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The Role of Green Absorptive Capacity and Green Innovation Capability in Mediating the Impact of Green Supply Chain Management on the Sustainability Performance of SMEs

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Abstract:

The purpose of this study is to develop an empirical model to assess the role of small and medium-sized manufacturing enterprises resource consumption capabilities through green absorptive capacity and green innovation capability in building a significant relationship between green supply chain management practices, and sustainability performance. The model was developed after a rigorous review of existing literature and it was tested based on the data obtained from 384 managers and entrepreneurs from manufacturing small and medium firms operating in Karachi, the largest city in Pakistan. The data is analyzed using Structural Equation Modeling to validate the proposed research hypotheses. The findings confirmed that green supply chain management practice directly relates to sustainability performance and positively impacts green absorptive capacity and green innovation. Moreover, the results revealed that green absorptive capacity and green innovation capability not only positively impacts sustainability performance but mediates the ties among green supply chain management practices, and sustainability performance. Green absorptive capacity and green innovation capability in the context of manufacturing corporations as resource capability is a novel approach described in this study. Lastly, the results of the study advise industry practitioners that leveraging through practicing natural resource capabilities such as total quality management and green innovation capability can help to achieve high environmental, social goals and excellence with better economic performance.

Introduction

In recent times the focus of Small and Medium Enterprises (SMEs) towards sustainability has intensified and proactive attempts are made to uplift the standards for sustainability. The incorporation of green absorptive capacity (GAC), green innovation capabilities (GIC), green supply chain management (GSCM) have appeared instrumental for improving sustainability performance within SMEs. This study is an attempt to explore the linkages and relationships between the variables to better understand how GSCM practices influence sustainability performance while keeping in view the mediating roles of green innovation capability and green absorptive capacity. Green Supply Chain Management (GSCM) attempts to include the effects of environmental considerations into operations of supply chain, including logistics, end-of-life management, procurement, and manufacturing. The concept has gained significant attention globally due to rising concerns about climate change, resource depletion, and sustainability.

From theoretical lens, the concept of GSCM is built upon resource-based view and institutional theories. Resource-based theory posits that the adoption of green practices can help the firm better environmental sustainability (Barney, 1991) whereas the institutional theory postulates how regulatory frameworks, external pressures, expectations of society and market demands force firms to implement GSCM practices (DiMaggio & Powell, 1983).

From a managerial perspective, GSCM is comprised of practices such as eco-design, green purchasing, reverse logistics, and compliance with environmental standards (Srivastava, 2007). However, SMEs face unique challenges, including limited technical expertise, resource constraints, and lack of policy support (Kusi-Sarpong et al., 2016). Despite these hinderances, SMEs holds true potential to create sustainable supply chain due to their potential for innovation and flexibility to incorporate change (Rao & Holt, 2005).

Globally, the GSCM practices have been adopted by the industries to comply with stringent environmental regulations. For example, European Union's Waste Electrical and Electronic Equipment (WEEE) directive and their compliance is a must for SMEs (Chiarini & Vagnoni, 2017). Similarly, in China, the adoption of GSCM has been linked with financial incentives offered by the government resulting in improved financial performance of the firm (Zhu & Sarkis, 2004).

In Pakistan, the contribution of SMEs in the economy is extremely significant with over 90% of the firms hold the status of SMEs (SMEDA, 2023). However, the adoption of GSCM practices by SMEs does not contribute significantly because of numerous issues including inadequate infrastructure, lack of awareness, and limited financial capabilities (Ahmed et al., 2022). To be served as the evidence for the shallow adoption of GSCM practices, studies have shown that the adoption of GSCM is in nascent stage with firm's intention of compliance rather than innovation (Ali & Kanwal, 2021).

Literature Review

Green Supply Chain Management Practice:

GSCM practices are comprised of various strategies aiming to reduce adverse environmental impact, including eco-design, green procurement, waste reduction, and green logistics (Seuring & Müller, 2008). The implementation of these strategies minimizes the worst environmental impact by reducing waste generation, emissions and resource consumption of SMEs, thus contributing to sustainability (Sarkis et al., 2011).

