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Leveraging Green Supply Chains in Developing Countries: An Analysis of Barriers for Somalia's Manufacturing Firms

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Abstract. This study investigated the challenges faced by manufacturing firms in Mogadishu, Somalia when implementing green supply chain management (GSCM) practices. A survey was conducted of 73 employees from manufacturing companies. Results showed reducing internal and external barriers positively influenced GSCM implementation. External barriers like government regulations had a stronger negative correlation. The findings emphasize the importance of addressing these barriers through interventions like training, supplier engagement, and technology adoption. This research makes key theoretical contributions by examining GSCM barriers in a developing country context. It also provides practical insights into promoting sustainable practices in the manufacturing sector in Somalia. Further research on the specific mechanisms through which internal and external barriers affect green supply chain implementation is recommended.

Keywords: green supply chain management, manufacturing companies, internal barriers, external barriers, sustainable practices.

1. Introduction

In the aftermath of the Industrial Revolution and post-World War II developments in developed nations, the global community is faced with significant environmental issues. In response, legislation has been put in place and emerging economies have implemented their own measures to prevent environmental degradation. Organizations now have a responsibility to not only comply with environmental regulations but also adopt strategies aimed at mitigating the environmental impact of their products as well as services they offer (Zhu, Sarkis, & Lai, 2008; Wisner et al., 2012).

To limit pollution, industrialized nations such as the European Union have taken steps to restrict the presence of hazardous materials. For example, the European Union introduced the RoHS (Restrictions on the Use of Hazardous Substances) directives on July 1, 2006. These guidelines enable the approval of certain substances, including mercury, lead, hexavalent chromium, cadmium, polybrominated biphenyls (PBBs), and polybrominated diphenyl ethers, for use in electrical and electronic equipment (Zhu, Sarkis, & Lai, 2008).

The unrestrained exploitation of natural resources and the release of pollutants by human activities, particularly in the manufacturing sector, have significantly altered the natural environment (Zhu, Sarkis, & Lai, 2008). Business activities, including carbon monoxide emissions, improper disposal of harmful chemicals and packaging materials, other forms of industrial pollution, and traffic congestion pose a significant threat to the environment (Wisner et al., 2012).

Environmental concerns and the inclusion of green practices in supply chain management have become increasingly important topics in academic discussions in recent years (AbebawWorku et al., 2019). Organizations expanding their supply chain networks globally to improve competitive advantage have significantly increased the demand for natural resources. However, this demand must be balanced with the limited supply of resources on Earth to achieve sustainable development (Neramballi et al., 2017).

As the global manufacturing landscape undergoes rapid changes, corporate management is recognizing the growing importance of addressing environmental and social issues. Green supply chain management (GSCM) serves as a means to improve the efficiency of processes and products. GSCM, based on environmental regulations, encompasses all stages of a product's life cycle (Borade & Bansod, 2007). Embracing eco-friendly principles within supply chain management strategies through GSCM is driven by increased customer awareness and demand for green practices (Gilbert, 2000; Luthra et al., 2011). Thus, enterprises must give attention to the efficient use of resources and energy to create supply chains that adhere to environmentally friendly practices. (Luthra et al., 2011).

The growing interest in environmental and climate issues, along with Initiatives undertaken by cooperates and governments to reduce the environmental impact, highlights the importance of balancing economic, social, and environmental performance for industrialized firms (Ayuso, Roca, & Colomé, 2013). There is now increased pressure from various stakeholders for companies to adopt environmentally friendly practices.The need to enhance economic feasibility and cope with challenges posed by developing countries and manufacturing industries has led to the exploration and adoption of green value chain practices (AbebawWorku et al., 2019). However, organizations encounter internal and external challenges in the execution of GSCM (Ojo et al., 2014).

Given the growing significance of environmental concerns in the industrial sector, it is crucial to address the challenges faced by manufacturing firms. Finding solutions to the obstacles hindering the effective adoption of green practice is essential for creating an environmentally compatible supply chain (Aslinda et al., 2012). The IMF (2019) report highlights how the enduring conflict in Somalia over the past thirty years has impeded the country's advancement. However, despite this setback, the manufacturing sector has demonstrated remarkable expansion and persistence, becoming an essential driver of the national economy. As per Mohamed, Isak, and Roble (2019), the manufacturing sector in Somalia is currently in a phase of growth and development. While there are studies investigating the

benefits of environmental management in industries, the research on barriers to adopting green practices is currently inadequate. In Somalia, the manufacturing sector plays a significant role in economic growth. However, companies in Mogadishu face substantial environmental challenges that necessitate the adoption of green practices in supply chain management. Hence, this study aims to identify the challenges faced by manufacturing companies in Mogadishu, Somalia when implementing GSCM. Scientific data on the barriers of the adoption of green manufacturing in Somalia are presented in the findings of this study. These findings are of practical use to practitioners and academicians alike, as they shed light on how to mitigate such barriers in a context where limited research has been conducted on the topic. The paper is structured as follows: the first section describes the background of the study, the second section reviews the related literature, the third section presents the research methods, the fourth section presents the results and discussion, and the final section provides the conclusion and recommendations.

