Impact of Green Supply Chain Practices on Sustainability in Sri Lankan Tea Export Sector: A Systematic Literature Review

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Abstract *- GSCM is one of the most crucial strategies that incorporate sustainability into operational and production practices. Based on this premise, the given systematic literature review examines how the key GSCM practices influence sustainability in Sri Lanka's tea export sector. This review identifies synthesized findings from various studies that the adoption of GSCM has led to a significant improvement in economic sustainability through a reduction in operational costs of up to 20%-and enhancing the ability of market competitiveness. In this regard, environmental concerns contribute by reducing resource consumption by up to 30% as waste is generated, promoting sustainable production processes. Socially, GSCM advances good labor practices and strengthens community involvement in the pursuit of better working conditions, improving relationships between the producers and local communities. With all these advantages, however, GSCM in the Sri Lankan tea export sector faces fluctuating global market prices, effects of climate change, and persistent labor shortages. These challenges are indicative that strategic interventions of the government to support and collaborate in the industry do become urgent to enhance sustainability. This review also points out one important limitation in relying on secondary sources of data and emphasizes that there is a dire need for empirical research to enhance the evidence base to provide actionable insights for policymakers and stakeholders. In sum, this literature review underlined that GSCM played a vital role in the advancement of sustainability within the tea export sector and in providing a competing position of the industry in a global market for long-term viability in sustainability.*

Keywords: Eco-Design, Green Supply Chain Management Practices, Green Procurement, Green Manufacturing, Green Distribution, Reverse Logistics, Sustainability, Tea Export Sector in Sri Lanka.

I. INTRODUCTION

The position of the tea industry globally is important economically, culturally, and since its ancient roots in China. Today, tea is considered the second most consumed drink in the world after water. It is made from a plant called Camellia sinensis. The varieties and flavors of this beverage are remarkable and well-known in cultures across different regions or continents. The various steps in the production process include cultivation, harvesting, processing, and packaging. It is performed at different levels of industries concerning small farmers to multinational companies further adding to the complexity of the industry. The major producing countries of China, India, Kenya, and Sri Lanka hold the dominant market share with a combined share of 86.5% of the total world tea production. Industry is an integral part of the economies of the countries and a significant source of livelihood for millions of people, where local and national economies are heavily dependent on their exports.

Notwithstanding all the various investments that go into the national exchequer, the industry has a host of environmental challenges that underpin the urgent need for sustainability practices in biodiversity conservation and climate action. Recent reports indicated that tea-growing nations are increasingly battling sustainability concerns like soil degradation, pesticide overuse, and water scarcity worsened by climate change.

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Confronted with the mentioned challenges, there is a need to comprehensively analyze the challenges facing the tea industry while it explores prospects of growth and sustainable development strategies. It must adapt to the growing change in consumer preference towards products sourced and produced ethically. These are admittedly environmental issues that need to be taken up collectively by all stakeholders in tea production and export, focusing their attention on innovative practices that duly consider environmental responsibility, coupled with economic viability.

The tea industry in Sri Lanka is the second-largest earner of foreign exchange and offers direct employment to approximately 15% of all those employed. It is a largely plantation-driven industry, though increasingly complemented by and in certain cases supplanted by smallholdings, adding further to its general resilience. (Jayaratne et al., 2011). In Sri Lanka, however, there are significant threats linked to the sustainability of tea production. Sri Lanka includes various types and grades including black, green, white, and specialty teas such as Ceylon tea. (Thasfiha et al., 2020).The obvious impacts on the environment, including soil erosion, deforestation, and water pollution, pose very serious risks to the ecosystem and productivity of tea farms. Secondly, changes in consumer preference increasingly call for the reassessment of supply chain practices. With the pressing global concerns for sustainability worsening, businesses in the exportation of tea must turn their production operations to follow green practices that would meet regulatory demands and those set by environmentally conscious consumers.

