Adoption of Green Supply Chain Practices in Agriculture Exports - An Analysis of Key Influencing Factors

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ABSTRACT - A key strategy for promoting sustainability, boosting competitiveness, and satisfying international environmental norms is the use of green supply chain strategies in agricultural exports. The main determinants of green supply chain management (GSCM) adoption in agricultural export industries are examined in this study. It analyses factors like stakeholder pressure, market demand for environmentally friendly products, regulatory frameworks, and technical breakthroughs. The barriers that are explored include high implementation costs, limited access to green infrastructure, and low levels of technical expertise. The report highlights that capacity- building programs, as well as business collaboration and government incentive, can all help overcome these challenges. These findings underscore the need for a comprehensive approach that encompasses both economic viability and environmental sustainability to ensure the growth of agricultural exports in a sustainable manner. The growing body of scientific on green logistics is incorporated into this study, which provides useful recommendations to parties, businesses & governments on ways to heighten environmental performance in international agribusiness supply chains.

Keywords: Environmental Sustainability, Green supply chain management (GSCM), Government incentives, Green Infrastructure, Regulatory framework, environmentally friendly products.

I. INTRODUCTION

One of the primary factors of both economic expansion and food security is the global agriculture sector. The environmental effects of agriculture, such as greenhouse gas emission, deforestation, and resource misuse, have drawn special attention to agricultural production and exports. Businesses may cut environmental damage and still make money by implementing green supply chain management (GSCM) strategies. Sustainable manufacturing, processing, distribution, and exporting methods must all be incorporated into green supply chain adaption. For agricultural exports to adapt to this shift, economic shifts brought about by more stringent environmental laws, growing consumer demand for sustainable products, and international market scrutiny are essential. Considering the possibility of benefits, a number of related problems affect the use of green supply chains in agricultural exports. In addition to market conditions, technology advancements, infrastructural awareness, and regulatory frameworks, there are financial and expertise-related limitations. Understanding these problems is essential to creating workable solutions that balance stakeholder interests and improve sustainability. This study looks at the factors that encourage, restrict, and limit the adoption of green supply chains in agricultural exports in order to give governments, corporations and industry leaders relevant data. Global food security and economic growth depend on agricultural commodity exports. However, the negative effects on the environment, such as waste generation, resource depletion, and greenhouse gas emissions, are calling into question sustainability. One strategy to reduce environmental impact and maintain competitiveness in the global market is to implement green supply chain practices, or GSCPs. These initiatives include waste reduction, energy efficiency, carbon footprint reduction, and sustainable purchasing. Despite the well-recognised advantages of GSCPs, the agricultural export industry finds it difficult to implement them effectively. Adoption is frequently hampered by a lack of experience, poor infrastructure, financial limitations, regulatory restrictions, and resistance to change. Moreover, the complexity of the industry, which includes a wide range of factors, make implementing green practices more challenging.

II. REVIEW OF LITERATURE

- **Jing Zhang, Shizhen Bai and Na Xu (2020)** China has worked hard to support the impressive of green

agriculture. A marketing-mix program that includes both preselling and spot selling of green agricultural products has become more and more popular worldwide in recent years. This study improves the dynamic pricing of the seller of green agricultural products during the preselling and spot selling periods by taking into account the driving effects of premium green agricultural products in supermarkets and the difference in product valuation between preselling and spot selling consumers. The seller may decide to cut the spot selling price and increase the preselling price in light of the findings.

- **Jing Wang, Mingfei Liu, Yun Chen and Mengyun Yu (2023)** Disasters caused by nature and the COVID-19 pandemic have caused significant problems, including long-term interruption and an effect on the global supply chain. Because of the fact that many greenhouse gases are contributing to global warming, there is now a greater emphasis on environmental sustainability in society. The results show that environmental regulations and government-sponsored financial incentives have a major role in strengthening green supply chains for agricultural products.

- **Tudor El Andrei, Bogdan Oancea and Andreea mirica (2022)** This study looks at how much the agri-food products exports have increased in Romania and Bulgaria, two countries in eastern Europe, since they joined the EU. Probability is used to determine the agri-foods variability product exports by category, and it assesses the effects of changes on the range of agri-food product exports regarding the dynamics of the volume of agri-food product exports for these two countries. The results indicate that it is impossible to ensure a consistent increase in agri-food product exports due to Romania's high export concentration on a small number of agri-food product categories, the majority of which involve agricultural raw materials.