2. Literature Review

Green Supply Chain Management (Gscm)

Incorporating environmental criteria into corporate purchase behavior and establishing long-term partnerships with suppliers were common traditional supply chain management practices. This approach, known as Green Supply Chain Management (GSCM), aims to minimize the environmental impact of an organization's supply network by conserving energy, containing waste within the industrial system, and preventing the release of hazardous materials (Gilbert, 2000; Torres et al., 2004).

Within the scope of GSCM, a multitude of tasks are involved, spanning green manufacturing, eco-friendly packaging, sustainable distribution, environmentally responsible procurement, and eco-conscious marketing. The ultimate aim is to mitigate waste by reducing energy consumption, minimizing emissions, eliminating hazardous chemicals, and managing solid waste effectively (Olugu et al., 2010). Scholars have proposed different concepts and methods to address the challenges associated with GSCM. In one study, the Interpretive Research Structural Modeling (ISM) approach was employed to identify barriers that may create additional obstacles and barriers that are primarily controlled by driving factors (Ravi & Shankar, 2005). Another research investigation delved into the electrical and electronic sectors of Taiwan, known for their specialization in manufacturing hardware and conducting initial design and production processes. Statistical tools and a structural model were utilized to examine GSCM practices in this industry (Chien & Shih, 2007).

In pursuit of advancing the environmental sustainability of procedures and products, in accordance with environmental requirements, a proactive GSCM approach was recommended by Luthra et al. (2011). The integration of environmental factors into supply chain management practices has emerged as an essential aspect for organizations aiming to minimize their environmental footprint and enhance sustainability efforts (Gilbert, 2000; Torres et al., 2004; Olugu et al., 2010; Ravi & Shankar, 2005; Chien & Shih, 2007; Yu Lin & Hui Ho, 2008; Luthra et al., 2011).

Internal Barriers

Obstacles in adopting GSCM can be categorized as relating to "people," "resources," and "strategy implementation" (Walker and Jones, 2012; Tay et al., 2015). If GSCM objectives are not aligned with other Supply Chain Management (SCM) goals, such as cost reduction (Walker and Jones, 2012), corporations are less likely to prioritize GSCM without executive support (Walker and Jones, 2012; Wu, Ding and Chen, 2012; Tay et al., 2015).

The implementation of GSCM requires significant human and financial resources, which may pose challenges, particularly for smaller businesses. To address resource constraints, investments in information and technology systems, supportive corporate structures, and environmental expertise for managers are recommended (Stremlau & Tao, 2016). Additionally, technical factors, such as a lack of understanding of integrating purchasing and traditional accounting practices, can hinder commitment

to GSCM (Stremlau & Tao, 2016).

2.1.1. Organizational encouragement

Organizational encouragement is crucial for integrating green practices, and this can be accomplished by making informal connections and employing efficient communication methods (Yu Lin & Hui Ho, 2008). To successfully implement GSCM, training and education are recognized as fundamental requirements (Ravi & Shankar, 2005). Incentives and support provided by employers can motivate employees to explore environmental issues and seek solutions to environmental challenges (Hsu & Hu, 2008). A research article by Pagell et al. (2007) highlighted that internal resistance to change was a significant barrier to the implementation of sustainable supply chain. This resistance can be attributed to employee attitudes, lack of awareness, and fear of disruption to existing operations.

2.1.2. Cost implications

Cost implications present a significant barrier to GSCM adoption, as green practices often require a substantial initial investment (AlKhidir & Zailani, 2009). Green design, green production, and green packaging labeling, among other practices, contribute to higher costs. The expenses associated with environmental management can be categorized as direct and transaction costs, which pose a significant challenge for GSCM implementation (AlKhidir & Zailani, 2009; Stremlau & Tao, 2016).

2.1.3. Top management commitment

A study by Kannan and Tan (2005) found that a lack of support from senior management was identified as a significant internal barrier to implementing green practices of supply chain in manufacturing industries. This lack of support hinders the allocation of resources and the establishment of green initiatives within the organization. For any strategic program, including GSCM, the success greatly relies on the crucial involvement of top management, as highlighted by Hamel and Prahalad (1989) and Zhu and Sarkis (2007).