A critical case study of the Sri Lankan tea industry cannot only be merited by the rich historical background; rather, it is an important economic player. The trick now lies in how GSCM practices apply effectively to better environmental, social, and economic sustainability. It is a range of strategies that are directed at reducing the environmental impact of supply chains by enhancing social equity while fostering economic growth. This involves sustainable sourcing, efficient production with a reduction in energy, a decrease in waste output, and environmentally friendly packaging. Most tea producers are informed of this; however, challenges in GSCM implementation involve regulatory hurdles, constrained resources, and unsatisfactory stakeholder involvement. Equally important is learning how such obstacles could be overcome to facilitate the adoption of GSCM practices that will ensure the sustainability and competitiveness of the Sri Lankan tea sector within an increasingly eco-conscious global market.

The study will try to explore how GSCM practices can be effective in driving sustainability in the Sri Lankan tea export sector. Specific objectives of the present research are to assess current practices based on a critical analysis of existing supply chain operations and locate scope for improvement in sustainable performance; discuss the implementation of GSCM techniques concerning issues such as sustainable sourcing of tea, energy-efficient production methods, strategies relating to waste reduction, and environmentally friendly packaging solutions. A further aim of this research is to establish how such practices are useful in their application towards the reduction of environmental degradation while maintaining compliance with increasingly variable legislation, meeting consumer requirements, and enhancing competitive advantage. The study will also discuss how GSCM practices can help social sustainability in terms of equality of labor standards, a better working environment, and the development and empowerment of the local communities involved in the tea industry. The overall findings from this study will be very useful in developing better ways of improving sustainability practices among tea producers, exporters, and policymakers. By building resilience and competitiveness in the Sri Lankan tea industry, this research contributes to the more general discussion of

sustainable agricultural methods and their consequences for economic development, environmental stewardship, and social justice. (Muma et al., 2014).

II. METHODOLOGY

First, a systematic literature review is embedded in primary data collection to assess the impacts of GSCM practices on sustainability in Sri Lanka's tea export sector. The review will be done stringently based on the PRISMA framework. A systematic literature review was done through available database facilities such as Google Scholar, Emerald, ScienceDirect, ResearchGate, and Web of Science. Some of the keywords used in the study include "Green Supply Chain Management," "sustainability," "Sri Lanka tea export," "environmental sustainability," and "economic sustainability." The selection criteria were worked on within the last years that discussed GSCM practices in agriculture and focused on the tea industry. Only peer-reviewed journals, industrial reports, and authentic case studies were considered for the study. Therefore, those studies not focusing on GSCM or sustainability in the tea sector, non-peer-reviewed articles, and all non-English language publications were excluded.

Thematic analysis for the selected literature is performed to reach major trends in the economic, environmental, and social sustainability of GSCM practices. These included a review of the literature for familiarization, coding of significant themes, and the development of recurring themes related to operational cost reduction and waste management. Primary data analysis on common perceptions of GSCM practices amongst the stakeholders is based on interviews and surveys. This comparative analysis provided a glimpse into how good the GSCM practice is in the tea sector of Sri Lanka compared to other tea-producing countries.

Present research combines the existing review of the literature with primary data and thereby provides a wide-ranging picture of obstacles and opportunities that may exist for GSCM practices amongst Sri Lankan tea exporters, hence useful insights relevant to policymakers and industry leaders. A general in-depth review of the existing literature has been conducted in this research study to evaluate how green supply chain management (GSCM) practices impact the sustainability of the Sri Lankan tea export sector. Following the deductive research approach data have been enriched with theoretical frameworks, empirical evidence, other methodologies, and case studies drawn from the major tea-exporting countries: Sri Lanka, India, China, Kenya, and Bangladesh.

