

**The Effects of Green Procurement, Green Production, and Green Logistics in the Overall Performance of Green Supply Chain Management****Maria Siddiqui¹, Ayman Taj², Saira Jessani³, Asadullah Lakho⁴****Abstract**

The goal of the study is to examine the effects of green procurement, green production and green logistics on overall performance of green supply chain management. Pakistan is a country where green practices are still rare and environmental performance of the organizations needs to be focused. In the given backdrop it is a dire need that gaps are identified, and organizations should strategize their role and environmental responsibility and set benchmarks for the sustainable businesses as well as betterment of the society. A prescribed questionnaire with close ended questions was designed to collect data from various sector of Pakistan industries. The nature of this study is quantitative; simple random sampling is used and the sample size is set to 325 respondents. Reliability test, exploratory factor analysis followed by regression analysis were carried out by using SPSS. Results showed that there are positive and significant relationships of green procurement, green production and green logistics on overall performance of green supply chain management. The results are further elaborated in the respective sections of this research with some concrete recommendations. This research may be of great help in implementation of green practices in large organizations as well as SMEs and will ultimately benefit the all stakeholders, environment and will provide long-term sustainability.

Keywords: green procurement, green production, green logistics, green supply chain management

1. Introduction**1.1. Background**

The exorbitant increase in the population across the country demands extraordinary efforts to ensure the availability of required products i.e., packed foods, beverages, medicines, cosmetics, and other consumables every time in customer's reach. Along with these necessary goods, industrial material which contributes to every aspect of life are required to be available timely.

In logistics, one of the most critical success factors is the ability to build and maintain a concrete distribution network which includes equipped warehouses supported with some ERP software, solid logistics arrangement, and a huge network of retailers across the pertaining demographic footprint of an organization. (Rodrigue et al, 2001; Imran et al., 2021).

Green purchasing refers to the procurement of any products or services with a proper strategy of having a lesser or red on society, human health, and environmental efficiency when compared with competing products or services that serve the same purpose. This applies to raw materials, production processes or manufacturing, packaging, distribution, recycling, and maintenance of the product at the supplier's end. However, there are serious concerns about the depletion of natural resources including forests which is impacting the environment directly and indirectly through mining and fossil fuel production.

In recent years, a few industries in Pakistan have started integrating their supply chain strategies with broader environmental policies but it is not at par and some serious steps need to be taken in this regard supported by some concrete mechanism with compulsory compliance requirements by the concerned regulatory bodies. Therefore, the development of adequate strategies and practices to ensure green procurement and green production followed by green logistics will not only improve the overall performance of supply chain management to an utmost extent but will also bring organizations to a new eco-friendly mechanism which will be a great contribution to the environment and the society.

1.2. Problem statement

For decades, the traditional approach to logistics generally does not consider environmental sustainability by the organization during making their strategies and decision-making. In the modern world, logistics is immensely affected by sustainable policy challenges. Organizations seek innovative approaches to strategize and coordinate the whole logistics process from one end to another to avoid pollution and other environmental effects.

Besides the above, customers have also become more environmentally conscious and emphasize choosing companies that are working to decrease their carbon dioxide emissions, efficiently handling waste disposal and overall waste management, and using recyclable materials. Green practices are still a challenge for the world irrespective of organization category. For instance, the high technology industry is one of the rapidly increasing industries in the world expanding leading to technological inventions and global economic production.

There are some problems in continuity of the industrial energy usage and CO₂ emissions. The effective use of resources and green stuff to provide goods, virtuous and clean manufacture is a serious challenge in supply chain management in green part procurement cooperation, especially for electronics OEMs. Companies purchasing costs result in a very high percentage of complete product rates.

Research carried out by (Min-Ren Yan et al., 2016; Imran et al., 2022) shows by using system dynamic simulation analysis and statistical corroboration with empirical data. The researchers gathered data from the Taiwanese manufacturing chain, the world's biggest producers' clusters of high technology parts, and their global green provider to analyze the advantages of green part procurement to divide rates and enhanced shipping time performance.

There are several developed countries including Japan, the United States, and Germany has already advanced green logistics strategies in place for a long (Xiu & Chen, 2012), while underdeveloped or emerging countries must look into seriously implementing logistics integration practices and should contribute to addressing environmental challenges (Green, Whitten & Inman, 2008; Imran et al., 2023).

Unfortunately, Pakistan is one of the countries where green, procurement, green production, and green logistics thus, in total overall green supply chain management practices are rare, and organizations do not bother for the safety of the environment, as well as the lack of related regulations and procedure, plays a vital role in non-compliance of the green practices. An overview of a few large organizations of the different sectors is as follows to determine where we stand in green supply chain management and what

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should be our plans to achieve this ultimate objective:

Atlas group is one of the largest groups in Pakistan for decades. While reviewing the supply chain practices of atlas group (involved in automobile manufacturing and funds management); there are so many best industry practices prevailing in the production processes which help in reducing waste and emphasizing quality products. They have started using eco-friendly technology in their engines which helps save the environment. Atlas' internal supply chain processes are based on Japanese standards and their efforts for the green environment are considerable; while improvements are required from their suppliers end in line with the green practices. Furthermore, transportation of cars from the atlas plant to various parts of the country may be improved by using eco-friendly long wheelers or electric-operated units.

Pakistan petroleum limited (ppl) is an oil and gas company in Pakistan operating for decades. The company is equipped with some ERP software however, their greener supply chain management is still a dream as they have several suppliers across the globe with a variety of products but only a few have implemented green practices which means ppl's green procurement has yet a lot to do. Similarly, the production processes are struggling to reduce emissions to the surrounding population as there is several gases are flashed during the process including h₂s which is harmful. As far as logistics are concerned, their 3rd party logistics is based on a traditional vehicle fleet; which needs to be turned to on priority. In total, the adopted strategies are so less than the required and some war footing steps need to be taken on an immediate basis.

Bosch Pharmaceuticals (Pvt) Ltd. It is one of the company grow rapidly. Having a variety of products on its portfolio. They have several production facilities in Pakistan and around the world with optimized processes and a controlled environment. However, their packaging suppliers are so traditional without considering green practices and so as their logistics. In the given backdrop, it is a dire need that all the processes and business practices about procurement, production, and logistics as a holistic approach must minimize the environmental impact in every stage and ensure serving the surrounding communities in better ways without hampering the organizational operations and make it more economical and sustainable.

1.3. Objective of the study

The main objective of this research is to identify the effects of green procurement and green production in green logistics and the overall performance of supply chain management and how it can contribute to the environment, society and economy. The objective may further be narrowed down as follows:

- Identify challenges in the implementation of green procurement, green production, and green logistics in different category organizations.
- Provide recommendations in the implementation of green procurement, green production, and green logistics to improve the overall performance of supply chain management.

This research investigates how green practices can play a vital role in various organizations that can provide an eco-friendly environment and can contribute to the sustainability of the respective organization.

