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Driving Sustainable Supply Chains through Green Leadership, Culture, and Employee Engagement

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Abstract

Purpose: *This study aims at analyzing the drivers of sustainable supply chain management in organizations. It seeks to determine the functions of leadership, organizational practices as well as employee behaviors in facilitating sustainability results. The study enables a holistic view of the processes through which efficient and responsible supply chain operations are achieved through the analysis of these relations.* ***Design:*** *The study was conducted using Partial Least Squares-Structural Equation Modelling (PLS-SEM) and a well- researched survey questionnaire.* ***Findings:*** *The results indicate that Green Intrinsic Motivation, Green Knowledge Sharing, Green Work Engagement and Task-Related Pro-Environmental Behavior are key drivers of Sustainable Supply Chain Management. Such green behaviors are closely connected with green leadership, organizational culture, and green thinking, which make leadership and cultural support significant. The mediation analysis supports the fact that the organizational factors and sustainable supply chain practices depend on such key processes as motivation, knowledge sharing, and pro-environmental behavior. Nonetheless, the negative moderating impact of Green Work Engagement on Knowledge Sharing implies that complete engagement is not necessarily beneficial to knowledge sharing, which brings out the multidimensionality of employee engagement in sustainability activities. In general, although green behaviors are the core of sustainability, their performance relies on internal processes of engagement and organizational support.* ***Theoretical Contribution:*** *The theoretical contribution includes incorporating the notions of green transformational leadership, green thinking, and green organizational culture into a unified model along with the rest of the employee practices and engagement, which aids in the promotion of the literature on sustainable supply chain management.* ***Practical Implications:*** *The practical implications of the study mention the need of any organization to create green transformational leadership, encourage green thinking and evolve sustainability-focused culture, where managers and employees actively support the efforts to address the sustainability of supply chain management and long-term effectiveness of operations.*

Introduction

Sustainable supply chain management (SSCM) has become a critical priority for organizations seeking to balance economic performance with environmental responsibility (Nweje & Taiwo, 2025). With increasing global pressures from regulatory bodies, consumers, and stakeholders, organizations are expected to implement practices that minimize environmental impact, optimize resource use, and promote long-term ecological and operational efficiency (Nweje & Taiwo, 2025). Despite this growing recognition, many organizations continue to face significant challenges in translating sustainability strategies into effective practices. A primary concern is the misalignment between leadership approaches, organizational culture, and employee behaviors, which often limits the successful implementation of sustainable supply chain initiatives (Hong et al., 2022). Without the active engagement of employees and supportive leadership, even well-designed sustainability policies may fail to produce meaningful environmental outcomes.

Leadership is a critical factor in the determination of organizational sustainability where green transformational leadership (GTL) has become a major source of employee engagement, knowledge sharing, and environment-friendly actions (Batarfi et al., 2025). Likewise green thinking, the implementation of an environmentally minded attitude, can bring individual behaviors in line with organizational sustainability objectives, resulting in intrinsic motivation and task-specific pro-environmental behaviors (Faraz et al., 2021). The effectiveness of sustainability initiatives is also affected by organizational culture, where an organizational culture that emphasizes the importance of environmental responsibility motivates the employees to be actively always involved in green practices. Although studies have been conducted on them separately, there has been little focus on their interactions on SSCM, particularly the influence of leadership, culture, and cognition on employee behaviors and the overall sustainability of the supply chain (Hong et al., 2022; Susanto, 2023). Moreover, the moderating effect of employee engagement in the improvement of the effect of green behaviors has not been studied adequately.

To fill these gaps, the research creates a combined model that examines the relationship between green transformational leadership, green thinking, and green organizational culture and SSCM via green knowledge sharing, task-based pro-environmental behavior, and intrinsic motivation, and the moderating effect of green work engagement. Through these relationships, the study does not only offer a better insight into the behavioral and organizational processes that underline SSCM but also offers practical advice to managers and practitioners who wish to bring sustainability initiatives to life efficiently throughout the supply chain. Finally, the study will add value to the theoretical and practical fields by establishing the key drivers, mediators, and moderators that will assist organizations in overcoming obstacles to sustainable supply chain practices.

Theoretical Foundation:

The theory on Transformational Leadership and the Theory of Planned Behavior (TPB) contain useful insights on the impact of leadership, the personal attitudes of people, and the organizational culture on the sustainability of the supply chain management (SCM) (GaikLan et al., 2019). The Transformational Leadership Theory that was developed by Bass and Bass Bernard (1985) dwells upon the significance of the leader to influence and motivate the employees to overcome their own interests and work in the interests of the organization. The issue of green transformational leadership (GTL) is particularly applicable within the framework of sustainability, as leaders with a clear sustainability vision, an intellectual stimulator, and individual

support providers will create an environment where the employees are motivated to engage in pro-environmental practices and share green knowledge across the entire supply chain (Ramadan Shabib et al., 2025).