- **Pagalla Bhavani Shankar, M. Babu Reddy, Yarlagadda Divya Vani (2023)** Due to involvement of unethical middlemen, the cost of agricultural products is constantly rising these days, and even farmers are not receiving enough compensation for their goods. Implementing a supply chain for agricultural products is the aim of this study.

- **Haiyan Shan, Chen Zhang and Guo Wei (2020)** This research utilizes three pricing models to both analyze changes in the optimal degree of green manufacturing of complementary commodities and the supply chain participants ideal earnings. Although the retailer's preferred strategy is complex, the results indicates that two manufactures generally favor the pure bundling pricing strategy. Green manufacturing can help one product complementary manufacturing level, but it can also hinder the development of its complementary products optimal green manufacturing level.

OBJECTIVES

- To construct a factor analysis model to understand the relationship between various elements influencing the green supply chain.

- To examine government policies and advanced technologies for promoting green supply chain adoption in agriculture exports.

- To analyse the significant differences in the adoption of green supply chain practices among agriculture exporters based on different factor

III.   RESEARCH METHODOLOGY

All of the methods and strategies used to locate and analyse data related to a particular research topic are together referred to as "research techniques." It is the process by which researchers organise their investigations to meet their objectives while utilising the selected research instruments. It encompasses all of the essential components of research, including the study's framework, data collection and analysis methods, and overall research design.

• **Research design:** Analytical and descriptive research designs

• **Study area:** Coimbatore District

• **Method of sampling:** Simple Random Sampling

• Primary and secondary data are collected; the sample size is 50.

• **Analysis tools** include, Factor analysis, and simple percentage analysis.

IV.   DATA ANALYSIS AND INTERPRETATION

TABLE 1: SHOWING THE SIMPLE PERCENTAGE OF YEAR OF EXPERIENCE

S. No	Particulars	Frequency	Percentage
1	Less than 5 years	7	14.0
2	5-10 years	8	16.0
3	11-15 years	16	32.0
4	More than 15 years	19	38.0

INTERPRETATION

from the above table, only 14% of people have less than 5 years of experience, which suggests that beginners and early-career professionals are not included. The category appears to have a moderate amount of mid-career professionals, as seen by the slightly higher percentage 16% with 5–10 years of experience. A sizable percentage 32% of the group falls into the 11–15-year range, showing that a big section of the group is made up of

experienced workers who have worked in the area for more than ten years. The largest group 38% is composed of people who have worked for more than 15 years, suggesting that the group is primarily composed of highly experienced professionals.

TABLE 2: SHOWING THE SIMPLE PERCENTAGE OF SIZE OF THE ORGANIZATION

S. No	Particulars	Frequency	Percentage
1	Less than 50 employees	15	30.0
2	50-100 employees	14	28.0
3	101-150 employees	10	20.0
4	More than 150 employees	11	22.0

TABLE 3: SHOWING THE SIMPLE PERCENTAGE OF ANNUAL TURNOVER

S. No	Particulars	Frequency	Percentage
1	Up to 20 lakhs	11	22.0
2	21-40 lakhs	15	30.0
3	41-60 lakhs	13	26.0
4	More than 60 lakhs	11	22.0

INTERPRETATION

The above table indicates a majority, 30% have fewer than 50 employees, Businesses with 50– 100 workers come in second at 28%, Meanwhile 20% of businesses fall within the 101-150 employees range, while 22% of employees are more than 150 people Overall, the results show that although smaller companies (less than 100 employees) account for 58% of the distribution, larger companies (more than 100 employees) still make for an important 42%, suggesting that a balanced range of company sizes is represented.

INTERPRETATION

The above information shows how businesses are distributed according to their financial scale or revenue. The majority of enterprises operate within this mid-level financial category, as seen by the highest number (30%) falling between the 21–40 lakh range. Closely behind, 26% of businesses generate between 41 and 60 lakhs in revenue, indicating a significant number of higher-earning organisations. In this period, 22% of firms fall into the Up to 20 lakh and more than 60 lakh categories, indicating a fair presence of both smaller and larger enterprises.