1.4. Research Questions

Q1. What are the impacts of green procurement on overall supply chain management? Q2. What are the impacts of green production on overall supply chain management?

Q3. What are the impacts of green logistics on the overall performance of supply chain management?

1.5. Significance of the study

The research once complete will give adequate suggestions to the SMEs working as suppliers to improve their practices and turn green. On the other end, this study will provide sufficient techniques to optimize production processes with lesser natural resources and cost-effective solutions in line with green practices. This study will also assist logistics service providers with the required changes in their strategy and techniques to enhance their operations without hampering society and the environment with a substantial reduction in carbon emissions. The aforementioned suggestions will ultimately help in improving the overall performance of the supply chain management from one end to another and will prove to be a motivational agent for many organizations to consider turning their industry practices into green practices with unlimited benefits.

1.6. Scope of the study and limitations

This research aims to investigate the differences between traditional and green procurement, production, and logistics and the prospects of green practices concerning overall supply chain management. This research is placed on the primary data which will be acquired through a prescribed questionnaire. The target population is around three large firms of different categories to ascertain competitive results. The main focus of this study will remain on green procurement, green production, and green logistics (transportation only) in the different organizations while taking into consideration of overall supply chain management. The study will be conducted with limited, though, validated data and a prescribed timeframe.

2. Literature Review

Numerous research and studies have been found on green procurement, green production, green logistics, and green supply chains; though, of course, the specific details about the Pakistan perspective are limited in this regard. Globally, there are multiple examinations on green supply chain management practices and how corporates made it part of strategies. That also includes the challenges they faced during the implementation phases.

2.1. Green procurement

It is evident that the lack of implementation of green supply chain practices immensely affects society, people, and the environment. Analysis based on collected data through a self-structured questionnaire revealed that green purchase, procurement, and customer environmental cooperation have a very positive correlation with environmental performance. With the outcome, it was also noticed that green supply chain practices have also a great influence on internal environment management and performance. As a result, the implementation of green innovation furnished substantial effects on environmental performance across Bahrain (Darwish, M. Shah & Umair Ahmed, 2021; Wang & Manopimoke, 2023; Limjaroenrat & Ramanust, 2023).

While a fixed level of the configuration of the observations across the FMCG supply chain exists and logistics services suppliers participating a pivotal role as composer of the cyber supply chain risk management (CSCRM) process towards a more "supply chain-oriented" response to cyber threats and risk events. (Alessandro, Claudia, Salvatore and Fabrizio, 2021; Singh & Kumar, 2023; Saluy & Nuryanto, 2023; Imran et al., 2024).

(Santosh b. Rane & Shivangi, 2020). Green purchasing is in the process of growing and spreading in many under-developing

countries in comparison to Europe and many more developed countries around the globe. The success is mainly attributable to the strategies and standards which were imposed by the government and the work contribution from manufacturers and consumers to apply such changes in their procedures.

Industrial modernization also demands increased care for the environment, low carbon emission, and all required actions for environmental protection so as to avoid the recurrence of mishaps and accidents which have been faced in past in the conventional era. This necessitates that organizations strategize a prescribed framework including suppliers' assessment and other stakeholders as well as the internal operational strategy (Zheng et al, 2022; Al Masri & Wimanda, 2024).

Green public procurement has become the most desirable practice to keep the environment clean and green and firms are working on green procurement to make their final product eco-friendly. These practices are not only implemented by large firms but also by small enterprises. (Bastian Krieger & Vera Zipperer, 2022; Skhirtladze, S., & Nurboja, 2019).

2.2. Green production

A study carried out by (Hashmi and Akram, 2021) shows the connection between green supply chain practices, the environment, and financial performance. Researchers measured this relationship by using quantitative research methods. In addition to the outcome, external environment pressure enhanced the integration between GSCM and operational performance. The most important reason to plan and adopt the green strategy is to reduce the burden of the polluted environment. It is a basic theme and concept which shows the relationship between organizational operations and the natural environment. A detailed review of green supply chain management describes slow steaming, voyage optimization, and efficiency in port operations are some of the major recent trends of green transportation identified in green supply chain management (Raeda Saada, 2020; Emodi, 2019).

Pro-environmental behavior plays a crucial role in FMCG supply chains, where numerous business operations such as the disposal of unused products, packaging, transportation of production and packaging waste, and hygiene issues about food, fruits, and vegetables depend directly on human interaction, especially including the end user. If the pro-environmental behavior is known and in place in the organization, it will greatly improve the quality of products, quality of service, and eventually revenues as well as the trust of consumers at large and their loyalty to the organization for a long-term basis. (Jelena, Radenko, Goran and Sonja, 2021).

(Nguyen, 2022) explore causal factor's effects on green agriculture establish outlining them within four issues (farm operational capacity, technology spillover, environmental awareness, and health concerns) concerning the pandemic era. The results showed that green innovation in the production phase is essential to attain these four factors concerning the agriculture industry. (Lim et al; 2021) analyzed the practicability of forming seaweed films and their viability with the help of green technologies. It was found that seaweed films that are directly formed without chemicals are promising but more research can make it easier and more doable in the industry. Seaweeds have numerous advantages as compared to other biomass. It is practical to use seaweeds to replace conventional plastic which will not only help in economic production but will ultimately be beneficial for the environment and society.

The construction sector signifies the importance of infrastructure in any country and the government gives emphasis to it. Similarly, the Indian construction sector has intense focus from their government but at the same time, environmental balancing is also a necessary challenge in the current scenario. The study identified that "decrease burden from upper management", "insufficiency of assistance", and "insight of exorbitant price holding to green purchasing" are the major boundaries to the adoption of green practices. (Abhishek Mojumder, Amol Singh, Ashwani Kumar & Yang Liu, 2022).

Thailand has started a national road map for green production and consumption and its continuity and applied green product procurement (GPP) the impact of green product procurement on green production and consumption did not analyze up till now. All the strong points and failure points that are relatable to the strategies and operations of 15 key institutions, were evaluated to find delays and problems. Green product procurement brings on a maximum amount of environmental preference for products and services over 1200 producers. (MungKung et al.; 2021).

Corporate management is paying more attention to continuity in producing and transporting products for the betterment of the company's environment and social impact and their expansion by keeping in mind the protection of natural assets and minimizing the effect of the change in the climate. Researchers explore five studies about production and logistics for sustainability in planning and strategizing with different methodologies concerning operations and whole supply chain management. (Günter Fandel, Andreas Kleine & Andreas Dellnitz, 2020).

Extracting raw materials from the environment and returning the same in the form of products and wastages are the basis for environmental damage to the utmost extent. This triggers and obligates the huge responsibility of organizations to ensure using waste responsibly and acceptably as raw materials in production processes if we want to preserve our current standard of living without causing further damage to the environment. The environmental management system (ISO 14001) necessitates the required emphasis on organizations to address the environmental impact of their domain. Although environmental management systems have not been designed to address products themselves, they pursue coping with the processes within the organizations to reduce the environmental impacts. (Moedinger et al, 2019).