This perspective is supplemented by the TPB Ajzen (1991), which demonstrates the fact that attitudes mediate behavior, subjective norms and perceptions of behavioral control mediate intentions, are the strongest predictors of actual behavior. This study utilizes the TPB to explain whether the employees would take the actions that are environmentally responsible behaviors or not depends on the positive attitudes of the employees towards sustainability, perception of social expectation and belief in their capability to act in the green ways (Fawehinmi et al., 2024). The theoretical view is particularly practical in the delivery of such mechanisms of green thinking, green sharing of knowledge, task-related pro-environmental behavior, and green intrinsic motivation as a robust foundation of the research hypotheses.

Hypothesis Development:

Green Transformational Leadership, Green Knowledge Sharing, Pro-Environmental Behavior, Green Intrinsic Motivation, and Sustainable Supply Chain Management:

Green knowledge sharing, task-oriented pro-environmental behavior, and green intrinsic motivation in workers are promoted by green transformational leadership to the sustainability of the entire supply chain (Zhang et al., 2024). Transformational leaders promote sustainable practices by their employees and promote green initiatives among them, which leads to the elevated level of knowledge exchange and more environmentally friendly practices (Farrukh et al., 2022). A more sustainable supply chain is also linked to transformational leadership since employees will tend to become intrinsically motivated to meet sustainability objectives.

It has been found that green transformational leadership fosters an atmosphere in which employees can feel at liberty to participate in sustainability, exchange best practices, and embrace eco-friendly practices (Afsar et al., 2017). Leaders who underline sustainability not only inspire employees to engage in task-related pro-environmental behavior, such as waste reduction, resource optimization, and energy saving; but also promote intrinsic motivation, which makes employees more committed to sustainability over time (Gagné & Deci, 2005; Ryan & Deci, 2000).

H1: Green Transformational Leadership has a positive effect on green knowledge sharing within the supply chain.

H2: Green Transformational Leadership has a positive effect on task-related pro-environmental behavior within the supply chain.

H3: Green Transformational Leadership has a positive effect on green intrinsic motivation.

Green Thinking, Green Knowledge Sharing, Pro-Environmental Behavior, and Green Intrinsic Motivation:

Green thinking referring to the adoption of an ecologically aware attitude influences the green knowledge sharing, task-related pro-environmental behavior, and green intrinsic motivation (Miah et al., 2024). When internalized green thinking, employees have higher chances of sharing knowledge on sustainable practices, pro-environmental behavior, and developing intrinsic motivation towards achievement of sustainability objectives (Faraz et al., 2021). Green thinking aligns personal action with the goals of sustainability in the organizations, thereby promoting good results in supply chain management (Yang et al., 2018).

When employees start thinking green, they tend to exchange knowledge on sustainable practices within the organization, and it results in the enhancement of sustainability practices

within the supply chain (Moser, 2015). Besides, green thinking improves the loyalty of the employees to the environmentally friendly activities, as it motivates them to be involved in the energy-saving, waste-cutting, and greener sourcing activities (Paul et al., 2016). When people adopt such values, there is green intrinsic motivation that increases the general participation in the sustainability efforts, hence the environmental performance of the supply chain is reinforced.

H4: Green Thinking positively influences green knowledge sharing behavior within the supply chain.

H5: Green Thinking positively influences employee task-related pro-environmental behavior within the supply chain.

H6: Green Thinking positively influences green intrinsic motivation.

Green Organizational Culture, Green Knowledge Sharing, Green Intrinsic Motivation, and Sustainable Supply Chain Management:

Green organizational culture, in which sustainability is incorporated into organizational values and practices, has a significant influence on green knowledge sharing and green intrinsic motivation (Wang et al., 2022). A sustainable organizational culture will inspire employees to share green knowledge, and every employee will become more intrinsically motivated to participate in environmental-friendly behavior (Hayat et al., 2023). This culture does not only encourage collaboration but also aligns individual to the goals of sustainability objectives of the organization and encourages more effective supply chain management.

Employees will be encouraged to share green knowledge to sustainability when an organization has a green culture because they see sustainability as an organizational objective (Chang & Hung, 2021). Green intrinsic motivation is also improved by this cultural focus where employees will tend to engage in green behaviors and take initiative steps in green sustainability programs when they feel that these values are in tandem with those set by the organization (Meng et al., 2024). Positive green culture enhances the sustainability of the entire supply chain because the employees are likely to do actions that minimize environmental impact, save resources, and maximize operational efficiency (Roscoe et al., 2019).

H7: Green Organizational Culture positively impacts green knowledge sharing.

H8: Green Organizational Culture positively impacts employees' green intrinsic motivation to engage in sustainable supply chain practices.

H9: Green Organizational Culture positively impacts green intrinsic motivation.

Green Knowledge Sharing, Pro-Environmental Behavior, Green Intrinsic Motivation, and Sustainable Supply Chain Management:

The main drivers of sustainable supply chain management are green knowledge sharing, task-involved pro-environmental behavior, and green intrinsic motivation (Wei et al., 2025). The company will be capable of making its supply chain leaner by involving employees in knowledge sharing on green practices and pro-environmental behaviors (Li & Khan, 2023). Employees who are motivated internally tend to become more environmentally friendly and implement the same through the supply chain.