Organizational support and the influence of senior management in implementing green initiatives throughout the corporation are crucial for effective GSCM (Sarkis, 2009). Ongoing support from top management is necessary to implement strategic goals and action plans related to GSCM (Ravi & Shankar, 2005). However, high employee turnover poses a challenge to GSCM integration in the Indian automobile industry, as it impacts the continuity of top management commitment (Stremlau & Tao, 2016).

External Barriers

External constraints on implementing GSCM practices can arise from a variety of factors. Some factors that contribute to this situation are the increasing consumer demand for more affordable products, the intense competition in the market, and a lack of active involvement from suppliers (Caniato et al., 2011; Stremlau & Tao, 2016). However, some critics argue that GSCM operations are merely a response to government regulations and incentives, or a way for companies to create a facade of environmental concern without substantial changes (Tay et al., 2015).

The adoption of sustainable supply chain practices can face hurdles when government regulations are at odds with the long-term trends in the industry, as indicated by the research conducted by Tay et al. (2015) and Walker and Jones (2012). For instance, stringent regulations may impose financial burdens on companies, making it harder for them to implement green initiatives (Walker and Jones, 2012). Furthermore, the lack of dedication from suppliers is identified as a major external barrier to implementing GSCM. For companies, maintaining a sustainable supply chain can prove to be challenging if their suppliers are unwilling or unable to engage in eco-friendly initiatives, potentially due to financial constraints, as Caniato et al. (2011) revealed.

The overall performance of the supply chain can be positively influenced by developing strong relationships with suppliers and promoting their participation in design processes and technology

adoption, as highlighted by Sarkar and Mohapatra (2006). A study conducted by Zhu et al. (2017) found that a lack of collaboration with suppliers was a major external barrier in implementing green supply chain management. The reluctance of suppliers to adopt green practices can hinder the implementation of sustainable practices in the entire supply chain. Another study conducted by Yu et al. (2013) identified regulatory and policy barriers as external factors hindering the adoption of green supply chain practices. Complex regulations, inconsistent policies, and lack of enforcement can create challenges for manufacturers in implementing green practices of supply chain.

The adoption of GSCM criteria and the facilitation of productive interactions can be impeded by outdated machinery at supplier facilities and challenges related to information and communication technology (ICT) and Researchers such as Walker and Jones (2012) and Stremlau and Tao (2016) have underscored the significance of these obstacles. Language and cultural barriers may also impede communication and result in misinterpretation and differing interpretations of given instructions (Stremlau& Tao, 2016).

External constraints can hinder the implementation of GSCM practices. Factors such as consumer demands, competitive pressures, government regulations, supplier engagement, and technical challenges can all contribute to the complexities associated with adopting sustainable supply chain practices (Walker and Jones, 2012; Caniato et al., 2011; Sarkar & Mohapatra, 2006; Tay et al., 2015). Nevertheless, addressing these constraints and fostering strong supplier relationships can lead to lower costs, decreased inventory levels, and enhanced overall supply chain performance (Sarkar&Mohapatra, 2006).

Theoretical Framework

Numerous organizational theories were employed to examine the application of green supply chain management (GSCM) as highlighted by Sarkis et al (2011). Four prominent theories that encompass both internal and external factors driving GSCM operations are institutional theory, transaction cost economics, the resource-based approach, and resource dependence theory (Sarkis et al., 2011). One aspect of green supply chain theory is Stakeholders Theory (ST), which emphasizes the significance of considering various stakeholders in decision-making processes (Freeman & McVea, 2001). Freeman and McVea (2001), argue that stakeholders are individuals or groups who can influence or are impacted by an organization's objectives. ST posits that businesses should take actions to minimize negative effects on stakeholders while maximizing positive outcomes (Freeman & McVea, 2001).

Due to resource constraints, organizations should prioritize their engagement with key stakeholders, taking into account attributes such as authority, legitimacy, and urgency, as well as their goals and strategies (Mitchell et al., 1997; Frooman, 1999). Stakeholder theory has been employed in various studies investigating green purchasing practices, reverse logistics, SC greening, pressures by customers demanding improved environmental performance, and compliance standards (Zhu & Sarkis, 2007; Zhu et al., 2008b; Sarkis et al., 2011). However, it is worth noting that this theory may encounter limitations when the preferences of key stakeholders significantly differ (Sarkis et al., 2011).