An article written by (Jordan Bar et al., 2022) and published on the McKinsey website states that organizations need to put their all efforts focusing on biologically derived ingredients, recycled material for packaging purposes, biodegradable & certified materials, and agricultural farming in harmony with nature. In this regard, it necessitates that organizations should first assess the volume of emissions caused by each purchasing category and potential reductions in each category. Procurement should be tasked to ensure explore suppliers adhere the social and environmental standards. While, as to the logistics, organizations should explore alternatives for their vehicle fleets including electric-driven vehicles to ensure more sustainable transport options which would be environmentally friendly of course. As far as warehousing is concerned; organizations to consider space optimization as well as consider using renewable sources to ensure energy supplies, and arrangements of their solar panels, if possible. It should also be investigated how organizations can effectively utilize water sources and options to reduce their pertaining waste.

2.3. Green logistics

Green logistics refers to the set of sustainable strategies and measures intended to reduce the environmental effects caused by the activities of traditional logistics. The green logistics concept affects the reconfiguration of processes involved, infrastructure and systems, and vehicle fleets in the transport, distribution network, and warehousing. The traditional approach to logistics often leaves environmental sustainability on the sidelines during decision-making. On the other hand, green logistics aims to

find a balance between ecology and economy. Logistics operations contribute substantial amounts of greenhouse gas emissions into the environment. As per the world economic forum, logistics alone contributes 5.5% of worldwide emissions this certainly resulted in inefficient logistics because it is not only polluting the environment but also affecting human health in various aspects.

The logistics operations are mainly attributable to carbon emissions. As per IEA (2018), transportation emissions comprise 25% of world carbon emissions, which is 71% greater than that in the 1990s. The main reason is fossil fuel which was 23% in 1971 and increased to 29% in 2017. To deal with carbon emissions for the safety of the global environment, the challenges in the transportation sector need to be addressed as a top priority. (Tayyab, Sana Ullah, Tariq & Ahmed Usman, 2021; Ali & Audi, 2016; Audi & Ali, 2018).

The logistics industry has created serious environmental pollution problems across the globe and especially in China because of its larger scale of economy and infrastructure. There are several cities in China those are strictly implemented green practices in the logistics industry and the same can be replicated across China to ensure a substantial reduction in carbon emissions in the logistics industry. (Gang Du & Wendi Li, 2022).

A concrete and continually improving transportation network is needed to serve the fast-expanding port area. Modern geographic information systems equipped with the latest technological tools can be used to improve transport and logistics infrastructure and can meet both social and economic needs and form an integral part of logistics operations. (Jurij Kotikov, 2015).

Certainly, fossil fuels are the core of logistics functions and unfortunately, it is the major contributor to carbon emission. The more fossil fuels are used, the more it is dangerous for the environment and society as a whole. Green logistics is negatively correlated with fossil fuel energy consumption and carbon emissions per capita in countries along the Belt and Road. Against the given backdrop, it is a great opportunity to adopt green practices in these countries through the Belt and Road megaproject to secure a safe environment and sustainable economic development along the Belt and Road. (A.K.M. Mohsin et al; 2022).

In the modern world, where carbon footprint reduction is a serious challenge for organizations; the adoption of carbon regulation mechanisms can facilitate an evolution toward a green and sustainable supply chain. To evaluate that, a testing framework for planning sustainable logistics was presented in which various vehicle types and gas emissions in transportation, and other SC operations, were taken into consideration. The testing of the model suggested that governmental incentives for a cap-and-trade policy would be more effective for supply chains in lowering logistics pollution through investing in modern cleaner technologies and adopting greener practices. (Zahra et al.; 2021).

After covid logistics industries were required to establish new strategies for their growth to make sure the logistics operations should be free from CO₂ emissions and efficient consumption of energy in China. The result of the research concluded that the help of government support and their policies to control CO₂ emission logistics and revolution in technologies and contribution of infrastructure may help in achieving this massive goal. (Xiaole Wang & Feng Dong, 2022).

Logistics service providers are emphasizing environmental sustainability in recent years because of its significance as a competitive advantage. This study reveals that now environmental issues are being considered on priority by many freight carriers either operating on a large scale or small. Furthermore, designated staff have been tasked to pay attention to the sustainability issues of their organization. More importantly, the reduction of pollution in any form is being given top priority which is a very impressive leverage in this competitive business sector. (Mariangela, Anna & Giulio Mangano, 2022).

2.4. Green supply chain management (GSCM)

Supply chain management (SCM) refers to the process of input and transforming these inputs through a prescribed process into an output; thus, creating a complete supply chain. To achieve green supply chain management (GSCM); organizations to ensure all the processes starting from input to output are supported with environmentally friendly practices. This includes green procurement from suppliers, green production through the manufacturing or production process, and green logistics by reducing carbon emissions. In recent years, GSCM has gained immense popularity to reduce waste and preserve the quality of products life, and natural resources. Eco-efficiency and remanufacturing processes are now important assets to achieve sustainability and best practices.

Green products are the most reliable resolution for environmental sustainability. It carries a significant role and affects society and the environment to the utmost extent. With time, there is a significant increase in environmental awareness among the common public which has increased the pressure on organizations to steer their strategies as per consumer demands. This whole scenario is positive for the greener goal and should be practiced across the globe, especially in developing countries. Awareness at all levels is necessary for the betterment of society and the environment to achieve a green environment at large. (Peter Ansu, 2021).

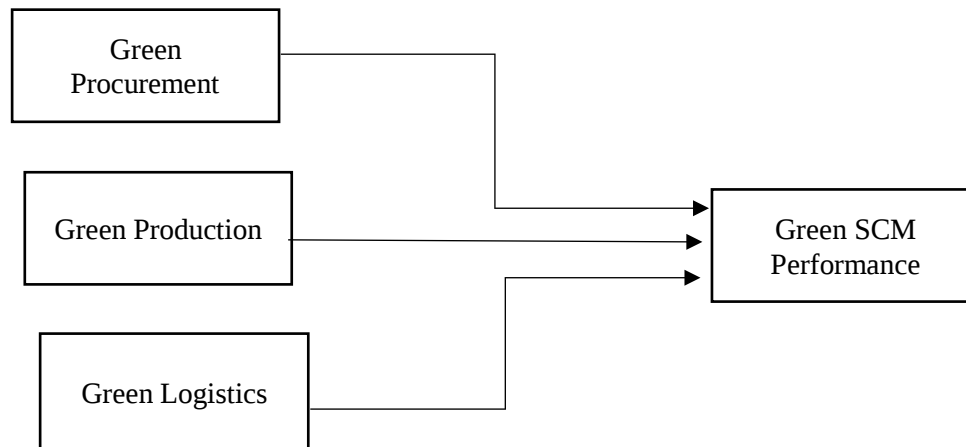
(Morgane, 2022) proposed in his research a view of a sustainable supply chain and then provided a theory to elevate this level with the continuation of good practices throughout the organization's footprint. The theory shows that close integration of all internal and external stakeholders is very necessary for the sustainable or green supply chain management. The theory supports the collaboration between parties to identify gaps and explore opportunities for long-term sustainability.