For instance, green logistics can enhance the capabilities of supply chain processes to reduce carbon emissions while green procurement helps SMEs to use eco-friendly materials (Zhu et al., 2008). Moreover, GSCM practices not only improve efficiency but also enhance the operational performance while reducing the cost (Jabbour et al., 2013). Also, these practices align with the growing pressure from regulatory bodies, consumers, and stakeholders for SMEs to adopt sustainable practices, thus improving their long-term sustainability performance.

Green Absorptive Capacity:

Green Absorptive Capacity (GAC) refers to a firm's ability to acquire, assimilate, transform, and exploit external environmental knowledge to enhance its green performance (Zahra & George, 2002). The GAC helps the SMEs to overcome challenges associated with improvement in environmental performance and sustainability while optimizing the internal resources for environmental innovation. For example, GAC lays strong emphasis on acquisition: SMEs acquire external environmental knowledge through collaboration with suppliers, customers, and industry experts (Abbas & Saeed, 2022), transformation: The acquired knowledge is adapted to the firm's specific operational context (Chen et al., 2014) and exploitation: SMEs leverage this knowledge to implement green innovations and improve performance (Sarkis et al., 2010).

There are hindrances for SMEs to develop GAC, including inadequate employee training for eco-friendly technologies, insufficient access to the body of knowledge, rigidity towards embracing change due to motives such as short-term profits (Ahmed et al., 2022). Research has shown that GAC is instrumental for SMEs to adopt green practices. For instance, firms having high affinity for GAC hold better potential for innovation, waste reduction and comply with global environmental standards, such as ISO 14001 (Chen et al., 2014). One such study showed that the SMEs in Pakistan practicing GAC at higher levels have achieved better financial and environmental performance compared to those with little or no capacity (Ali & Kanwal, 2021).

Green Innovation Capability

The conceptual description of green innovation capability (GIC) is described as firm's ability to develop and implement innovative solutions that minimize environmental impact while simultaneously creating economic value (Akhtar et al., 2024). The ever-increasing stakeholder pressure to improve environmental performance and sustainability has led many firms, specifically small and medium-sized enterprises (SMEs), to include eco-innovation into their processes. Green innovation is not limited to technological advancements but also encompasses processes and product innovations that contribute to environmental sustainability. Also, GIC incorporates the

adoption of knowledge, strategies and resources to innovate for the achievement of sustainability objectives (Kemp & Pearson, 2007). SMEs face constraints and limitations due to insufficient financial resources or infrastructure, but they still hold true potential of innovation given their innate agility and flexibility (Hojnik & Ruzzier, 2016).

The green innovation capability does not only serve to enhance sustainability but also helps the SMEs to gain competitiveness. In this context, the green innovation capability can act as an important component for SMEs to respond to increasing pressures for enhancing sustainability by regulatory and market forces. Empirical studies have shown that SMEs with higher green innovation capabilities are more likely to develop environmentally friendly products and processes, thereby improving their environmental performance (López-Gamero, et al., 2011). For example, SMEs in the manufacturing sector, such as those in the automotive industry, can adopt green product designs, energy-efficient production methods, or closed-loop supply chains that contribute to reducing waste and carbon emissions (Tariq, et al., 2019).

Sustainability Performance

Sustainability performance encompasses environmental, social, and economic dimensions, aimed at ensuring long-term viability and growth. The sustainability practices can serve the SMEs to gain dual benefits i.e. it helps SMEs to fulfil compliance requirements, and it helps them to gain superior competitive advantage. Specifically, environmental sustainability involves adoption of renewable energies, minimizing waste generation, and reducing carbon footprints. Universally, SMEs have adopted practices such as life-cycle assessments, eco-labeling, and green certifications to gain a strong position in market (Chiarini & Vagnoni, 2017). However, in developing countries like Pakistan, SMEs often struggle to integrate these practices due to cost and resource constraints (Ahmed et al., 2022). Moreover, social sustainability lays emphasis on fair labor practices, ethical sourcing, and community engagement. This can help SMEs to gain advantages from superior brand reputation and customer loyalty (Rao & Holt, 2005). Economic sustainability involves ensuring profitability while maintaining environmental and social standards. Studies indicate that SMEs implementing sustainability practices often achieve higher operational efficiency and cost savings (Zhu & Sarkis, 2004).