It is demonstrated that, with workers exchanging green knowledge and adopting pro-environmental behaviors, the supply chain can adopt more sustainable processes that lead to improved performance on environmental indicators, such as a reduced amount of waste, reduced energy consumption, and optimization of resources (Hsu et al., 2013). Also, green intrinsic drive establishes long-term sustainability commitment, and these actions are permanently built in the

supply chain, which results in improvements in the environmental performance and efficiency (Ryan & Deci, 2000).

H10: Green Knowledge Sharing positively affects sustainable supply chain management.
H11: Task-related pro-environmental behavior positively affects sustainable supply chain management.
H12: Green intrinsic motivation positively affects sustainable supply chain management.

Green Transformational Leadership, Green Thinking, Green Organizational Culture, and Sustainable Supply Chain Management:

The combined effect of the green transformational leadership, green thinking, and green organizational culture on sustainable supply chain management is significant (Ryan & Deci, 2000). All these factors have specific yet complementary contributions to the sustainability of the supply chain. Green transformational leadership encourages employees to participate in green behaviors, and green thinking and green organizational culture encourage a situation in which sustainability is a component of organizational ethos (Li & Khan, 2023). These issues combined create a more sustainable, efficient, and environmentally responsible supply chain.

Sustainable supply chain management will succeed in the long-term through leaders, employees, and organizations that practice sustainability because of their culture (Bass, 1999; Moser, 2015). The overall impact of these aspects is organizational commitment towards sustainability and that sustainable practices are being carried out throughout all levels of the supply chain, which helps in achieving better environmental outcomes and enhanced supply chain efficiency.

H13: Green Transformational Leadership has a positive effect on sustainable supply chain management.
H14: Green Thinking has a positive effect on sustainable supply chain management.
H15: Green Organizational Culture has a positive effect on sustainable supply chain management.

Mediating Role of Green Knowledge Sharing, Pro-Environmental Behavior, and Green Intrinsic Motivation:

Green knowledge sharing, task-related pro-environmental behavior, and green intrinsic motivation intercede in the positive relationship between green transformational leadership, green thinking, and green organizational culture and sustainable supply chain management (Mousa & Thaher, 2025). The mediation factors are the channels through which leadership, culture, and mindset have a role in the supply chain sustainable practices. Pro-environmental behavior, knowledge sharing, and intrinsic motivation enable employees to practice activities that enable better sustainability performance, which increases the overall performance of the supply chain (Li & Li, 2025).

This mediating effect plays a key role in ensuring sustainability efforts at the supply chain level because it serves to guarantee that the green efforts advocated by the leadership and entrenched in the corporate culture are in fact put into practice by the employees at the ground level. These intermediaries are used to convert the core strategic objectives into specific actions and behaviors that are beneficial to the sustainability of the supply chain (Afsar et al., 2017).

H16: The positive effects of green transformational leadership, green thinking, and green organizational culture on sustainable supply chain management are mediated by green knowledge sharing, task-related pro-environmental behavior, and green intrinsic motivation.

The Moderating Role of Green Work Engagement in Sustainable Supply Chain Management:

Green work engagement is an important moderator in the correlation between green knowledge sharing, task-focused pro-environmental behavior, green intrinsic motivation and sustainable supply chain management (Elkhweildi et al., 2025). Engaged employees will be more willing to engage in the green initiatives actively, exchange their knowledge, be more pro-environmental and highly have intrinsic motivation towards sustainability (Saleem et al., 2019). The moderating position of green work engagement makes sure that the positive implications of knowledge sharing, pro-environment behavior and intrinsic motivation on the sustainability of supply chains are heightened, and the sustainability practices become more effective and constant throughout the supply chain.

It is researched that employee engagement does not only improve the performance of employees, but also, they put in surplus effort to sustainability programs which enhances performance of the supply chains in the long run (Bakker & Demerouti, 2008). This increased involvement towards green initiatives makes them long term and sustainable practices that make the overall management of the supply chain to be greatly improved (Schaufeli et al., 2002).

H17: Green work engagement moderates the relationship between green knowledge sharing and sustainable supply chain management.

H18: Green work engagement moderates the relationship between task-related pro-environmental behavior and sustainable supply chain management.

H19: Green work engagement moderates the relationship between green intrinsic motivation and sustainable supply chain management.

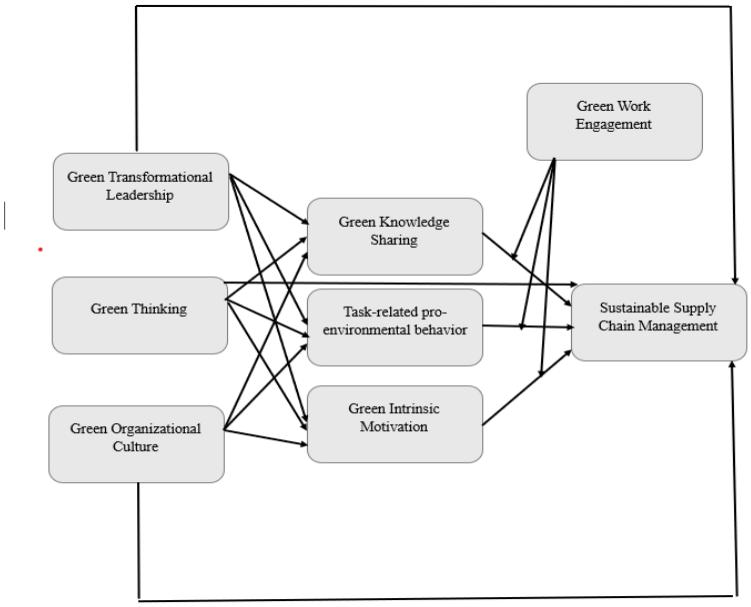

Figure 1: Theoretical Framework

Methodology

Design and Data Collection:

The sample population used in this study included supply chain managers, executives, suppliers, and vendors, involved actively in sustainable practices in supply chain operations. To obtain primary data, a self-administered questionnaire was designed based on validated scales in earlier studies. The questionnaire was created on a five-point Likert scale according to the strategy proposed by (Hox & Boeije, 2005). To be sure that the participants possessed pertinent experience and knowledge about sustainability and supply chain management, a purposive sampling method was employed. Out of 700 questionnaires mailed, 550 responses were received giving a response rate of about 78.57. Following the elimination of un-responded questionnaires, 499 empirical questionnaires were analyzed and 51 were discarded with missing values. To make statistically strong inferences, statistical analysis was performed using a two-tailed test with a level of significance of 5% (a = 0.05).

Measures:

Every construct in this research was measured by well-established and reliable measures, which guaranteed high validity and reliability throughout the survey. The perceptions of respondents were captured on a 5-point Likert scale. Green Transformational Leadership was evaluated with five revised items based on (Chen & Chang, 2013). Green Thinking was assessed with five tailored (Al-Ghazali et al., 2022) items. Three items based on Wang (2019) were used to capture Green Organizational Culture. Lin and Chen (2017) used four items to measure Green Knowledge Sharing. Three items based on the original scale Griskevicius et al. (2010) were used to measure task-related pro-environmental behavior. There were two modified items used to assess Green Intrinsic Motivation (Gilal et al., 2019). The Green Work Engagement was assessed with four (Aboramadan, 2022) items. Lastly, Sustainable Supply Chain Management was measured with three items borrowed off (Roh et al., 2022). The accuracy and consistency of data presented in the analysis were guaranteed by these predetermined scales.

Empirical Findings:

PLS-SEM is known to be a highly effective analytical method because it can evaluate a variety of relationships at a time (Ali et al., 2018). It provides more flexibility when testing complex models, according to Ringle (2005), and it is especially beneficial when data has a small sample, or non-normal distributions (Hair et al., 2016). This research followed the recommendations of (Henseler et al., 2012), where two-stage analysis with SmartPLS was conducted to test the hypotheses suggested. Confirmatory factor analysis was conducted during the first stage to determine the convergent and discriminant validity of the measurement model. The second phase entailed path analysis, mediation, and moderation tests, to test the structural model. Such a strict process guaranteed an in-depth analysis of the associations between all the study variables.

Measurement Model Assessment:

Measurement model has high reliability and validity with all constructs. Each factor loading is more than the acceptable level of 0.70, which means strong indicator reliability. The alpha of Cronbach and composite reliability of all the constructs is above 0.70, which is an indication of high internal consistency. The AVE values fall within the range of 0.62 to 0.83, which is above the recommended minimum of 0.50, thus creating high convergent validity. The

interaction terms (GIMGWE, GKSGWE, TPB*GWE) exhibit high values more than 1.0 which is normal in PLS-SEM moderation with product indicators and does not mean that there is a problem. In general, the measurement model satisfies all the criteria of reliability and validity, and you can safely move on to structural model analysis.

Table 1: Convergent Validity

	Items	Factor Loadings	Alpha	CR	AVE
Green Transformational Leadership	GTL1	0.826	0.848	0.849	0.623
	GTL2	0.785			
	GTL3	0.781			
	GTL4	0.756			
	GTL5	0.796			
Green Thinking	GT1	0.772	0.863	0.869	0.647
	GT2	0.843			
	GT3	0.862			
	GT4	0.797			
	GT5	0.743			
Green Organizational Culture	GOC1	0.910	0.866	0.867	0.788
	GOC2	0.878			
	GOC3	0.875			
Green Knowledge Sharing	GKS1	0.863	0.869	0.873	0.718
	GKS2	0.851			
	GKS3	0.872			
	GKS4	0.801			
Task-related pro-environmental behavior	TPB1	0.885	0.837	0.840	0.754
	TPB2	0.885			
	TPB3	0.834			
Green Intrinsic Motivation	GIM1	0.924	0.805	0.811	0.836
	GIM2	0.905			
Green Work Engagement	GWE1	0.845	0.876	0.876	0.729
	GWE2	0.864			
	GWE3	0.879			
	GWE4	0.826			
Sustainable Supply Chain Management	SSCM1	0.830	0.778	0.780	0.693
	SSCM2	0.858			
	SSCM3	0.808			
	GIM * GWE	1.247	1.000	1.000	1.000
	GKS * GWE	1.187	1.000	1.000	1.000
	TPB * GWE	1.077	1.000	1.000	1.000