In general, operations management is all about the efficiency, effectiveness, and economy of SCs. However, the modern customer-driven market and growing pressures from governments and SC stakeholders are forcing organizations to critically review their strategies to deal with the environmental and social sustainability perspective. Organizations should look into it with a holistic approach considering all the factors, especially customer demand and expectations for environmental and social responsibility. (Sachin Kumar Mangla et al; 2020).

To ensure environmental protection from industrial waste and carbon emissions; it is essential to identify the role environmental performance of an organization. The more an organization invests in green practices the more customer satisfaction and loyalty will be achieved. However, all the components of the supply chain network including procurement, production, packaging, and logistics must perform in a holistic approach for green practices. The ultimate results would be reduced pollution, economic benefits, and environmental sustainability. (Hafiz M. Usman, 2022).

It is dire need of time that organizations find ways of dealing with environmental challenges through planning and implementation of green strategies in all SCM processes, new product development, and customer relations, to remain competitive. Management should always be prepared and extra conscious of the cost implications of new laws and regulations, in addition to the high cost of defensive litigation, and the possibility of losing their place in the market to competitors. (Banjo Ogunlela, 2018).

2.5. Conceptual framework



3. Methodology

3.1. Research Approach

There are three types of research approaches; Quantitative, Qualitative, and Mixed research approach. In this study, the quantitative approach is used as a research approach. The data has been collected through the questionnaire. The respondents' responses are run and tested to analyze the impact of the variable by using the statistical tool. Data was collected by using a questionnaire consisting of 5 questions of each variable and measured responses using the Likert scale. Furthermore, tests were carried out on SPSS to analyze the results.

3.2. Research Purpose

There are many reasons to do research so it is important for the researchers to identify the real purpose of the research that why they are doing it, what they want to explore, and why they are using the different techniques and experiments of measurements. The reason of the research is to recognize the effect of green procurement, green production, and green logistics in overall supply chain management. The reason for the study is to collect the information to identify the effects of green procurement green production and green logistics in overall supply chain management.

3.3. Data source

Two types of data collection are primary and secondary. Primary data is unique research that is found through original hand investigation. It includes questionnaires, surveys, interviews, etc. Secondary data refers to the already available data through websites, governmental departments, surveys, organizational records, etc.

The data was collected from a primary source through a prescribed questionnaire. The past researchers and literature helped identify the research gap to ensure this research is meaningful. The instrument used for data collection of the study is based on past research papers specifically measuring the impact of green procurement green production and green logistics in overall supply chain management. The respondents fill out the questionnaire to share their opinion on the variables that have been used to extract the outcome.

3.4. Target Population

The research target populations are employees of logistics, production, procurement, and packaging department of different organizations mainly from the textile, manufacturing, and service industry.

3.5. Sample size

The sample size I have chosen for this study is 325 to try and ensure significant results. The respondent includes both male and female respondents, ranging from the age of 18-55.

3.6. Data Collection Tools and Techniques

There are various types of data techniques that can be used to collect information related to any object, person, or phenomenon. Data tools include 4 common techniques for gathering information from respondents that support the study and guide the researchers toward the accuracy of the results obtained. These 4 tools are given below:

- Questionnaires
- Observation
- Interviews
- Focus groups

The tool used in this study is a survey-based questionnaire and further applied quantitative techniques to assemble the entire information gathered by the respondents, opinions, and whole responses. More than 300 responses were received through online questionnaires that represented each variable significantly. The results were further analyzed and tested over SPSS.

3.7. Sample Technique

The purpose of the sampling method is to represent the people targeted in the research examine the pattern and then generalize to the people. The sampling technique used in the research is convenience sampling. In convenience sampling, we used an individual as a respondent who was the most conveniently accessible but pertains to the procurement, production, and logistics functions in their respective organizations. This technique allows us to save time, as well as cost benefits.

3.8. Statistical Tools and Techniques

The tools which we use in our research are:

3.8.1. Reliability

We use reliability to check the internal consistency of the variables. We can check it overall and individually as well. The

benchmark value of Cronbach Alpha is greater than or equal to 0.70 and in some exceptional cases, it can be greater than or equal to 0.60 or 0.50 as well.

3.8.2. Exploratory Factor Analysis

We use EFA to check the dimensions/factors. EFA is a data reduction technique. It gives meaningful output. The benchmark value of the coefficient should be greater than or equal to 0.4. We should not have cross-loadings in EFA and maximum loadings should be 0.5. In EFA there is KMO result is also present. The benchmark value of KMO is 0.7 and it tells about the adequacy of the sample.

3.8.3. Regression

It gives the average of all the questions. P-value shows that the variable is significant if the value is less than 10% and insignificant if the value is greater than 10%. The coefficient tells about the positive or negative relationship between the dependent and independent variables. R square tells how much your independent variable jointly predicts and jointly explains the dependent variable.

The data was analyzed through different tests in SPSS (statistical package of social sciences). The first tool will use in the research is factor analysis (EFA); this helps to identify the variable's correlation with each other. The KMO and Bartlett test run to show the effectiveness of collected data, then run a regression test, helped to find the relationship between each variable and the p-value of each variable.

3.9. Hypothesis

H1 = green procurement has a positive impact on green logistics

H2 = green production has a positive impact on green logistics

H3 = green logistics has a positive impact on green supply chain management

4 Data Analysis and Findings

Table 1: Respondent's profile

demographic items	frequency	percentile	
Gender			
Male		240	74%
Female		85	26%
Age			
18-25		73	22.3%
26-35		125	38.5%
36-above		127	39.1%
Education			
gender graduate			
	6	17.7%	
Graduate	56	51.1%	
post graduate	65	31.2%	
monthly income			
0000-40000	1	8.3%	
40000-50000	3	10.7%	
50000 and above	65	81%	
Ownership type			
state owned		39	17.7%
Foreign		13	7%
private company		60	64.4%
joint venture		15	11%

4.1. Research Procedure

Table 2: Sample size calculation

Margin of error	%
Confidence level	5%
population size	0000
Responses	0%
sample size	77
pilot testing	0
original testing	27

The research was carried out through an online prescribed questionnaire distributed to the employees of different firms (including textile, manufacturing, and services companies) working in Production, Procurement and logistics functions. A total of 325 responses were collected. The questionnaire was designed based on the selected variables. Following general information on demographics, companies, and other general information; employees were asked to respond to the questions (5 questions for each variable) based on the Likert scale.

4.2. Data Analysis

I have done pilot testing of 50 respondents after that I ran the test on SPSS software and the results came out positive.