Green Supply Chain Management (GSCM) and Green Absorptive Capacity of SMEs

The Green absorptive capacity is related to the firm's capability to recognize the worth of information related to the betterment of environment and to make use of this information to enhance environmental performance (Cohen & Levinthal, 1990). In this regard, GSCM practices can play a critical role for SMEs to take advantage of information related to environment and resources to enable environmental sustainability into the processes. It has been established that, firms engaged in GSCM are more likely to accumulate green knowledge through collaboration with suppliers, adoption of eco-friendly technologies, and involvement in sustainable practices (Rasli et al., 2012). Furthermore, SMEs' commitment to environmental sustainability through GSCM allows them to acquire new capabilities, which enhance their green absorptive capacity. Research by Figueiredo (2010) suggests that firms with strong green absorptive capacity are better equipped to integrate environmental innovations, thus leading to better sustainability performance.

Green Supply Chain Management (GSCM) and Green Innovation Capability of SMEs

GSCM practices such as eco-design, green procurement and green logistics can set up the basis for innovation while improving the knowledge and management of resources for the firm. This is reflected in the ability of the firm to develop eco friendly products, services and processes also known as green innovation (Chen, 2008). Specifically, the GSCM practices facilitate innovation in SMEs for packaging, product design, and processes for production which are the critical dimensions to create environmental sustainability (Dangelico & Pujari, 2010). According to Tseng et al. (2013), SMEs engaged in GSCM practices are more likely to invest in green innovations, such as the development of low-carbon technologies, energy-efficient products, and waste-reducing processes. Moreover, GSCM emphasizes building collaboration with suppliers that can help the SMEs to co-create green innovation thereby enhancing the innovation capability further to a higher level (Vachon & Klassen, 2008).

Green Absorptive Capacity and Sustainability Performance of SMEs

The ability of the SMEs to understand and take advantage of the environmental knowledge to make strategies for the improvement of their sustainability performance is termed as green absorptive capacity. Such initiatives can help the SMEs to reduce waste, optimize their processes, and minimize their environmental footprint. According to Tang et al. (2015), firms with high green absorptive capacity are better equipped to integrate sustainable practices, leading to improved environmental performance. Furthermore, firms can achieve better economic stability by reducing cost through resource optimization and use of energy efficient technologies while practicing higher level of green absorptive capacity utilization (Zhang et al., 2013). Socially, these firms can enhance their reputation by responding to increasing consumer and regulatory demands for sustainable practices. Therefore, green absorptive capacity holds three dimensional benefits for SMEs in terms of better environmental, social and economic performances.

Green Innovation Capability and Sustainability Performance of SMEs

The efforts of the SMEs to make and offer environmentally friendly processes, products and services is directly linked with their capability for green innovation. Whereas sustainability performance refers to a firm's ability to meet its present needs without compromising the ability of future generations to meet their own needs. It encompasses three dimensions: environmental performance, social performance, and economic performance (Elkington, 1997). Green innovations, such as eco-friendly products, energy-efficient processes, and waste reduction technologies, significantly contribute to environmental sustainability by minimizing the negative impact of business operations on the environment (Pujari, 2006). Moreover, green innovations can enhance economic sustainability by improving operational efficiency, reducing costs, and opening new market opportunities (Hojnik & Ruzzier, 2016). In addition to environmental and economic benefits, green innovation can also improve social sustainability by addressing consumer demands for sustainable products and aligning with corporate social responsibility (CSR) initiatives (Testa et al., 2016). Therefore, the capacity to innovate in green technologies plays a critical role in enhancing the overall sustainability performance of SMEs. There is a strong and direct connection between these concepts because green innovation, product innovations, for instance, is an attempt