The findings on the discriminant validity show that the constructs are mostly clearly distinguished. As indicated in the Fornell Larker criterion, the square roots of AVE (diagonal values) are all greater than the correlations between them and the other constructs, which is to confirm that each variable has greater common ground with its own indicators than with other constructs. This facilitates a sufficient discriminant validity. All the construct pairs also fall below the conservative threshold of 0.85 (as well as below the liberal threshold of 0.90), which points to the fact that multicollinearity or conceptual overlap is not an issue. The interaction terms (e.g., GKS*GWE*SSCM, TPB*GWE*SSCM) would act as required with artificially perfect loadings and extremely high correlations, which is typical of PLS-SEM moderation models and has no impact on the validity of reflective constructs. Overall, both Fornell Larcker and HTMT criteria testify to the fact that the model has a high level of discriminant validity, i.e. the constructs can be empirically differentiated.

Table 2: Discriminant Validity (Fornell-Larcker Criterion)

	GIM	GKS	GKS>GWE>SSCM	GM>GWE>SSCM	GOC	GT	GTL	GWE	SSCM	TPB	TPB>GWE>SSCM
GIM	0.914										
GKS	0.674	0.847									
GKS>GWE>SSCM	-0.270	-0.187	1.000								
GM>GWE>SSCM	-0.398	-0.257	0.844	1.000							
GOC	0.600	0.584	-0.255	-0.323	0.888						
GT	0.775	0.678	-0.294	-0.363	0.714	0.805					
GTL	0.721	0.658	-0.301	-0.356	0.685	0.840	0.789				
GWE	0.723	0.608	-0.268	-0.376	0.663	0.783	0.862	0.854			
SSCM	0.702	0.639	-0.329	-0.364	0.725	0.746	0.717	0.726	0.832		
TPB	0.605	0.675	-0.149	-0.194	0.649	0.652	0.646	0.677	0.653	0.869	
TPB>GWE>SSCM	-0.225	-0.165	0.860	0.765	-0.204	-0.222	-0.246	-0.220	-0.259	-0.115	1.000

Table 3: Discriminant Validity (HTMT Ratio)

	GIM	GKS	GKS>GWE>SSCM	GM>GWE>SSCM	GOC	GT	GTL	GWE	SSCM	TPB	TPB>GWE>SSCM
GIM											
GKS	0.804										
GKS>GWE>SSCM	0.300	0.197									
GM>GWE>SSCM	0.443	0.273	0.844								
GOC	0.717	0.673	0.274	0.346							
GT	0.926	0.781	0.318	0.393	0.824						
GTL	0.870	0.764	0.327	0.386	0.799	0.983					
GWE	0.858	0.696	0.287	0.402	0.761	0.901	1.000				
SSCM	0.882	0.773	0.371	0.411	0.883	0.905	0.880	0.879			
TPB	0.736	0.793	0.163	0.213	0.762	0.764	0.766	0.791	0.808		
TPB>GWE>SSCM	0.250	0.173	0.860	0.765	0.218	0.240	0.267	0.235	0.292	0.124	