4.3. Reliability Test

The standard statistical package for social sciences SPSS 23 was used to analyze the collected data. The value of Cronbach's alpha (α) (from 1 dependent and 3 independent variables) that is based on a total of 20 items is 0.950 i.e., 95% which shows the consistency of the items.

The data scale is relevant for evaluating the opinions of employees, as confirmed by the Cronbach Alpha coefficient, indicating a good level of reliability and validity of the applied scales as mentioned in below tables of each variable:

The independent variables (green procurement, green production and green logistics) are based on 5 items each. Reliability test of each variable was carried out separately and the reliability of all the variables is more than 0.8 (more than 80%).

Table 3

Reliability Statistics (Overall)	
Cronbach's Alpha	No. of Items
.950	20

Table 4

Cronbach's Alpha	No. of Items
.858	5

Table 5

Reliability Statistics (Green Production)	
Cronbach's Alpha	No. of Items
.906	5

Table 6

Reliability Statistics (Green Logistics)	
Cronbach's Alpha	No. of Items
.855	5

Table 7

Reliability Statistics (Green Supply Chain Management)	
Cronbach's Alpha	No. of Items
.935	5

4.3.1. Kaiser–Meyer–Olkin and Bartlett's tests (KMO)

Table 8

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.928
	Approx. Chi-Square	4564.961
	df	153
Bartlett's Test of Sphericity	Sig.	.000

4.3.2. Regression Analysis

Subsequent to reliability testing, regression analysis was carried out to check the hypothesis. The results are shown below:

Table 9

Model Summary				
Adjusted R Square				
Model	R	R Square		Std. Error of the Estimate
1	.809	.654	.651	.59009
Predictors: (Constant), Green Logistics, Green Procurement, Green Production				
Dependent Variable: GSCM				

As indicated in the above table the R-square value is 0.65, which means that the independent variable (Green Procurement, Green Production, and Green Logistics) causes more than 65% change in our dependent variable (GSCM).

This table shows the outer variables result the analysis of factors that demonstrates the 20 items of the four factors. Factor

analysis is utilized as a technique in which the data is reduced which is also used to distinguish the loaded items which are appointed on the same build. It can depreciate the large data into a small data. According to Emory and Cooper (1991) claims that the factor analysis can help the scholars in determining the resources of the factors. The first factor which is green procurement with the loading GPR3 is .747 , GPR4 is .753 GPR5 is .839. the second factor green production with the loading GPD2 is .660, GPD3 is .738 ,GPD4 is .728 , GPD5 is .719. the third factor green logistics with the loading GL2 is .737, GL3 .817, GL5 .805. the fourth factor is green supply chain management with the loading GSCM1 is .795, GSCM2 is .796, GSCM3 is .760 , GSCM4 is .735 , GSCM5 is .782. eliminated items are GPR1, GPR2, GPD1, GL1, GL4.

Table 10

	Component			
	1	2	3	4
PR 3				.7
PR 4				.7
PR 5				.8
PD 2		.6		
PD 3		.7		
PD 4		.7		
PD 5		.7		
L 2			.7	
L 3			.8	
L 5			.8	
SCM 1	.7			
SCM 2	.7			
SCM 3	.7			
SCM 4	.7			
SCM 5	.7			

Table 11

			ANOVA			
Model	Sum of Squares	df	Mean Square	F	Sig.	
gression	211.642	3	70.547	202.600	.000 ^b	
sidual	111.775	321	.348			
1 tal	323.417	324				
Dependent Variable: GSCM						
Predictors: (Constant), Green Logistics, Green Procurement, Green Production						

Table 12

Model	Unstandardized Coefficients		Standardized Coefficients		Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Tolerance VIF
(Constant)	.001	.077		.012	.990	
Green Procurement	.040	.011	.161	3.616	.000	.544 1.837
Green Production	.585	.048	.560	12.206	.000	.512 1.952
Green Logistics	.197	.042	.195	4.648	.000	.609 1.642

Dependent Variable: GSCM

The above table shows that the p-value is 0.00 which is less than 0.05, hence we may conclude that there is a significant relationship between all three independent and dependent variables.

The above table indicates that green procurement, green production, and green logistics (independent variables) positively impact green supply chain management (dependent variable). While the p-value of green procurement, green production, and green logistics is less than 0.05 thus we may conclude that all independent variables have a significant relationship with dependent variables. The more the companies adopt green practices the more they would affect positively achieve green supply chain management goals.

Table 13

S. No.	Hypothesis	Status	P-value (Sig. value)
1	green procurement has a positive impact on green logistics	Accepted	Positive and Sig. Less than 0.05
2	green production has a positive impact on green logistics	Accepted	Positive and Sig. Less than 0.05
3	green logistics has a positive impact on green supply chain management	Accepted	Positive and Sig. Less than 0.05

The above table proves the hypothesis as follows:

- Green procurement has positive impacts on green supply chain management
- Green production has positive impacts on green supply chain management.
- Green logistics has positive impacts on green supply chain management.

The summary of the hypothesis testing.

4.4. Findings

By reviewing the above table in-depth it is revealed that green procurement has fewer positive effects on green supply chain management as per the current ongoing practices; green production has the most positive contribution in achieving the green supply chain while green logistics is contributing at 2nd position.

The results prove the hypothesis but at the same time, it shows that green procurement and green logistics are contributing lesser than green production. It is understandable that the production function is in total control of the organization and the green practices adopted in reducing wastage, reducing dangerous gases, and improving the overall environment are bearing fruits.

Though, however, it is important for organizations to look into improving their supplier's practices as well as logistics functions. There are several companies that have 3rd party logistics and have restricted control over them but in order to improve overall efficiency and to achieve desired results in green supply chain management, suppliers and logistics services need to be aligned with the companies' green objectives.

5. Conclusion and Recommendation

5.1. Conclusion

Green supply chain management can only be achieved if all the supply chain stages go green. The greener practices are implemented the more they will play a significant part in environmental protection. This research discusses the green practices implemented in an organization and the effects of overall supply chain management. The results showed positive impacts however, it also necessitates the requirements of some concrete strategies to align the supplier's end with organizational green objectives.

After all the data collection and testing procedures, it has been analyzed that green production is highly affecting environmental performance in different manners and contributing more towards green supply chain management. However, green purchasing needs attention as the suppliers of raw materials (generally SMEs) are lacking competency or are least bothered by their green practices.

Similarly, the logistics part especially the transportation sector needs to be aligned with some adequate strategies by the organizations. The most important finding is that majority of the respondents agreed that green supply chain management improves the corporate image. This realization must turn into a driving force for improvements in the organizations so as to achieve optimum results and to improve the overall environment and benefit the organizations and the society by implementing green practices in the end-to-end supply chain.