to create environmentally friendly products that improves the environmental footprint while increasing the revenue through higher customer demand for sustainable goods (Vachon & Klassen, 2008). Similarly, process innovations can reduce the operational expenditure through the deployment of energy efficient processes for production that can enhance the firm's economic stability (Hojnik & Ruzzier, 2016). Therefore, green innovation capability serves as a pivotal factor in enhancing overall sustainability performance, particularly for SMEs that may have limited resources but possess significant potential for creativity and innovation.

Mediating Role of Green Absorptive Capacity

Green absorptive capacity mediates the relationship between GSCM practices and sustainability performance by enabling firms to effectively absorb and apply environmental knowledge derived from GSCM practices. SMEs that engage in GSCM practices are more likely to develop strong green absorptive capacity, which enhances their ability to implement sustainability strategies effectively (Zhang et al., 2012). According to Cohen and Levinthal (1990), firms with better absorptive capacity can better utilize external knowledge to enhance innovation and improve their performance. In this context, green absorptive capacity allows SMEs to leverage GSCM practices to achieve improved sustainability outcomes.

Mediating Role of Green Innovation Capability

Green innovation capability acts as a mediator between GSCM practices and sustainability performance by enabling firms to convert their green supply chain efforts into tangible environmental, social, and economic benefits. GSCM practices provide SMEs with the necessary knowledge and resources to develop innovative green products and processes (Zhao et al., 2013). These innovations, in turn, enhance sustainability performance by reducing environmental impacts and increasing cost efficiency. The mediating effect of green innovation capability is particularly relevant for SMEs seeking to differentiate themselves in competitive markets through sustainable innovations (Chen et al., 2014). GSCM practices enhance green absorptive capacity, which in turn strengthens green innovation capability, ultimately leading to improvements in sustainability performance. This sequential mediation highlights the complex processes through which GSCM practices influence sustainability outcomes in SMEs. Empirical studies have shown that both green absorptive capacity and green innovation capability play crucial roles in driving sustainability performance (Feng et al., 2018).

The literature suggests that GSCM practices, green absorptive capacity, and green innovation capability are all crucial factors in improving the sustainability performance of SMEs. GSCM provides the foundation for both green absorptive capacity and green innovation capability, which mediate the relationship between GSCM and sustainability performance. Understanding these relationships can help SMEs leverage GSCM practices to enhance their sustainability outcomes, creating a competitive advantage in an increasingly environmentally conscious market. Green supply chain management, green absorptive capacity, and sustainability practices are interconnected elements critical for SMEs' long-term success. While SMEs in Pakistan face unique challenges, targeted interventions such as capacity-building programs, financial incentives, and collaborative networks can significantly enhance their adoption of sustainable practices. Future

research should focus on sector-specific strategies to address these challenges and promote green growth.

Green Supply Chain Management (GSCM) practices aim to integrate environmental considerations into the entire supply chain, from raw material sourcing to product disposal. The relationship between GSCM practices and sustainability performance is well-documented in the literature, with green innovations serving as a bridge between these two factors. Green innovation capability has been identified as a mediator that enhances the effectiveness of GSCM practices in improving environmental, social, and economic performance (Wagner, 2012). Firms that adopt green supply chain practices, such as eco-friendly sourcing, waste reduction, and energy-efficient logistics, can further enhance their outcomes through innovations that reduce their environmental impact and increase resource efficiency.

In the context of SMEs, green innovation can act as a mediator in the GSCM-sustainability performance relationship by helping firms overcome resource constraints and technological gaps (Hojnik & Ruzzier, 2016). For example, SMEs can develop green products that satisfy both customer demands and regulatory requirements, leading to improved market performance. This, in turn, improves their sustainability performance, contributing to long-term environmental and economic benefits (Chen, et al., 2014).