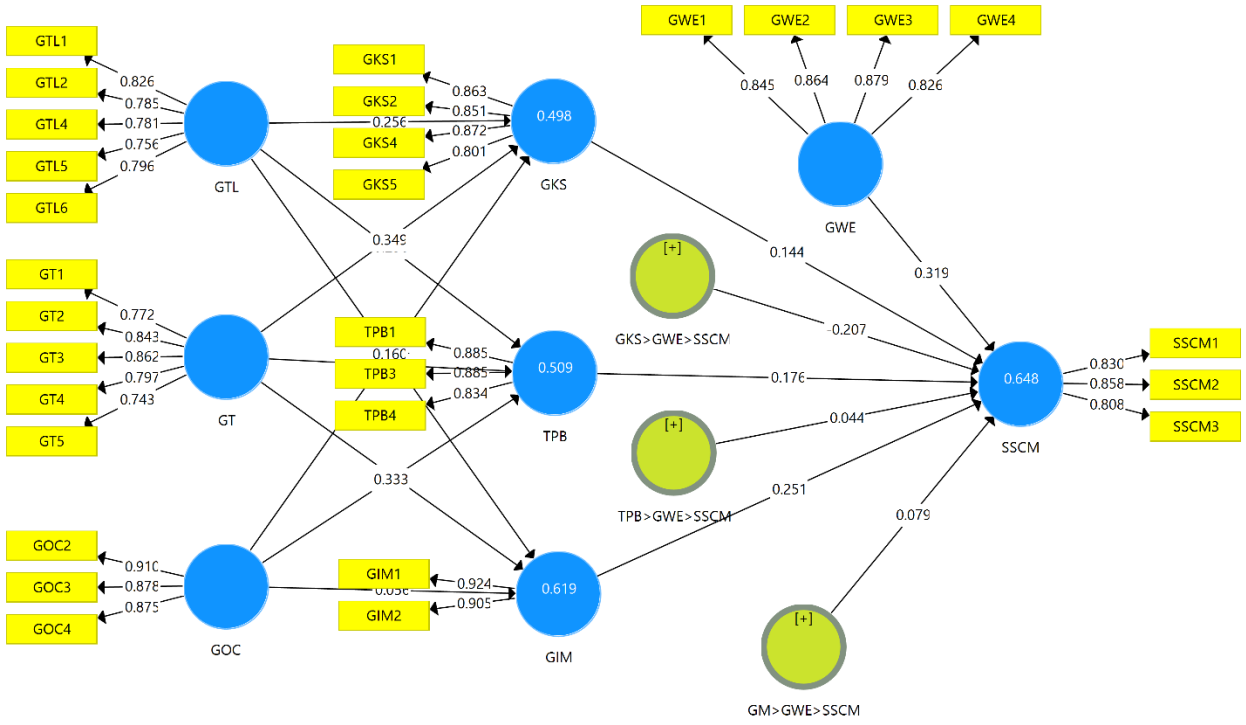

Figure 2: Measurement Model Assessment

Structural Model Assessment:

The assessment of the structural model shows that the proposed relationships in the model are largely supported. R square values indicate that the endogenous constructs have a lot of explanatory value, and SSCM (Sustainable Supply Chain Management) has a 0.648, GIM is 0.619, GKS is 0.498 and TPB is 0.509, indicating that the model accounts for a substantial percentage of the variance in the endogenous constructs. Direct effects indicate that GIM (= 0.251, p = 0.001), GKS (= 0.144, p = 0.001), GWE (= 0.319, p = 0.001), and TPB (= 0.176, p = 0.001) have significant and positive effect on SSCM, and the interaction term GKS>GWE.SSCM is significant and negative (= -0.207, p = 0.001 Other predictors like GOC, GT and GTL play significant roles in GIM, GKS and TPB and this proves the strong position of organization and technological forces. The presence of indirect effects implies meaningful mediation, of which GIM, GKS, and TPB mediate the relationship between GOC, GT, GTL, and SSCM, and all of which have significant effects ($p < 0.05$). Most paths have small to medium size effects, with the most significant ones being GT → GIM (F 2 = 0.204) and GWE → SSCM (F 2 = 0.108). Overall, the structural model proves high predictive relevance and high path relations, proving that the whole set of practices described by green innovation, governance, technology, and leadership practices can lead to the success of sustainable supply chain management.

Table 4: Path Analysis (Direct Effects)

	Beta	STDEV	F square	T Statistics	P Values	Min	Max
GIM -> SSCM	0.251	0.053	0.066	4.715	0.000	0.149	0.321
GKS -> SSCM	0.144	0.041	0.025	3.472	0.000	0.079	0.219

GKS>GWE>SSCM -> SSCM	-0.207	0.049	0.030	4.266	0.000	-0.298	-0.139
GM>GWE>SSCM -> SSCM	0.079	0.048	0.007	1.661	0.049	-0.011	0.136
GOC -> GIM	0.056	0.039	0.004	2.000	0.046	-0.004	0.122
GOC -> GKS	0.160	0.041	0.024	3.868	0.000	0.089	0.225
GOC -> TPB	0.333	0.052	0.105	6.439	0.000	0.239	0.409
GT -> GIM	0.549	0.059	0.204	9.224	0.000	0.466	0.670
GT -> GKS	0.349	0.066	0.063	5.301	0.000	0.236	0.452
GT -> TPB	0.215	0.062	0.024	3.491	0.000	0.112	0.305
GTL -> GIM	0.222	0.065	0.036	3.411	0.000	0.117	0.326
GTL -> GKS	0.256	0.067	0.036	3.843	0.000	0.137	0.365
GTL -> TPB	0.236	0.059	0.032	4.023	0.000	0.139	0.323
GWE -> SSCM	0.319	0.050	0.108	6.442	0.000	0.241	0.401
TPB -> SSCM	0.176	0.048	0.037	3.677	0.000	0.111	0.264
TPB>GWE>SSCM -> SSCM	0.044	0.057	0.002	2.000	0.045	-0.047	0.138

Table 5: R Square

	R Square
GIM	0.619
GKS	0.498
SSCM	0.648
TPB	0.509

Table 6: Path Analysis (Indirect Effects)

	Beta	**STDEV**	**T Statistics**	**P Values**	**Min**	**Max**
GOC -> GIM -> SSCM	0.014	0.010	2.01	0.045	-0.001	0.034
GT -> GIM -> SSCM	0.138	0.036	3.875	0.000	0.092	0.207
GTL -> GIM -> SSCM	0.056	0.019	2.992	0.002	0.025	0.085
GOC -> GKS -> SSCM	0.023	0.010	2.214	0.014	0.009	0.045
GT -> GKS -> SSCM	0.050	0.018	2.707	0.004	0.025	0.084
GTL -> GKS -> SSCM	0.037	0.013	2.782	0.003	0.019	0.059
GOC -> TPB -> SSCM	0.059	0.020	2.878	0.002	0.029	0.098
GT -> TPB -> SSCM	0.038	0.015	2.584	0.005	0.016	0.067
GTL -> TPB -> SSCM	0.042	0.015	2.699	0.004	0.020	0.070