5.2. Recommendations

The results of the study demonstrate the effects of green practices in overall supply chain management and subsequent impacts on environmental performance. In order to further improve these effects and to ensure the optimum implementation of green practices following are recommended:

Organizations need to take their suppliers onboard on environmental policies and green initiatives.

Organizations may also constitute a small team of professionals to provide a viable solution to their suppliers and provide support with the help of their experiences and practices to the utmost extent.

Suppliers' eligibility criteria should be reviewed and some specific clauses with respect to green practices be part of it. For example, compliance with ISO 9001 (Quality Management System) and ISO 14001 (Environmental Management System).

Awareness and training sessions must be arranged with suppliers to align them with the organizational strategies for green practices.

Industry-academia collaboration needs to be in place. Green practices should be part of courses so that fresh professionals must aware of the necessity of environmental protection and could utilize their learning to turn into best industry practices. Viz-a-viz industries should invest in academia to promote green practices and encourage ideas and initiatives for the betterment of climate control.

Paperless environment should be encouraged and enforced within the organization as well as with the external stakeholders.

Alternate energy resources should be explored and adopted to decrease the carbon footprint of the organizations.

Transportation functions need more attention and alternate fuels (electric trucks) are the best options, especially within the warehouses.

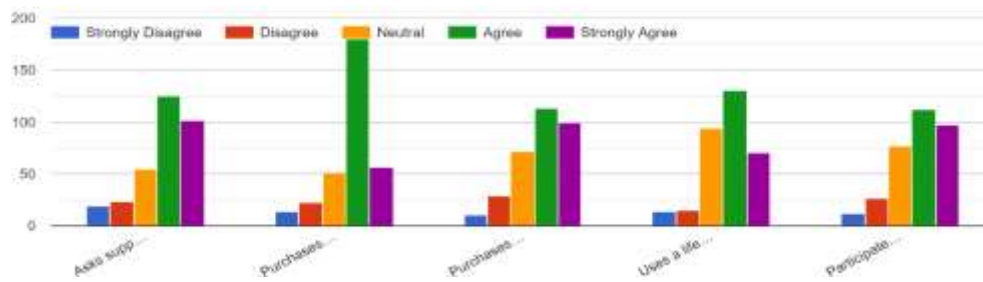
It goes without saying that green supply chain management would result in improving the corporate image of the organizations as well as boosting the confidence of customers in their respective products which would ultimately be beneficial for the organizations in long-term sustainability. It is sincerely hoped that this study and its recommendations would go a long way in improving the environment, reducing operational costs, helping the society, and gaining a competitive advantage.

5.3. Discussion

The findings obtained in the research are reliable as it is illustrated by the consistency of the scales that were obtained with the help of applying the Cronbach alpha technique of reliability. In responses that were obtained, the majority of the representatives of the organizations that participated in the research are related to supply chain management processes directly and are well aware of the practices being carried out in their respective organizations.

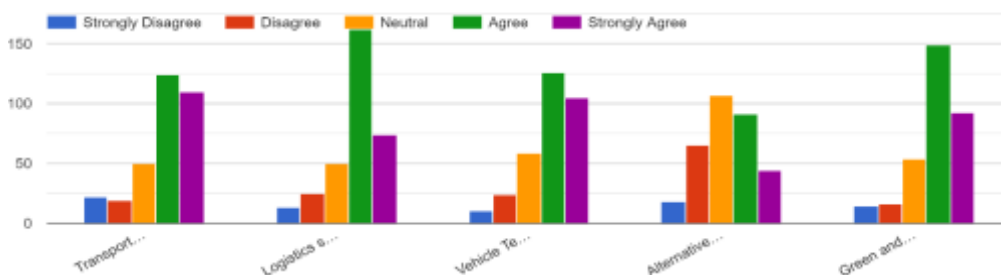
The study findings indicate that organizations have to work along with their suppliers and provide the necessary support to build their capacity for green practices. Respondents remained neutral in a few questions related to green procurement practices in their respective companies which shows that this is an opportunity for improvement. The below chart is self-explanatory in this regard.

Green Procurement



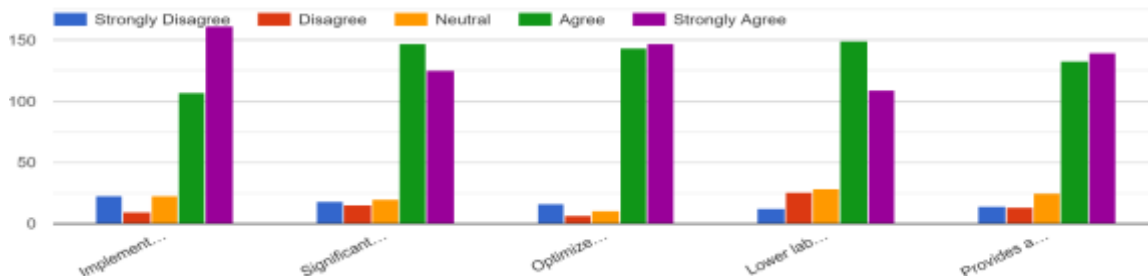
A similar situation was noted in green logistics where respondents remained either disagree or neutral in answering alternate fuel utilization or using the electric truck for transporting goods. The results show that organizations are mostly using traditional logistics and other alternate options are yet to be explored. Since there are a number of organizations using 3rd party logistics and it becomes more challenging for them to ensure efficient and environmental-friendly logistics. The below chart explains the findings.

Green Logistics



Based on the responses received it is evident that green practices in production functions are the major contributor to green supply chain management. The below chart indicates the green practices in production function within the organization which means organizations are committed to reducing wastages, optimizing resources and energy, and improving overall productivity. Furthermore, ISO compliance of 9001 and 14001 is another helpful tool that provides opportunities for continuous improvements.

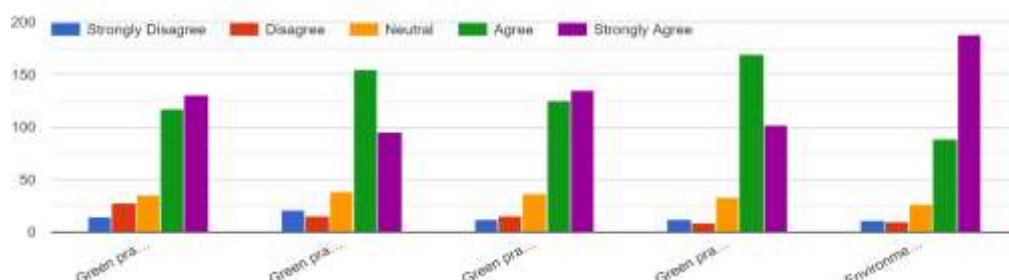
Green Production



Most of the respondents agreed that green practices in different stages of supply chain management help in achieving desired output reducing overall wastage and improving efficiency, optimizing the cost of the finished product, and improving corporate image.