In analyzing the factors influencing GSCM practices, several theoretical frameworks are essential. The Institutional Theory explains how institutional pressures, such as regulatory frameworks and societal expectations, impact companies' adoption of green practices. Transaction Cost Economics explores how transaction costs affect companies' decisions to adopt GSCM practices, considering the expenses associated with switching suppliers, implementing green technologies, and managing green initiatives. The Resource-based Approach considers how companies leverage their resources, capabilities, and competencies to gain a competitive advantage in implementing green practices. Additionally, the Resource Dependence Theory examines the interdependencies between manufacturing companies and external entities, such as suppliers, customers, and regulatory agencies, and their influence on GSCM implementation. This will enable researchers to comprehensively explore the factors influencing the application of green practices in supply chain management (Sarkis et al.,

2011).

The manufacturing sector in Mogadishu, Somalia has tremendous potential for growth and development. However, it faces numerous challenges during the implementation of GSCM practices. These obstacles are influenced by external factors such as infrastructure, regulations, and cultural norms. To overcome these challenges, it is crucial to involve various stakeholders in decision-making processes. The Stakeholders Theory highlights the significance of collaboration and consensus-building among stakeholders in implementing GSCM practices effectively.

The prolonged conflict in Somalia over the past thirty years has hindered the country's progress, including the implementation of GSCM practices. To mitigate the impact of conflict, strategies must be implemented. This research provides valuable insights into these challenges and emphasizes the need for overcoming obstacles caused by conflict to enhance GSCM practices in Mogadishu's manufacturing sector. Overall, this study contributes to a better understanding of the factors influencing the adoption of green practices in supply chain management.

3. Methodology

The research design utilized in this study was a descriptive research design, which aimed to provide a comprehensive analysis of the topic under investigation. The study population consisted of employees, managers, and other staff members from selected manufacturing firms in Mogadishu, Somalia. By including individuals from different levels within the organization, the study sought to gather a wide range of perspectives and insights. The sample size for this investigation was determined using the Cochran formula, resulting in a total of 73 respondents from the target population of manufacturing firms in Mogadishu, Somalia. The researchers employed a purposive sampling technique in selecting the sample, allowing them to carefully handpick participants who possessed the specific characteristics necessary for the study.

The primary instrument used in this study to collect data from the respondents was a questionnaire with a scale ranging from "strongly disagree" to "strongly agree" to measure the responses. Prior to distributing the questionnaire, a pilot test was conducted to evaluate the reliability of the scale. This test ensured that the instrument accurately measured what it intended to measure, enhancing the validity and credibility of the study's findings. Upon the completion of data collection, the researchers utilized partial least squares analysis, a statistical technique widely used for structural equation modeling. This analysis enabled them to explore the relationships and interactions among the variables examined in the study.

In order to further analyze the data collected, inferential statistics, specifically least square regression, were applied. These statistical methods allowed the researchers to draw conclusions and make predictions about the larger population based on the characteristics of the sampled respondents. Additionally, the researcher employed the content validity index to enhance the credibility of the questionnaire. This index evaluates the extent to which the questions in the questionnaire align with the overall objectives and content of the research, increasing the reliability and trustworthiness of the study's results.

4. Results and Discussion

4.1. Demographic Data

Understanding the demographics of the study respondents will provide valuable insights into the characteristics of the sample population and aid in interpreting research findings. The demographics of the respondents were taken into consideration as part of the data collection process. Several variables were assessed to gain a comprehensive understanding of the study population. Among the variables, respondents' age, gender, education level, and marital status are included. The obtained data for each of these demographic factors will be detailed and explored in the subsequent sections.

4.1.1. Gender of respondents

According to the study, the gender demographics of the research respondents indicated that male employees accounted for the highest representation, comprising approximately 68.5% of the participants. On the other hand, female respondents constituted 31.5% of the sample. This distribution sheds light on the gender composition within the organization and highlights the predominance of male employees in the manufacturing firms in Somalia. Table 1 below, details the frequency and percentage of the obtained data regarding the gender demographics of the research respondents:

Table 1: Gender

		Frequency	Percentage
Valid	Male	50	68.5
	Female	23	31.5
	Total	73	100.0

Source: Author

4.1.2. Age of respondents

Table 2 below provides valuable insights into the age demographic of the study respondents, a second demographic variable that was examined. The data collected from the 73 participants reveals a comprehensive distribution of age groups within the sample. Among the respondents, it was observed that 55 individuals (75.3%) fell within the age range of 20 to 35 years old. Additionally, 12 participants (16.4%) were aged between 36 and 50 years, while 6 respondents (8.2%) fell within the age range of 51 and above years.