Hypotheses Development

Direct Effects

H1: Green supply chain management (GSCM) practices positively influence sustainability performance of SMEs.

H2: Green supply chain management (GSCM) practices positively influence green absorptive capacity of SMEs.

H3: Green supply chain management (GSCM) practices positively influence green innovation capability of SMEs.

H4: Green absorptive capacity positively influences sustainability performance of SMEs.

H5: Green innovation capability positively influences sustainability performance of SMEs.

Indirect Effects (Mediating Roles)

H6: Green absorptive capacity mediates the relationship between green supply chain management (GSCM) practices and sustainability performance of SMEs.

H7: Green innovation capability mediates the relationship between green supply chain management (GSCM) practices and sustainability performance of SMEs.

H8: Green absorptive capacity and green innovation capability sequentially mediate the relationship between green supply chain management (GSCM) practices and sustainability performance of SMEs.

Research Methodology

Research Design

This study employed a quantitative research approach to examine the relationship between Green Supply Chain Management (GSCM) and Sustainability Performance (SP), with Green Absorptive Capacity (GAC) and Green Innovation Capability (GIC) acting as mediators. A deductive approach was adopted, as the study built upon existing theories and literature to formulate and test hypotheses. A cross-sectional research design was used, collecting data at a single point in time from SMEs to analyze the proposed relationships.

Population and Sampling

The target population consisted of small and medium-sized enterprises (SMEs) operating in Pakistan that had adopted green supply chain practices. SMEs were selected due to their significant role in economic development and their growing focus on sustainability. A stratified random sampling technique was employed to ensure diverse representation across different sectors, including manufacturing, automotive, textiles, and food processing. The sampling frame was obtained from business directories, industry associations, and environmental regulatory bodies. The sample size was determined based on Cohen's (1992) power analysis, ensuring adequate statistical power for hypothesis testing. A final sample of 384 SMEs was selected, following recommendations from structural equation modeling (SEM) studies, which suggest a minimum of 10 responses per parameter estimate (Hair et al., 2019).

Data Collection Method

Primary data were collected using a structured survey questionnaire distributed to senior managers, supply chain managers, and sustainability officers in SMEs. The questionnaire was shared through email, online surveys, and in-person visits to maximize the response rate. Before the full-scale distribution, a pilot study with 30 respondents was conducted to ensure clarity and reliability of the survey items. Based on the feedback, minor modifications were made to improve comprehension.

Measurement Scales and Instrument Development

The study employed well-established scales from previous literature to measure the variables:

Green Supply Chain Management (GSCM): Measured using a scale adapted from Zhu et al. (2013), covering green purchasing, eco-design, and reverse logistics. Green Absorptive Capacity (GAC): Measured using items from Chen et al. (2009), assessing the ability to acquire, assimilate, and apply green knowledge. Green Innovation Capability (GIC): Measured using scales from Xie et al. (2019), focusing on green product innovation and green process innovation. Sustainability Performance (SP): Measured using a scale from Seuring & Müller (2008), which included environmental, economic, and social performance indicators. A five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) was used for all measurement items.

Data Analysis Techniques

Analysis and Discussion

This section presents the results of the statistical analyses conducted using SmartPLS 4 for structural equation modeling (SEM) and SPSS 28 for descriptive statistics and reliability tests. The findings are discussed in relation to previous literature, highlighting the impact of Green Supply Chain Management (GSCM) on Sustainability Performance (SP) and the mediating roles of Green Absorptive Capacity (GAC) and Green Innovation Capability (GIC) in the context of Pakistani SMEs.

Descriptive Statistics and Reliability Analysis

The dataset was first analyzed using SPSS 28 to compute descriptive statistics (mean, standard deviation, skewness, and kurtosis) and assess reliability.

Demographic Analysis

The sample consisted of 384 SMEs from various industries, including manufacturing (45%), textiles (25%), automotive (15%), and food processing (15%). The majority of the firms had been operating for more than 10 years (60%), while the remaining were between 5–10 years old (30%) or less than 5 years old (10%).