The above results prove the hypothesis that green procurement, green production, and green logistics have a positive impact on supply chain management and improve the performance of the end-to-end supply chain and provide immense benefits to the organization. The below chart is self-explanatory pertaining to the responses received against the questions of GSCM.

Green Supply Chain Management (GSCM)



References

- Achieving a sustainable future in consumer goods | McKinsey. (2022, December 1).
- Al Masri, R., & Wimanda, E. (2024). The Role of Green Supply Chain Management in Corporate Sustainability Performance. *Journal of Energy and Environmental Policy Options*, 7(2), 1-9.
- Ali, A., & Audi, M. (2016). The Impact of Income Inequality, Environmental Degradation and Globalization on Life Expectancy in Pakistan: An Empirical Analysis. *International Journal of Economics and Empirical Research (IJEER)*, 4(4), 182-193.
- Aslam, M. M. H., Waseem, M., & Khurram, M. (2019). Impact of green supply chain management practices on corporate image: Mediating role of green communications. *Pakistan Journal of Commerce and Social Sciences (PJCSS)*, 13(3), Article 3.
- Audi, M., & Ali, A. (2018). Determinants of environmental degradation under the perspective of globalization: a panel analysis of selected MENA nations. *Journal of Academy of Business and Economics* 18 (1), 149-166.
- Creazza, A., Colicchia, C., Spiezia, S., & Dallari, F. (2021). Who cares? Supply chain managers' perceptions regarding cyber supply chain risk management in the digital transformation era. *SupplyChain Management: An International Journal*, 27(1),
- Darwish, S., Shah, S., & Ahmed, U. (2021). The role of green supply chain management practices on environmental performance in the hydrocarbon industry of Bahrain: Testing the moderation of green innovation. *Uncertain Supply Chain Management*, 9(2),
- de Souza, E. D., Kerber, J. C., Bouzon, M., & Rodriguez, C. M. T. (2022a). Performance evaluation of green logistics: Paving the way towards circular economy. *Cleaner Logistics and Supply Chain*, 3, 100019.
- Du, G., & Li, W. (2022). Does innovative city building promote green logistics efficiency? Evidence from a quasi-natural experiment with 285 cities. *Energy Economics*, 114, 106320.
- Emodi, S. A. (2019). Analyzing the Nexus between Energy Consumption, CO2 Emissions, and Economic Growth in Nigeria. *Journal of Energy and Environmental Policy Options*, 2(3), 84-94.
- Fandel, G., Kleine, A., & Dellnitz, A. (2020). Editorial "sustainable decision-making in production and logistics." *Journal of Business Economics*, 90(9).
- Fritz, M. M. C. (2022). A supply chain view of sustainability management. *Cleaner Production Letters*, 3, 100023.
- Hashmi, S. D., & Akram, S. (2021). Impact of green supply chain management on financial and environmental performance: Mediating role of operational performance and the moderating role of external pressures. *LogForum*, 17(3).
- Homayouni, Z., Pishvaei, M. S., Jahani, H., & Ivanov, D. (2021a). A robust-heuristic optimization approach to a green supply chain design with consideration of assorted vehicle types and carbon policies under uncertainty. *Annals of Operations Research*.
- Imam, H., Rahman, M. H., & Ali, M. H. (2022). Contributions of Green Supply Chain Management on Perceived Firm Performance: An Empirical Investigation of the FMCG Industry in Bangladesh. *International Journal of Science and Business*, 11(1).
- Imran, C. A. B., Shakir, M. K., & Qureshi, M. A. B. (2021). Regulatory Perspectives on AI in Autonomous Vehicles Global Approaches and Challenges. *The Asian Bulletin of Green Management and Circular Economy*, 1(1), 62-74.
- Imran, C. A. B., Shakir, M. K., & Qureshi, M. A. B. (2022). Applications of Artificial Intelligence in Enhancing Construction Safety and Productivity. *The Asian Bulletin of Big Data Management*, 2(1), 63-74.
- Imran, C. A. B., Shakir, M. K., Umer, M., Imran, Z., & Khalid, H. B. (2023). Construction Materials and Technologies: A Review of New Trends in Sustainable Development. *The Asian Bulletin of Green Management and Circular Economy*, 3(1), 10-21.
- Imran, C. A. B., Shakir, M. K., Umer, M., Imran, Z., Idrees, H. M. K. I., Ansari, Y., Imran, M., & Tariq, M. A. (2024). Building the Future: Applications of Artificial Intelligence In Civil Engineering. *Metallurgical and Materials Engineering* 30 (4), 733-42.
- Jazairy, A., von Haartman, R., & Björklund, M. (2021). Unravelling collaboration mechanisms for green logistics: The perspectives of shippers and logistics service providers. *International Journal of Physical Distribution & Logistics Management*, 51(4).
- Junaaid, M., Zhang, Q., & Syed, M. W. (2022a). Effects of sustainable supply chain integration on green innovation and firm performance. *Sustainable Production and Consumption*, 30, 145-157.
- Ker[en]Xin, W., Sen, Y. K., & Rajendran, S. D. (2019). A study on the benefits of eco-friendly packaging on sustainable supply chain management in fast moving consumer goods industry. *E3S Web of Conferences*, 136, 04092.
- Khanh Chi, N. T. (2022). Driving factors for green innovation in agricultural production: An empirical study in an emerging economy. *Journal of Cleaner Production*, 368, 132965.
- Končar, J., Marić, R., Vukmirović*, G., & Vučenočić, S. (2021). Exploring Pro-Environmental Behaviour in FMCG Supply Chain. *Tehnički Vjesnik*, 28(6).
- Kotikov, J. (2015a). Geographic information system modelling of freight transport and logistics in Saint Petersburg, Russia. *Proceedings of the Institution of Civil Engineers - Civil Engineering*, 168(5).
- Krieger, B., & Zipperer, V. (2022). Does green public procurement trigger environmental innovations? *Research Policy*, 51(6).
- Lee, C., Lim, S., & Ha, B. (2021). Green Supply Chain Management and Its Impact on Consumer Purchase Decision as a Marketing Strategy: Applying the Theory of Planned Behavior. *Sustainability*, 13(19).
- Leiper, Q. J., Riley, P., & Uren, S. (2000a). The environmental challenge for supply-chain management. *Proceedings of the Institution of Civil Engineers - Civil Engineering*, 138(6).
- Lerman, L. V., Benitez, G. B., Müller, J. M., de Sousa, P. R., & Frank, A. G. (2022). Smart green supply chain management: A configurational approach to enhance green performance through digital transformation. *Supply Chain Management: An International Journal*, 27(7).
- Life Cycle Assessment. (2001b). In *Sustainable use of new and recycled materials in coastal and fluvial construction* (pp. 173-185). Thomas Telford Publishing. <https://doi.org/10.1680/suonarmicafc.29507.bm05>
- Lim, C., Yusoff, S., Ng, C. G., Lim, P. E., & Ching, Y. C. (2021). Bioplastic made from seaweed polysaccharides with green production methods. *Journal of Environmental Chemical Engineering*, 9(5).