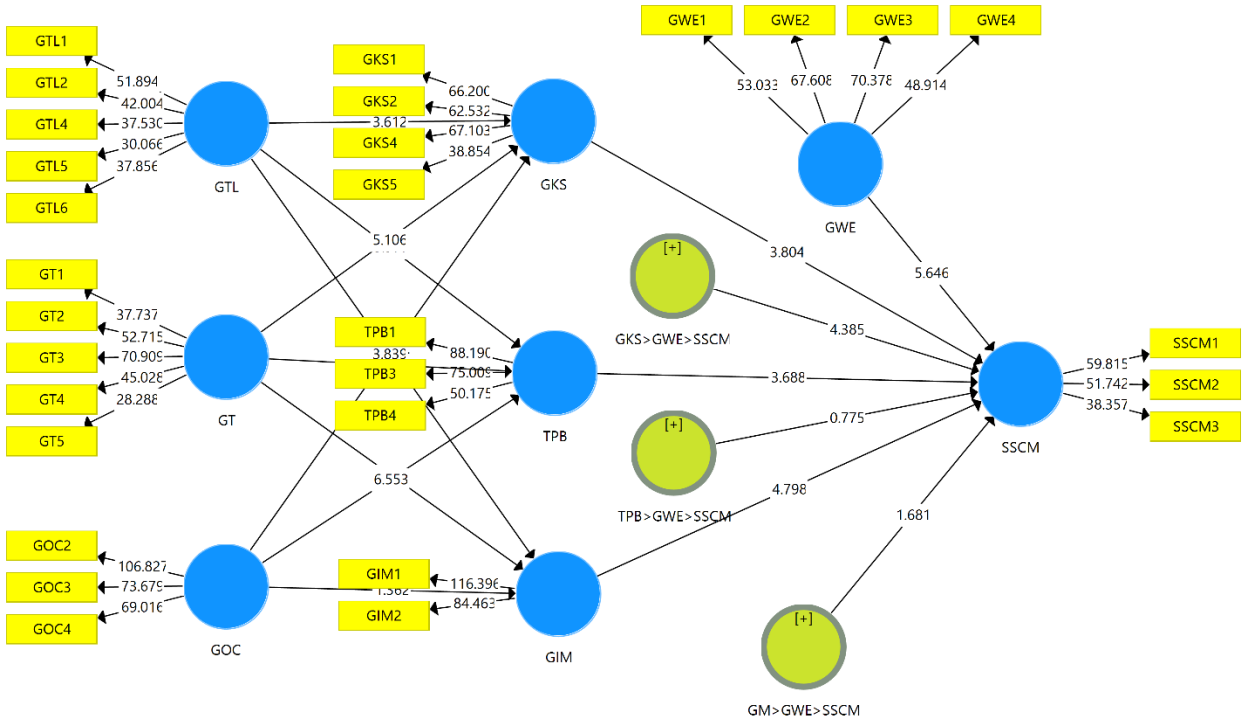

Figure 3: Structural Model Assessment

Discussion and Implications

The results of this research yield valuable details on the effects of green transformational leadership, green thinking and green organizational culture in driving sustainable supply chain management (SSCM) through mediating roles of green knowledge sharing, task related pro-environmental behavior and green intrinsic motivation, and moderating impact of green work engagement. The findings validate that green transformational leadership has a positive influence on employee behaviors and intrinsic motivations, which underscores the capacity of leaders to enhance employee's participation in sustainability efforts. This is consistent with the Transformational Leadership Theory that states that leaders can inspire employees to transcend individual interests and practice actions that are in the best interest of the organization (Pandey et al., 2016). When employees are led by transformational leaders, they are more likely to share environmental knowledge, practice environmentally friendly activities and internalize green values, all of which make supply chain more sustainable (Farrukh et al., 2022).

In a similar way, green thinking is indicated to facilitate knowledge sharing, pro-environmental behavior, and intrinsic motivation (Li & Li, 2025). This confirms the Theory of Planned Behavior, which states that the attitudes of employees, their perceptions of social expectations, and their self-perceived capabilities to undertake green behavior have a substantial impact on the participation of employees in sustainable practices (Xie et al., 2024). By instilling green mindsets, the employees will be more inclined to embrace and propagate environmental-friendly behaviors that enhance the sustainability of the entire supply chain (Hayyat, 2024). Green organizational culture turns out to be one of the most important factors as well, as it emphasizes that incorporating the concept of sustainability in organizational values and practices helps to make the staff more willing to share knowledge and engage in pro-environmental behaviors. This shows

that organizational culture is important in mediating between individual-level behaviors to collective sustainability outcomes.

The intermediary effect of green knowledge sharing, pro-environmental behavior and intrinsic motivation explains that even though leadership, culture and green thinking are the pillars of sustainability, actual behaviors of the employees directly influence SSCM. Strategic green policies are not the only way through which organizations can achieve successful sustainability; when employees participate in green practices, then effective sustainability is attained (Lee & Ball, 2003). Moreover, it is observed that the moderating effect of green work engagement shows that engaged workers enhance the positive association between knowledge sharing, pro-environmental behavior, and intrinsic motivation on SSCM. Highly committed and involved employees serve as change agents in that sustainability efforts are realized and sustained in the long run (Sackmann et al., 2009).