Table 2: Age

		Frequency	Percentage
Valid	20-35	55	75.3
	36-50	12	16.4
	51 and above	6	8.2
	Total	73	100.0

Source: Author

4.1.3. Marital Status of the Respondent

In examining the marital status demographics of the study participants, the third demographic variable of the study, the data obtained from the study reveals that 60 respondents, 82.2% were not married, while only 17.8% were married individuals. These findings, as documented in the study, shed light on the distribution and representation of different marital statuses within the research sample. The significant proportion of single respondents indicates a prevailing trend of singleness among the participants, which warrants further analysis and consideration of its potential influence on the firms. Table 3 displays the frequency and percentage breakdown of the marital status demographics within the study participants.

Table 3: Martial Status

		Frequency	Percentage
Valid	Single	60	82.2
	Married	13	17.8
	Total	73	100.0

Source: Author

4.1.4. Education Level

The study sought to investigate the educational background of the respondents as another pertinent demographic variable. The analysis revealed that out of the total sample, a minority of 9 individuals (12.3%) possessed a high school diploma. In contrast, a substantial majority of participants, comprising 61 individuals (83.6%), held a bachelor's degree, signifying a prevailing trend of this educational achievement. Moreover, a small proportion of 3 respondents (4.1%) reported having obtained a Graduate degree, representing a higher level of educational attainment among a select few. Table 4 provides an insightful depiction of the percentage and frequency distribution associated with the educational backgrounds of the respondents within the study.

Table 4: Education Level

		Frequency	Percent
Valid	High School Diploma	9	12.3
	Bachelor	61	83.6
	Graduate Degree	3	4.1
	Total	73	100.0

Source: Author

4.2. Latent Variables Measurement

In order to evaluate latent variables such as Internal barriers, External barriers, and green supply chain implementation, it is crucial to examine the explanatory capacity (R2) of each measurement. The outcomes of this analysis can be found in Table 3 and Figure 1 To be considered effective in capturing and evaluating the underlying variable, a measurement must have an R2 value of at least 0.70. In this particular analysis, all measurements exceeded this threshold, indicating their reliability and suitability for the intended purpose. This evidence, presented in the aforementioned representations, serves to reinforce the credibility and appropriateness of the measurements in assessing the designated variables.

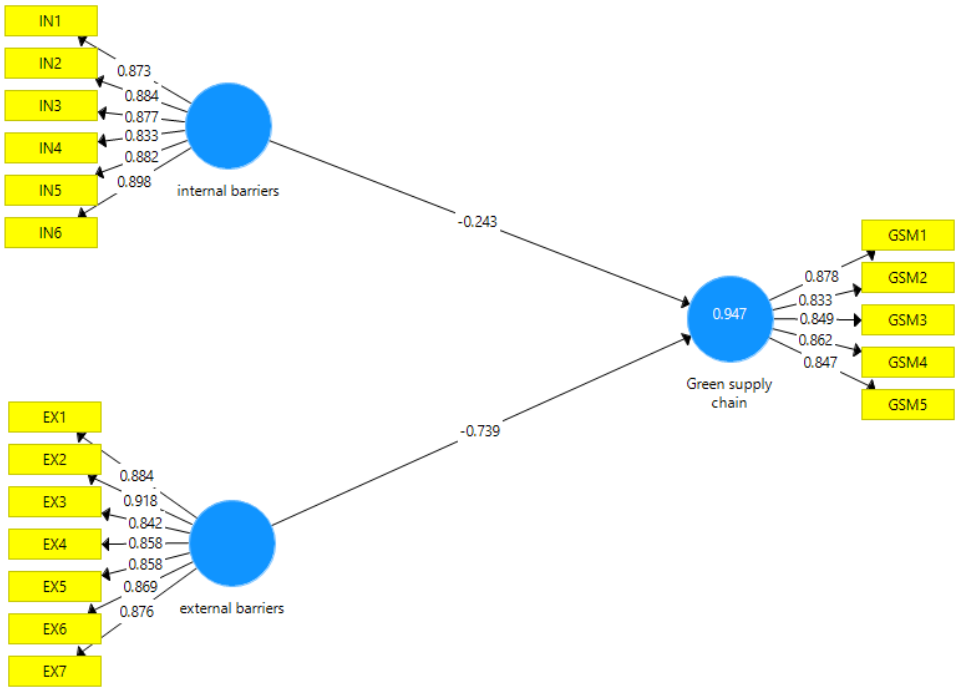

Fig.1: Latent Variable Measurments

Figure 1 visually presents the standardized β coefficients, -0.243 and -0.739, for the path analyzed. This indicates that a decrease of one unit in Internal barriers, while keeping other variables constant, will result in a proportional increase of 0.243 (24.3%) in green supply chain implementation. Similarly, a decrease of one unit in External barriers, with other variables held constant, will lead to a substantial increase of 0.739 (73.9%) in green supply chain implementation. These findings support the notion that reducing both Internal and External barriers positively influences the application of a green supply chain practices.

