning contributes significantly to green innovation and financial outcomes. These parallels reinforce the validity of this study's findings, highlighting behavioral GSCM as both a theoretical and practical mechanism for sustainability transformation.

Ultimately, the behavioral dimension of GSCM provides a comprehensive understanding of how organizations can achieve sustainable performance beyond compliance or technology adoption. The integration of training, empowerment, leadership, and CSR fosters a resilient organizational culture capable of adapting to environmental challenges while maintaining operational efficiency. This study thus extends the literature by offering a structured model that categorizes behavioral drivers based on their influence and dependency relationships, contributing both theoretically and empirically to the field of sustainable supply chain management.

Although this study offers valuable insights into the behavioral dimensions of GSCM, it is not without limitations. First, the study focused on a specific industrial context (tile and ceramic manufacturing), which may limit the generalizability of the findings to other sectors with different structural and cultural dynamics. Second, the use of expert judgment in the Delphi and ISM processes, while methodologically appropriate, introduces subjectivity that could influence the interpretation of factor relationships. Additionally, the study was cross-sectional, capturing behavioral relationships at a single point in time; thus, causal dynamics or longitudinal changes in behavioral patterns could not be fully examined. Finally, although the MICMAC analysis provided a robust understanding of influence and dependence among factors, the model does not account for non-linear feedback loops or contextual moderating variables such as digital transformation or geopolitical uncertainty.

Future studies could extend this research by applying the behavioral GSCM model across multiple industries and geographical regions to assess contextual variations. Longitudinal research designs could provide deeper insights into how behavioral changes evolve over time and how they interact with technological advancements in supply chain management. Researchers could also employ quantitative structural equation modeling (SEM) or agent-based simulation to validate the interrelationships identified through ISM and MICMAC. Moreover, integrating digital technologies—such as artificial intelligence, blockchain, and green analytics—could help explore how digital behavioral adaptation accelerates sustainability outcomes. Future studies should also consider exploring cross-cultural behavioral differences in GSCM implementation, especially in developing versus developed economies, to enrich global comparative understanding.

Organizations aiming to enhance sustainability performance should prioritize behavioral transformation alongside technical innovation. This involves implementing structured training programs that build environmental competence, fostering a culture of continuous learning, and embedding green values into corporate vision and leadership communication. Firms should also develop incentive systems that reward eco-innovation and collaborative problem-solving while ensuring transparent engagement with governmental and social institutions. Leadership commitment must remain central, with executives modeling environmental responsibility and aligning strategic decisions with CSR principles. By institutionalizing behavioral GSCM practices—such as empowerment, teamwork, and stakeholder trust—organizations can achieve lasting environmental and operational excellence.

Authors' Contributions

Authors contributed equally to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were considered.

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