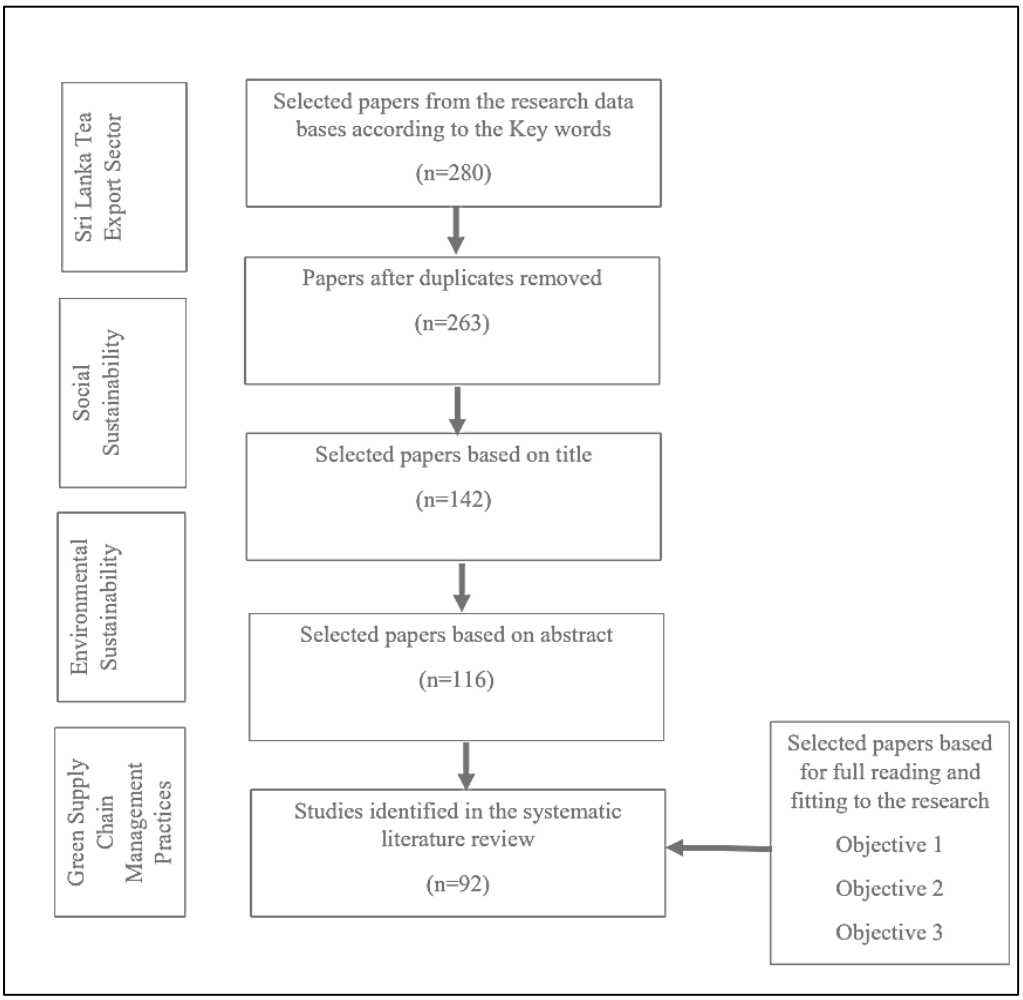
Thematic analysis was the foremost method of synthesizing reports for a better realization of the recurrent themes from the GSCM practices of the various green tea industries. The quality of data was assessed using stringent criteria, considering the inclusion of valuable, impact data. This literature review focuses on these areas and tries to give some practical insights for policymakers and industry captains who wish to learn how effectively strategies for sustainability can be driven by GSCM practices in the global tea export market.

III. LITERATURE REVIEW

Over the past years, studies have increased on Green Supply Chain Management as the emphasis on sustainability continues to gain momentum. On the other hand, GSCM practices in establishing sustainability within the tea export industry remain vague. The literature review seeks to assess previous research in GSCM, especially the part that dwells on GSCM practices within the tea export sector. It thus investigates some of the green practices like sourcing sustainably, waste reduction, and energy efficiency

considering their impacts on the economic, social, and environmental dimensions of sustainability. On this ground, this review identifies critical gaps in the current knowledge base and underlines the need for further research tailored to global contexts. Such insights can be used to optimize GSCM practices for better sustainability outcomes within the tea export sector.

Figure 1. Article Selection and Exclusion Process as per PRISMA Checklist



Source: Authors' compilation.