Furthermore, analyzing Figure 1, we observe that the coefficient of determination, R2, is 0.947 (94.7%). This means that approximately 94.7% of the variation in the dependent variable can be explained by the independent variables considered in the analysis. The remaining 0.053 (0.53%) can be attributed to the influences of other factors that were not included in this specific study. Thus, this figure provides substantial evidence supporting the significant impact of Internal and External barriers on the implementation of a green practices of supply chain. Moreover, the high R2 value suggests that the chosen independent variables explain a substantial proportion of the variance observed in the dependent variable. Nonetheless, it is important to acknowledge the possibility of other variables not accounted for in this research that may contribute to the remaining variance.

4.3. Reliability Analysis

In this section, the results of the reliability analysis are presented. It evaluates the internal consistency of the measurement scales employed in the study. The measurements were evaluated using two reliability coefficients: Cronbach's Alpha and Rho-A. Cronbach's Alpha measures the internal consistency reliability, while Rho-A assesses the reliability of the scale under conditions of unidimensionality.

Table 4 displays the Cronbach's Alpha and Rho-A values for each measurement scale, providing insights into the reliability and stability of the variables being measured.

Table 4: Reliability Analysis Results: Cronbach's Alpha and Rho-A

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Internal barriers	0.938	0.94	0.951	0.765
External barriers	0.948	0.948	0.957	0.761
Green supply chain implementation	0.907	0.907	0.931	0.729

Table 4 showcases the reliability and validity assessment conducted for this study. It presents the computed values of Cronbach's Alpha and Rho-A, assessing the reliability of the measurement scales utilized in measuring the latent variables of the independent variables. The observed values for both coefficients exceed the recommended threshold of 0.70, indicating a high level of internal consistency and reliability, thus affirming the effectiveness of these latent variables in accurately capturing and measuring the construct of green supply chain implementation.

Moving on to the aspect of validity, the values reported in the column labeled Average Variance Extracted (AVE) play a pivotal role in evaluating the construct validity of the measurement scales. An AVE value above 0.6 signifies that the independent variables, specifically Internal barriers and External barriers, aptly measure the intended dimensions of the dependent variable, which in this case is green supply chain implementation. This attests to the alignment between the theoretical concepts and the observed measurements, further strengthening the validity of the study.

Consequently, the findings from this analysis not only establish the reliability of the employed measurement scales but also verify their validity, affirming the accuracy and credibility of the data collected for assessing the construct of Green supply chain implementation.

4.4. Correlation Analysis

The correlation analysis among latent variables provides valuable insights into their interrelationships and helps in understanding the underlying constructs being studied. These correlations demonstrate the degree to which one latent variable is associated with another, shedding light on the potential connections and dependencies between them.

Table 5: Latent Variable Correlations

Varisables	Internal barriers	External barriers	Green supply chain implementation
Internal barriers	1	0.955	-0.948
External barriers	0.955	1	-0.97
Green supply chain implementation	-0.948	-0.97	1

Table 5 provides crucial insights into the relationships among the independent variables encapsulating the Barriers for green supply chain, namely Internal barriers and External barriers, while

considering the associated dependent variable denoting Green supply chain Implementation. This analysis aims to unravel the potential influence of these barriers on the successful application of green supply chain practices.

The results unveil a significant negative correlation between the independent variable of External barriers and the dependent variable of green supply chain Implementation. This strong negative correlation is substantiated by a notable correlation coefficient value of 0.739. This finding suggests that the presence of External barriers exerts a considerable inhibitory effect on the adoption of green supply chain practices.

Conversely, the independent variable of Internal barriers demonstrates a weak negative correlation with the dependent variable. This observation is supported by a correlation coefficient value of 0.243. While the relationship between Internal barriers and Green supply chain Implementation is negative, it is comparatively faint in strength. Thus, it can be inferred that the impact of Internal barriers on inhibiting the adoption of green supply chain practices may be less pronounced when compared to External barriers.