Overall, the work highlights that in the quest to have sustainable supply chain management there is a need to have a blend of visionary leadership, enabling organizational culture, environmentally aware mindsets, motivated employees, and proactive involvement of employees in green practices. Focusing on organizational issues and individual actions, organizations can develop a profitable and environmentally conscious supply chain that will not only achieve the operational goals but also help to reach long-term sustainability targets.

Theoretical Contribution:

This study can be considered a significant addition to the body of literature in sustainable supply chain management by the way it extends the Transformational Leadership Theory to environmental sustainability. It demonstrates that green transformational leadership is motivational among employees, as well as stimulates green knowledge sharing, task-based pro-environmental behavior, and intrinsic motivation that will facilitate sustainable supply chains practices (Zada et al., 2024). This contributes towards the body of the existing research in that it shows the direct influence of leadership on the actions of individuals and the performances of organizations towards the realization of sustainability. The study also favors and extends the Theory of Planned Behavior (TPB) in an organization. The analysis demonstrates that the role of cognitive processes in transforming leadership, culture, and green thinking into the reality of the sustainability impacts is vital. The empirical evidence of the mediating role of these practices brings to the fore the current situation that the organizational strategies cannot be effective unless they are complemented with employee-level engagement in green practices.

Finally, the research contributes to literature through its integration of leadership, green thinking, organizational culture, employee behaviors and engagement into one holistic approach. The fact that green work engagement is also a moderating factor contributes to the knowledge base as it demonstrates that engagement enhances the efficiency of employee practices in the management of sustainable supply chains. This holistic model assists in bridging the gap between strategic, cultural, and behavioral perspectives, which offers a good theoretical foundation on what may be carried on in future research concerning the mechanisms which determine sustainability in the supply chain.

Practical Implications:

The results of this research have several practical implications to the managers and practitioners who seek to improve sustainable supply chain management. To start with, organizations need to consider building green transformational leadership capacities in the leaders. Leaders who convey a visible sustainability vision, intellectually stimulate, and offer personalized

encouragement will be able to encourage employees to engage in environmentally responsible behaviors, knowledge sharing, and intrinsic motivation in sustainability (Faqera & Manaf, 2024). Green practice-based leadership development programs can therefore produce a workforce who will be actively involved in ensuring sustainability of the supply chain.

Second, it is important to develop the green organizational culture. Pro-environmental behaviors and effective knowledge sharing can be encouraged through implementing sustainability into organizational values, policies, and reward systems, which in turn encourages employees to take part in pro-environmental behaviors (Odhiambo et al., 2023). Awareness campaigns and training which would foster green thinking can also help to match the attitude of employees towards sustainability, engaging them and making them more committed to the practice of environmental friendliness in the long run. Companies must focus on cultural policies that enable involving a shared accountability towards environmental results.

Lastly, organizations must consider employee engagement, especially green work engagement since it enhances the effectiveness of knowledge share, intrinsic motivation and pro-environmental behaviors on sustainable supply chain results (Cantor et al., 2012). Participative decision-making, independence in the sustainability initiatives and appreciation of green contribution are the strategies that can promote the engagement and ensure that the sustainability initiatives are implemented and sustained over time (Hawkins & Wang, 2012). Using both leadership and employee level behaviors, organizations can operationalize sustainability which translates the strategy to workable improvements which may include resource optimization, reduction in waste, and an environmentally friendly form of operation.

Limitations and Future Research:

Although this study has useful insights, there are several limitations that must be noted. To begin with, the study is based on cross-sectional data based on self-administered questionnaires, so it is not possible to make causal conclusions. Subsequent research may employ longitudinal or experimental research designs that will be more effective in the dynamic relationship between leadership, employee behaviors, and sustainable supply chain management (SSCM).

Second, the research is specifically on supply chain professionals in particular organizational settings, and it may not be generalizable to other industries, regions as well as cultural settings. Future studies may consider various industries, geographical locations or different organizations sizes to confirm and generalize the proposed model to other settings.

Third, even though this study used major constructs like green transformational leadership, green thinking, organizational culture, employee behaviors, and engagement, it did not consider other possible influencing factors on SSCM, including technological innovation, regulatory pressures, or the cooperation of stakeholders. The future studies can be done to investigate further the organizational, environmental, and technological variables to offer a more detailed picture of the determinants of sustainable supply chain practices. Also, future research can examine moderators and mediators that may further elaborate on sustainability adoption among supply chains.

Conclusion:

This article shows that the concepts of green transformational leadership, green thinking, and green organizational culture have a strong impact on sustainable supply chain management (SSCM), and the behaviors of employees (green knowledge sharing, task-related pro-environmental behavior, intrinsic motivation, etc.) play the important role of mediators. Also, green work engagement enhances the effect of such behaviors and the need to actively engage

employees in sustainability initiatives is of significance. The results made both theoretical and practical contributions of having combined leadership, culture, cognition, and engagement into a single framework, demonstrating that the attainment of SSCM is not only possible by having strategic policies, but also motivated, knowledge, and engaged employees. Among practitioners, the development of green leadership, the culture of sustainability, and employee engagement may support the transformation of organizational sustainability goals into realistic environmental results, improving supply chain performance and sustainability.

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