Reliability and Validity Assessment

Table 1 shows Cronbach's Alpha and Composite Reliability (CR) were used to assess internal consistency. All constructs had Cronbach's Alpha values above 0.7, indicating acceptable reliability. Additionally, Average Variance Extracted (AVE) values were above 0.5, confirming convergent validity. Discriminant validity was assessed using Fornell-Larcker Criterion, confirming that all constructs were distinct from one another.

Table 1. Measurement Results on Items Loadings, AVE and Composite Reliability

Construct	Cronbach's Alpha	Average Variance Extracted (AVE)	Composite Reliability (CR)
Sustainability Performance (SP)	0.88	0.866	0.70
Green Absorptive Capacity (GAC)	0.84	0.63	0.89

Green Innovation Capability (GIC)	0.86	0.66	0.90
Green Supply Chain Management (GSCM)	0.87	0.68	0.91

Structural Model Assessment (SmartPLS 4)

Collinearity Assessment

Before testing hypotheses, variance inflation factor (VIF) values were computed to assess multicollinearity. All VIF values were below 3.0, confirming the absence of multicollinearity.

Path Coefficients and Hypothesis Testing

The hypotheses were tested using PLS-SEM bootstrapping (5000 resamples) to examine the significance of direct and indirect effects. Table 2 shows the results below,

Table 2. Structural Model: Test of Significance for Direct Relationships

Hypothesis		Path Coefficient (β)	t-value	p-value	Decision
H1	GSCM -> SP	0.41	7.85	0.000	Supported
H2	GSCM-> GAC	0.53	9.21	0.000	Supported
H3	GSCM -> GIC	0.49	8.45	0.000	Supported
H4	GAC -> SP	0.38	6.67	0.000	Supported
H5	GIC -> SP	0.35	5.92	0.000	Supported
H6	GSCM-> GAC->SP	0.20	5.44	0.000	Supported
H7	GSCM->GIC-SP	0.17	4.92	0.000	Supported
H8	GSCM->GAC|GIC->SP	0.18	5.06	0.000	Supported

Direct Effects Analysis

The analysis showed that GSCM practices positively influence sustainability performance of SMEs, GSCM practices positively influence green absorptive capacity of SMEs, GSCM practices positively influence green innovation capability of SMEs. Also, the analysis confirmed that green absorptive capacity positively influences sustainability performance of SMEs and green innovation capability positively influences sustainability performance of SMEs.

Mediation Analysis

To test the mediating roles of Green Absorptive Capacity (GAC) and Green Innovation Capability (GIC), the indirect effects were analyzed using bootstrapping confidence intervals (95%). GAC significantly mediated the relationship between GSCM and SP ($\beta = 0.20$, $p = 0.000$), confirming that SMEs with strong GAC leveraged GSCM practices more effectively to achieve sustainability.

GIC also significantly mediated the relationship between GSCM and SP ($\beta = 0.17$, $p = 0.000$), demonstrating that SMEs with higher innovation capabilities improved their sustainability performance through green practices.

Green Absorptive Capacity as a Mediator

The study confirmed that Green Absorptive Capacity plays a crucial role in helping SMEs adopt and internalize environmentally friendly supply chain practices, leading to improved sustainability performance. This aligns with prior research (Ibrahim, Mahmood, & Som, 2024), which emphasized the role of absorptive capacity in enabling firms to assimilate and apply green knowledge effectively. The significant mediation effect suggests that SMEs with higher absorptive capacity not only implement green supply chain practices but also integrate external sustainability knowledge, enhancing their overall performance.

Green Innovation Capability as a Mediator

The results also highlighted that Green Innovation Capability serves as a critical link between GSCM and sustainability. This supports studies by Xie et al. (2019), which found that firms with stronger innovation capabilities tend to develop more eco-friendly products and processes, leading to long-term environmental and economic benefits. In the context of Pakistani SMEs, limited financial resources often hinder innovation, yet the findings suggest that companies investing in green innovation see substantial sustainability improvements.