These findings highlight the importance for organizations to address and mitigate the identified barriers within the field of green supply chain management. Doing so is crucial for ensuring successful implementation. By recognizing the greater influence of External barriers over Internal barriers, organizations can strategically allocate resources and devise targeted interventions to overcome the challenges associated with implementing environmentally sustainable supply chain practices.

4.5. Structural Model Estimates

In order to accurately determine the magnitude of effects between variables and establish the significance of these relationships, a structural model estimation technique has been employed in this study. Specifically, partial least squares (PLS) analysis was employed to obtain robust and valid estimates. This technique is well-suited for examining complex relationships and has been widely utilized in academic research (Hair et al., 2019).

Table 6: Structural model estimates (95% confidence interval)

Path	**β Coefficient**	**T Statistics**	**P-values**	**Result**
Internal barriers -> Green supply chain implementation	-0.241	2.884	0.004	yes
External barriers -> Green supply chain implementation	-0.74	9.088	0	yes

Table 6 presents the t-values for the measurements and their corresponding latent variables, which are of utmost significance in this study. These t-values are greater than 1.96, indicating statistical significance for the two-tailed hypothesis data. Moreover, the table demonstrates significant results for convergent validity, as evidenced by the T-statistics of 2.884 and 9.088 for the two independent variables, Internal barriers and External barriers, respectively. The associated P-values for these variables are 0.004 and 0.00, reinforcing the significance of their relationship with the dependent variable.

The regression equation derived from the PLS-SEM model is Y = a + 0.004x_1 + 0.00x_2. This equation highlights the impact of the independent variables, Internal barriers and External barriers, on the dependent variable, green supply implementation. These independent variables explain the majority of the variance in the dependent variable, as reflected by the high determination coefficient (R^2) of

0.947, which accounts for 94.7% of the variance. It is important to note that the remaining 0.053 (0.53%) variance could be attributed to other factors that are not included in the current study.

The PLS-SEM analysis yielded robust findings, confirming the significant relationships between the independent variables of Internal barriers and External barriers, and their impact on the dependent variable, green supply implementation. These results elucidate the substantial explanatory power of the independent variables and emphasize the need to address these barriers to enhance the successful adoption of green supply chain practices.

4.6. Discussion

The results of the analysis demonstrate that all measurements used to evaluate latent variables such as Internal barriers, External barriers, and green supply chain implementation exceed the recommended threshold of 0.70 for the explanatory capacity (R2), indicating their reliability and suitability for the intended purpose. This reinforces the credibility and appropriateness of the measurements in assessing the designated variables.

The standardized β coefficients in Figure 1 show that a decrease of one unit in Internal barriers results in a proportional increase of 0.243 (24.3%) in green supply chain implementation, while a decrease of one unit in External barriers leads to a substantial increase of 0.739 (73.9%) in green supply chain implementation. These findings support the notion that reducing both Internal and External barriers positively influences the implementation of a green supply chain.

The coefficient of determination (R2) in Figure 1 is 0.947 (94.7%), indicating that approximately 94.7% of the variation in the dependent variable can be explained by the independent variables considered in the analysis. The remaining 0.053 (0.53%) can be attributed to other factors not included in the study. This suggests a significant impact of Internal and External barriers on the implementation of a green supply chain and highlights the explanatory power of the chosen independent variables.

The reliability analysis, assessed using Cronbach's Alpha and Rho-A, indicates a high level of internal consistency and reliability for the measurement scales. The observed values for both coefficients exceed the recommended threshold of 0.70, affirming the effectiveness of these latent variables in accurately capturing and measuring the construct of green supply chain implementation.

The validity assessment, measured by Average Variance Extracted (AVE), shows that the independent variables aptly measure the intended dimensions of the dependent variable, further strengthening the validity of the study. This affirms the accuracy and credibility of the data collected for assessing the construct of green supply chain implementation.

The correlation analysis reveals a significant negative correlation between External barriers and green supply chain Implementation, indicating that External barriers inhibit the application of green supply chain. In contrast, the correlation between Internal barriers and green supply chain Implementation is weak, suggesting a less pronounced impact compared to External barriers.

The structural model estimation technique, employing partial least squares (PLS) analysis, confirms the statistical significance and robustness of the relationships between the independent variables and the dependent variable. The t-values and associated P-values demonstrate the significance of the relationship between the independent variables and the dependent variable, reinforcing their impact on green supply implementation.

The regression equation derived from the PLS-SEM model shows that the independent variables, Internal barriers and External barriers, explain the majority of the variance in the dependent variable. The high determination coefficient (R2) of 0.947 signifies their substantial explanatory power in relation to green supply chain implementation.