TABLE 4: SHOWING THE SIMPLE PERCENTAGE OF EXPORTING COUNTRIES

S. No	Particulars	Frequency	Percentage
1	United State	6	12.0
2	Bangladesh	12	24.0
3	China	9	18.0
4	United Arab	4	8.0
5	Emirates	8	16.0
6	Indonesia	8	16.0
5	Others	3	6.0

INTERPRETATION

TABLE 5: SHOWING THE SIMPLE PERCENTAGE OF TYPES OF AGRICULTURE PRODUCTS

S. No	Particulars	Frequency	Percentage
1	Non-basmati rice	6	12.0
2	Basmati rice	7	14.0
3	Spices	11	22.0
4	Tea	4	8.0
5	Pulses	10	20.0
6	Fruits and vegetables	12	24.0

The distribution of businesses by their nation of origin is seen in the above data. With 24% of the total, Bangladesh has the most representation, suggesting that there are many companies from this nation. China comes in second with 18%, making an important contribution as well. Indonesia and the United Arab Emirates each have a 16% share, which shows their significant involvement. 12% of the total, indicating a moderate presence. The Others category, encompassing various additional countries, makes up 6% In general, the data indicates that companies have multiple nations, with Bangladesh at the top, followed by China, the United Arab Emirates, and Indonesia, indicating a varied global business environment

INTERPRETATION

The distribution of various agricultural products is shown by the statistics. With the largest percentage 24%, fruits and vegetables show a high level of supply or demand in this area. With 22%, spices come in second, highlighting their important position in the market. Pulses have a significant presence, accounting for 20%. The significance of basmati and non-basmati rice in the

agriculture sector can be seen by their individual contributions of 14% and 12%. At 8%, tea has the least percentage.

FACTOR ANALYSIS

TABLE 6: TOTAL VARIANCE

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	6.139	30.696	30.696
2	2.946	14.730	45.426
3	2.907	14.537	59.964
4	1.600	8.000	67.963

INTERPRETATION

It was noted from the table that the EIGEN values are provided by the "Initial Eigen Values" label. The "Total Variance" attributable to a factor is indicated by its EIGEN Value. It was discovered from the total of squared loadings extracted from the

- 30.696% of the variance, or 6.139, was explained by the I factor.

- 2.946, or 14.730%, of the variance was explained by the II component.

- 2.907, or 14.537%, of the variance was explained by the III component.

- The IV factor was responsible for 8.000% of the variance, or 1.600.

		Rotated Component Matrix				
		Component				Grouping Names
		1	2	3	4	
S17	Online resource and tools provide valuable support for my export business	.949				Navigation
S14	Finding reliable logistics providers is a challenge for my export business	.853				
S13	Tariffs and trade restrictions are a significant barrier to exporting agriculture products	.852				
S12	I am satisfied with the current export regulations and procedures	.840				
S16	In order to satisfy consumer needs and enhance their brand image, agriculture exporters are encouraged to adopt green supply chain strategies.	.828				
S15	Currency fluctuations have a significant impact on my export business	.735				
S1	Government policies have been effective in promoting the adoption of green supply chain practices in the agriculture export		.882			Green supply chain Adoption
S7	facing challenges in implementing sustainable supply chain practices due to limited resources		.861			
S2	Adopting green supply chain practices has improved company's compliance with environmental regulations		.839			
S3	The market for sustainable and environmentally friendly agriculture products is growing rapidly		.808			
S4	Customers are willing to provide feedback and suggestions on how we can improve our green supply chain practices		.710			
S10	Agriculture exporters are encouraged to implement green supply chain strategies by consumer awareness and the need for eco-friendly products.		.651			

S11	Exporting agriculture products has been a profitable venture for my business			.721		
S8	exploring new technologies and innovations to improve sustainability performance			.910		
S9	Agriculture exporters decisions to adopt green supply chain methods are heavily influenced by environmental regulations.			.871		**Sustainability**
S6	Demand for agriculture products produced sustainably is rising on a worldwide scale			.781		
S5	The adoption of new technologies and innovations has improved the efficiency and sustainability of our supply chain operations			.768		
S18	I plan to increase my export sales over the next 12 months				.775	
S19	I have clear understanding of the export regulations and procedures for agriculture products				.743	**Regulatory Framework**
S20	Company provides training and development programs to educate employees on sustainable practices				.543	
	Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.					
	a. Rotation converged in 5 iterations.					

INTERPRETATION

1. **Navigation** - The factor analysis highlights key challenges and supports in the export business. Online resources (0.949) are crucial for market insights and logistics, while finding reliable logistics providers (0.853) remains a major issue. Tariffs and trade restrictions (0.852) significantly impact agricultural exports, though some exporters are satisfied with current regulations (0.840). Green supply chain strategies (0.828) enhance brand image and meet consumer demands. Currency fluctuations (0.735) also pose financial risks. These insights underscore the main areas of concern and support for exporters in global trade.