Theoretical and Managerial Implications

The findings provide empirical support for the positive impact of GSCM on Sustainability Performance, aligning with previous studies (Zhu et al., 2013; Seuring & Müller, 2008). The results further reveal that both GAC and GIC act as significant mediators, amplifying the impact of GSCM on SP. The study contributes to existing literature by integrating absorptive capacity and innovation capability as mediating variables, offering a comprehensive perspective on how GSCM enhances sustainability performance. From a managerial perspective, SMEs should invest in knowledge acquisition and absorptive capacity to maximize the benefits of green supply chain practices. Develop innovation capabilities to create competitive advantages in sustainability. Leverage

external collaborations with government bodies, universities, and international firms to enhance green learning and technological advancement.

Conclusion

The study conclusively demonstrates that Green Supply Chain Management (GSCM) plays a pivotal role in enhancing Sustainability Performance (SP) among Small and Medium Enterprises (SMEs) in Pakistan. This relationship is not only direct but also significantly mediated by two critical factors: Green Absorptive Capacity (GAC) and Green Innovation Capability (GIC). GAC, which refers to the ability of firms to identify, assimilate, and apply external green knowledge, and GIC, which pertains to the capacity to develop and implement innovative green practices, were found to be essential mechanisms through which GSCM influences SP. These findings highlight the interconnectedness of external knowledge acquisition, internal innovation processes, and sustainable outcomes, emphasizing that SMEs must prioritize both absorptive capacity and innovation-oriented strategies to achieve long-term sustainability goals.

The results of this study carry important implications for both theory and practice. From a theoretical perspective, they contribute to the growing body of literature on GSCM by elucidating the mediating roles of GAC and GIC, thereby providing a more nuanced understanding of how GSCM translates into improved sustainability performance. For practitioners, particularly SME managers and policymakers, the findings underscore the need to invest in building organizational capabilities that support the absorption of green knowledge and foster innovation. This could involve training employees, fostering collaborations with external stakeholders, and creating an organizational culture that encourages continuous learning and innovation.

Moreover, the study opens avenues for future research to further explore and refine these relationships. For instance, investigating the moderating effects of external factors such as government policies, firm size, or industry-specific regulations could provide deeper insights into how contextual variables influence the effectiveness of GSCM practices. Additionally, future studies could examine the role of leadership, organizational culture, or technological advancements in shaping the relationship between GSCM, GAC, GIC, and SP. Cross-cultural comparisons could also be valuable to determine whether these findings hold true in different geographical or economic contexts. By addressing these gaps, researchers can contribute to the development of more comprehensive frameworks that support the adoption and implementation of sustainable practices across diverse organizational settings.

In conclusion, this study not only validates the significance of GSCM in driving sustainability performance among SMEs in Pakistan but also highlights the critical mediating roles of GAC and GIC. It calls for a strategic focus on building absorptive capacity and fostering innovation as key enablers of long-term sustainability. As the global business environment continues to prioritize environmental responsibility, these insights offer valuable guidance for SMEs seeking to align their operations with sustainable development goals while maintaining competitiveness in an increasingly eco-conscious market.

References

Akhtar, S., Li, C., Sohu, J. M., Rasool, Y., Hassan, M. I. U., & Bilal, M. (2024). Unlocking green innovation and environmental performance: the mediated moderation of green absorptive capacity and green innovation climate. Environmental Science and Pollution Research, 31(3), 4547-4562.

Ahmed, S., Jabeen, R., & Khalid, M. (2022). Barriers to green supply chain management practices in SMEs: Evidence from Pakistan. Journal of Cleaner Production, 332, 129988.

Ali, M., & Kanwal, N. (2021). Role of green absorptive capacity in enhancing sustainability performance in Pakistani SMEs. Sustainability, 13(9), 4987.

Barney, J. (1991). Firm resources and sustained competitive advantage. Journal of Management, 17(1), 99-120.