The findings from this study provide strong evidence supporting the significant impact of Internal and External barriers on the implementation of a green supply chain. It emphasizes the need for organizations to address and mitigate these barriers to ensure successful adoption of environmentally

sustainable supply chain practices. These findings align with other studies conducted on the barriers of implementing a green supply chain in the manufacturing industry. Several studies have shown that both internal and external barriers significantly impact the adoption and implementation of green supply chain practices.

For instance, a study by Yang et al. (2019) found that internal barriers such as lack of top management support, lack of employee awareness and training, and resistance to change hindered the successful implementation of a green supply chain. Similarly, external barriers such as lack of government regulations, limited supplier willingness to participate, and absence of customer demand for sustainable products were identified as obstacles to green supply chain implementation. Another study by Sarkis et al. (2016) highlighted the importance of addressing both internal and external barriers for successful green supply chain implementation. The authors emphasized that internal barriers, such as organizational culture, lack of resources, and resistance to change, need to be overcome to establish a foundation for implementing sustainable practices.

Additionally, external barriers, including regulatory constraints, lack of stakeholder collaboration, and uncertain market demand, must be addressed to create an enabling environment for green supply chain initiatives. Overall, the findings of this study support and reinforce the existing body of literature that emphasizes the significance of reducing both internal and external barriers for the effective implementation of a green supply chain in the manufacturing industry. The strong correlation between the reduction of these barriers and the increase in green supply chain implementation further validates the importance of addressing these barriers to drive sustainability in the supply chain.

5. Conclusion and Recommendations

In conclusion, this study has identified and examined the challenges faced by manufacturing companies in Mogadishu, Somalia when adopting green supply chain management practices. The results demonstrate that reducing both internal and external barriers positively influences the application of a green supply chain, with a decrease in internal barriers resulting in a 24.3% increase in green supply chain implementation, and a decrease in external barriers leading to a substantial 73.9% increase. The high coefficient of determination (R2) of 0.947 indicates that 94.7% of the variation in green supply chain implementation can be explained by the independent variables considered in the analysis.

Reliability analysis confirms the internal consistency and reliability of the measurement scales used in assessing green supply chain implementation. The validity assessment further strengthens the accuracy and credibility of the data collected. Additionally, the correlation analysis reveals that external barriers have a significant negative correlation with green supply chain implementation, indicating their inhibitory effect, while the impact of internal barriers is less pronounced.

The structural model estimation through partial least squares (PLS) analysis confirms the statistical significance and robustness of the relationships between the independent variables and the dependent variable. The regression equation derived from the PLS-SEM model emphasizes the substantial explanatory power of internal and external barriers in relation to green supply chain implementation.

Based on these findings, it is evident that addressing and mitigating internal and external barriers is crucial for effective adoption of sustainable and green supply chain practices. Manufacturing companies in Mogadishu, Somalia should focus on reducing these barriers to ensure the effective implementation of green supply chain management. The study contributes to the existing literature by shedding light on the challenges faced by manufacturing firms in a developing country context and providing valuable insights for practitioners and policymakers seeking to promote and advocate for sustainable practices in the manufacturing sector.

The findings of this study provide empirical evidence that reducing both internal and external barriers positively influences the implementation of a green supply chain. This suggests that organizations should focus on addressing and mitigating these barriers to ensure successful adoption of

environmentally sustainable supply chain practices. The regression analysis shows that internal barriers and external barriers explain a substantial amount of variance in green supply chain implementation. This highlights the importance of addressing both types of barriers for a successful green supply chain implementation strategy.

The significant negative correlation between external barriers and green supply chain implementation highlights the need to tackle external barriers, such as lack of government regulations and limited supplier willingness, that inhibit the application of green supply chain practices. On the other hand, the weak correlation between internal barriers and green supply chain implementation suggests a lesser impact compared to external barriers, but organizations should still address internal barriers like lack of resources and resistance to change.

Investigating the specific mechanisms through which internal and external barriers affect green supply chain implementation could offer valuable insights. For example, examining how top management support and employee training impact the adoption of sustainable practices, or how government regulations and stakeholder collaboration influence the willingness of suppliers to participate in a green supply chain. This research could provide organizations with a more comprehensive understanding of the factors that influence the successful implementation of a green supply chain and guide the development of effective strategies to overcome barriers. The limitation of this study is the restricted scope of assessment, which solely focused on the internal and external barriers of implementing green supply chain management practices. Additionally, the data used in the study was collected exclusively from manufacturing firms in Somalia. Considering the unique economic, cultural, and political context of Somalia, generalizing the findings to a broader population raises concerns about the applicability and validity of the results to other regions or industries.

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