2. **Green supply chain Adaption -** Key motivators and obstacles to implementing green supply chain practices in agricultural exports are highlighted by the factor analysis. Although resource constraints (0.861) continue to be a barrier to implementation, government initiatives (0.882) have been successful in advancing sustainability. Improved commitment to environmental rules (0.839) benefits businesses that use green practices, and the market for sustainable products is expanding quickly (0.808), which further encourages adoption. Because they provide suggestions for enhancements, customer involvement (0.710) is important. Furthermore, exporters are encouraged to adopt green methods by customer awareness and demand for eco-friendly products (0.651). These observations highlight the need for sustainable agricultural exports to strike a balance between market possibilities, regulatory assistance, and operational difficulties.

3. **Sustainability** - Significant aspects of agricultural export profitability, sustainability, and regulatory impact are highlighted by the factor analysis. Exploring new technologies and innovations (0.910) is the biggest indicator, suggesting a substantial focus on increasing sustainability performance. Environmental laws (0.871) have a significant impact on exporters' choices to use green supply chain practices. This change is also influenced by the rising demand for agricultural goods made carefully across the world (0.781). Adopting new technology has also improved the sustainability and efficiency of the supply chain (0.768). These findings imply that innovation and adherence to regulations are essential for sustaining long-term performance in the sector, even while exporting agricultural goods is still profitable (0.721)

4. **Regulatory Framework** - Key elements of corporate expansion, regulatory knowledge, and sustainability training in agricultural exports are highlighted by the factor analysis. Confidence in market potential is shown by a strong aim to grow export sales (0.775). Clear comprehension of export laws and processes (0.743) indicates that exporters are knowledgeable, which helps promote efficiency and compliance in global trade. Although sustainability is acknowledged, there can be gaps in staff education, as seen by the comparatively lower factor loading of training and development programs on sustainable practices (0.543). All things considered, these observations

point to the necessity

V.   FINDINGS OF THE STUDY

- 38% of the respondents are have more than 15 years of experience

- 30% of the respondents are have less than 50 employees in their company

- 30% of the respondents have an annual turnover between 21-40 lakhs

- 24% of the respondents export their products to Bangladesh

- With the largest percentage 24%, fruits and vegetables show a high level of supply or demand in this area.

- 30.696% of the variance, or 6.139, was explained by the I factor.

- 2.946, or 14.730%, of the variance was explained by the II component.

- 2.907, or 14.537%, of the variance was explained by the III component.

- The IV factor was responsible for 8.000% of the variance, or 1.600.

VI.   SUGESSTION

Due to global trade and sustainability, explore focused on key areas such as technological advancements, market demands, and legal frameworks. Analyse the effects of international environmental standards, governmental laws, and certifications like global G.A.P or organic labels on the adoption of green practices in agricultural exports. Consider how supply chains may become more sustainable with the use of technologies like precision farming, blockchain for tracking and environmentally friendly packaging It's also crucial to look at market variables including consumer preferences for eco-friendly products, pressure from global consumers, and financial incentives for eco- friendly supply chain operations. It may be essential to discuss topics including the financial impacts, opposition to change, and infrastructure challenges in emerging nations. Comparing effective green supply chain models across top agricultural exporting nations may provide valuable information and best practices for broader implantation. This study may conclude with suggestions on how of improved sustainability training programs, regulatory availability, and expansion. lawmakers, supply chain participants, and exports may enhance sustainability without compromising their ability to compete in international markets.

VII.   CONCLUSION

To sum up, achieving international standards, maintaining environmental sustainability, and boosting market competitiveness all depend on the use of green supply chain techniques in agricultural exports. The examination of important influencing elements reveals that consumer preferences, technology developments, and regulatory requirements all have a big influence on the adoption of green supply chains. Sustainable practices may increase production, profitability, and long-term resilience, as shown by successful models from top agricultural exporters,

despite ongoing obstacles such high implementation costs, opposition to change, and infrastructural problems. Participants must make investments in eco-friendly technologies, improve legal frameworks, and promote corporation among governments, corporations and farms in order to promote adoption. Countries can improve their standing in global trade and reduce their environmental effect by putting sustainable practices into place.

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