Chen, Y. S., Lin, Y. H., & Chang, C. H. (2014). Enhancing green absorptive capacity, green dynamic capabilities, and green service innovation to improve sustainable competitive advantage. Journal of Business Ethics, 120(4), 585-594.

Chiarini, A., & Vagnoni, E. (2017). Small and medium enterprises and sustainability: Managers' beliefs. Business Strategy and the Environment, 26(4), 350-360.

Chen, Y. S. (2008). The driver of green innovation and green image – Green core competence. Journal of Business Ethics, 81(3), 531-543.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. Administrative Science Quarterly, 35(1), 128-152.

Cohen, J. (1992). Statistical power analysis for the behavioral sciences. Routledge.

Dangelico, R. M., & Pujari, D. (2010). The relationship between green supply chain management and environmental innovation. Journal of Business Ethics, 95(3), 389-402.

DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. American Sociological Review, 48(2), 147-160.

Feng, M., Lee, C. C., & Chen, Y. S. (2018). The effect of green absorptive capacity on green innovation and performance: A case study of the Chinese manufacturing industry. Journal of Cleaner Production, 199, 156-164.

Figueiredo, P. N. (2010). Organizational absorptive capacity: A review of the literature. Innovation: Management, Policy & Practice, 12(3), 269-289.

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2019). A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). Sage Publications.

Hojnik, J., & Ruzzier, M. (2016). The adoption of green innovations: The case of SMEs in Slovenia. Business Strategy and the Environment, 25(5), 228-243.

Ibrahim, M., Mahmood, R., & Som, A. P. M. (2024). Green absorptive capacity and sustainability performance: A study on SMEs. Journal of Supply Chain and Innovation Research, 12(1), 45-67.

Jabbour, C. J. C., et al. (2013). Green supply chain management in emerging economies. Business Strategy and the Environment, 22(8), 435-449.

Kusi-Sarpong, S., Gupta, H., & Sarkis, J. (2016). Green supply chain practices and performance: A resource-based view perspective. International Journal of Production Economics, 181, 121-132.

Pujari, D. (2006). Eco-innovation and new product development: An analysis of the influence of environmental innovation on product innovation. Business Strategy and the Environment, 15(6), 409-421.

Rasli, A. M., et al. (2012). Green supply chain management: A literature review and future research directions. International Journal of Advanced Science and Technology, 50, 83-94.

Rao, P., & Holt, D. (2005). Do green supply chains lead to competitiveness and economic performance? International Journal of Operations & Production Management, 25(9), 898-916.

Sarkis, J., et al. (2011). Green supply chain management: A structured literature review. International Journal of Production Economics, 130(1), 1-15.

Seuring, S., & Müller, M. (2008). From a literature review to a conceptual framework for sustainable supply chain management. Journal of Cleaner Production, 16(15), 1699-1710.

Testa, F., et al. (2016). The drivers of green supply chain management practices: The case of Italian firms. Journal of Environmental Management, 182, 72-81.

Tseng, M. L., et al. (2013). Sustainable supply chain management: A literature review and future research directions. International Journal of Environmental Research and Public Health, 10(8), 3823-3844.

Xie, X., Huo, B., Qi, G., & Zhu, K. (2019). Green innovation and firm performance. International Journal of Production Economics, 211, 71-82.

Vachon, S., & Klassen, R. D. (2008). Environmental management and manufacturing performance: The role of collaboration in the supply chain. International Journal of Production Economics, 111(2), 299-315.

Zhang, Y., et al. (2013). The role of green innovation in the relationship between green supply chain management practices and sustainability performance. Journal of Cleaner Production, 40, 271-280.

Zhao, X., et al. (2013). The influence of green supply chain management on firm performance: A contingency and institutional theory perspective. Journal of Business Ethics, 114(3), 377-388.

Zhu, Q., et al. (2008). Green supply chain management in China: Pressures, practices, and performance. International Journal of Operations & Production Management, 28(5), 421-438.