- Limjaroenrat, V., & Ramanust, S. (2023). Green Marketing Tools and Consumer Behavior: Exploring the Influence of Eco-Brands and Environmental Advertising on Purchasing Decisions. *Journal of Energy and Environmental Policy Options*, 6(4), 33-42.
- Liu, H.-C., & You, X.-Y. (2021). Green Supply Chain Management. In H.-C. Liu & X.-Y. You (Eds.), *Green Supplier Evaluation and Selection: Models, Methods and Applications* (pp. 1–11).
- Mangla, S. K., Kusi-Sarpong, S., Luthra, S., Bai, C., Jakhar, S. K., & Khan, S. A. (2020). Operational excellence for improving sustainable supply chain performance. *Resources, Conservation, and Recycling*, 162, 105025.
- Moedinger, F. (2003a). Recycling and reuse of waste materials as raw materials within the framework of integrated product policy ipp. In *Recycling and Reuse of Waste Materials* (pp. 117–126). Thomas Telford Publishing.
- Mohsin, A. K. M., Tushar, H., Abid Hossain, S. F., Shams Chisty, K. K., Masum Iqbal, M., Kamruzzaman, Md., & Rahman, S. (2022). Green logistics and environment, economic growth in the context of the Belt and Road Initiative. *Heliyon*, 8(6), Article
- Mojumder, A., Singh, A., Kumar, A., & Liu, Y. (2022). Mitigating the barriers to green procurement adoption: An exploratory study of the Indian construction industry. *Journal of Cleaner Production*, 372, 133505.
- Moreira, A. C., Ribau, C. P., & Rodrigues, C. da S. F. (2022a). Green supply chain practices in the plastics industry in Portugal. The moderating effects of traceability, ecocentricity, environmental culture, environmental uncertainty, competitive pressure, and social responsibility. *Cleaner Logistics and Supply Chain*, 5, 100088.
- Mungkung, R., Sorakon, K., Sitthikitpanya, S., & Gheewala, S. H. (2021b). Analysis of green product procurement and ecolabels towards sustainable consumption and production in Thailand. *Sustainable Production and Consumption*, 28, 11–20.
- Nehdi, M. L., & Soliman, A. M. (2013). Novel green roofing membrane system made with recycled leftover paint. *Green Materials*, 1(4).
- Ofori Antwi, B., Agyapong, D., & Owusu, D. (2022). Green supply chain practices and sustainable performance of mining firms: Evidence from a developing country. *Cleaner Logistics and Supply Chain*, 4, 100046.
- Ogunlela, B. (2018). Green supply chain management as a competitive tool in the fast-moving consumer goods manufacturing industry. *Journal of Business & Retail Management Research*, 12.
- Ojo, E., Mbohwa, C., & Akinlabi, E. (n.d.). *Green supply chain management in developing countries*. 9. *Assessment of climate extremes in future projections downscaled by multiple statistical downscaling method over Pakistan*. (2022 December, 1).
- Raj, M., Fatima, S., & Tandon, N. (2021). Effects of the features of a green sound-absorbing material on its acoustical properties. *Green Materials*, 9(1).
- Rane, S., Thakker, S., & Kant, R. (2020). Stakeholders' involvement in green supply chain: A perspective of blockchain IoT-integrated architecture. *Management of Environmental Quality: An International Journal*, ahead-of-print.
- Renukappa, S., Akintoye, A., Egbo, C., & Suresh, S. (2016). Sustainable procurement strategies for competitive advantage: An empirical study. *Proceedings of the Institution of Civil Engineers - Management, Procurement and Law*, 169(1).
- Rosano, M., Cagliano, A. C., & Mangano, G. (2022). Investigating the environmental awareness of Logistics Service Providers. The case of Italy. *Cleaner Logistics and Supply Chain*, 5, 100083.
- Saluy, B., & Nuryanto, W. (2023). Green Competitive Advantage in Indonesia's Chemical Manufacturing. *Journal of Energy and Environmental Policy Options*, 6(4), 1-11.
- Searles, C., & Vaux, C. (2004). Briefing: Developing a sustainable market for recycled glass. *Proceedings of the Institution of Civil Engineers - Engineering Sustainability*, 157(3).
- Sharma, M., Luthra, S., Joshi, S., Kumar, A., & Jain, A. (2022). Green logistics driven circular practices adoption in industry 4.0 Era: A moderating effect of institution pressure and supply chain flexibility. *Journal of Cleaner Production*, 135284.
- Shi, Y., Lin, Y., Lim, M. K., Tseng, M.-L., Tan, C., & Li, Y. (2022). An intelligent green scheduling system for sustainable cold chain logistics. *Expert Systems with Applications*, 209, 118378.
- Singh, U., & Kumar, K. (2023). Exploring the Interconnection Between Anthropogenic Activities and Greenhouse Gas Emissions: An Empirical Study. *Journal of Energy and Environmental Policy Options*, 6(4), 43-53.
- Skhirtladze, S., & Nurboja, B. (2019). Exploring the Environmental Kuznets Curve Hypothesis: Deforestation, Trade, and Economic Growth in Pakistan. *Journal of Energy and Environmental Policy Options*, 2(2), 48-56.
- Sourani, A., & Sohail, M. (2013). Enabling sustainable construction in UK public procurement. *Proceedings of the Institution of Civil Engineers - Management, Procurement and Law*, 166(6).
- Sustainable inventory management for a closed-loop supply chain with energy usage, imperfect production, and green investment. (2022). *Cleaner Logistics and Supply Chain*, 4, 100055.
- Usman, H. M. (2022). *Impact Of Green Supply Chain Management Practices On Environmental Performance* (No. 3). 21(3), 3.
- Wakhid, A. (2022). Sustainable inventory management for a closed-loop supply chain with energy usage, imperfect production, and green investment. *Cleaner Logistics and Supply Chain*, 4, 100055.
- Wang, X., & Dong, F. (2022). The dynamic relationships among growth in the logistics industry, energy consumption, and carbon emission: Recent evidence from China. *Journal of Petroleum Exploration and Production Technology*.
- Wang, Z., & Manopimoke, P. (2023). Exploring the Interplay Between Supply Chain Dynamics and Organizational Culture in Green Practices Adoption: A Study of Thailand's Hospitality Sector. *Journal of Energy and Environmental Policy Options*, 6(4), 21-32.
- Zhang, A., Hartley, J., Wang, Y., & Wang, S. (2022). Special issue Editorial: Logistics and supply chain management in an era of circular economy. *Transportation Research Part E: Logistics and Transportation Review*, 166, 102911.
- Zheng, M., Li, Y., Su, Z., Fan, Y. V., Jiang, P., Varbanov, P. S., & Klemeš, J. J. (2022). Supplier evaluation and management considering greener production in manufacturing industry. *Journal of Cleaner Production*, 342, 130964.