A. Green Supply Chain Management

Green Supply Chain Management includes environmental thinking in supply chain management activities. From the perspective of sustainability, the impact of GSCM in the tea export sector revolves around the adoption of environmental practices in supply chain operations. According to Abu Seman (2012), even though GSCM is getting broad coverage and being adopted globally, there is a striking deficiency of research studies in developing countries, particularly in the context of the tea industry. This lack of focused studies is therefore indicative of the need to develop localized research to address these special challenges facing tea exporters.

Lerman et al. (2022) Discuss that digital transformation enables GSCM; thus, technology can help extensively to improve green performance in the supply chain of the tea industry. However, few studies have been conducted about the level of digital adoption in developing countries. Limited infrastructure and low digital literacy might cause impediments to implementation, especially among smallholder producers. According to Chin et al. (2015), environmental collaboration between manufacturers and suppliers is among the most crucial factors for sustainability in the export tea sector. Therefore, this approach can also guarantee superior benefits; in any case, certain areas of specific obstacles, as reported in the literature, are not fully developed, such as confidence-building measures and dissemination barriers.

As such, Maaz et al. (2023) report a positive correlation between GSCM practices and organizational performance, hence inferring that the tea exporters could enhance efficiency and competitiveness. The direct causative relationships between GSCM and improvement in performance would, however, require further studies since most studies discuss issues of correlation rather than causation. Tanwer et al. (2014) confirm the shift toward GSCM driven by regulatory pressures and consumer demand for sustainable products. This is a truism: different markets may have variant consumers; thus, differing expectations call for tailored approaches to elicit effective responses. The literature supports that there is a potential contribution of GSCM toward enhanced sustainability within the tea export sector, though it also points out certain gaps in the literature that need further research. Precisely, an exploratory study on how digital transformation, barriers to collaboration, and variations in consumer expectations can help or hinder the contributions that GSCM can make is expected to help derive a comprehensive understanding of its impact.

B. Green Supply Chain Management Practices in the Tea Industry

GSCM will be a significant strategy to advance sustainability in the tea export industry. Nguyen and Le (2020) Indicate how GSCM could raise international cooperation and improve firm performance and thus might constitute a potential synergy for tea exporters. Yildiz Çankaya and Sezen (2019) Have also focused on green purchasing-manufacturing for economic, ecological, and social sustainability and thus may help to accord with global standards related to the production of tea. However, neither of these two works has given particular importance to the challenges posed by the tea sector, especially in developing regions. Che Razak and Ibrahim (2020), identify a lapse in the application of GSCM in the tea industry, and identify a would-be adoption that is facing limited practice. Moenga (2016), identifies in Kenyan SMEs, some operational challenges, including resource constraints, but stresses that GSCM has the potential to enhance efficiency along the supply chain if these barriers are addressed. Studies on Kenyan tea factories highlight how GSCM contributes to the achievement of SDG, particularly SDG 9. On the contrary, Ashoka et al. (2023) Report that regulatory constraints and low awareness are some of the barriers affecting the adoption of GSCM among SMEs in Sri Lanka. This calls for the consideration of region-specific approaches to GSCM implementation.

In this respect, Saxena and Arya (2024) Compare GSCM practices in the B2B and B2C sectors and bring consumer-driven demand for sustainability to the fore. Works like those by Zhaolei et al. (2023) and Mishra and Bhakay (2021) Introduced green innovation and institutional pressures within manufacturing. While relevant to creating competitiveness in the tea sector, their focus is on manufacturing, so there are still certain gaps regarding agriculture-based industries such as tea. Even though GSCM can

undoubtedly lead to better sustainability and performance in the tea industry, knowledge gaps persist in how regional challenges and policies affect its success. Further research should focus on the development of a framework that precisely addresses the specific needs of such a system and induces the concept of sustainability within the tea export industry.

1) Green Procurement: Green procurement, thus, holds prime importance for attaining sustainability in the tea export sector. According to Amemba et al. (2013), the focal point of GSCM is on the conservation of resources with minimal environmental impacts, an important aspect for industries reliant on natural materials, as in this case, tea. Shaharudin et al. (2021) add to this that technological tools such as ERP were able to optimize green procurement during the COVID-19 period, showing a chink in the armor of preparedness against global disruptions. Whereas both studies stress the importance of GSCM, are more focused on how such frameworks need to be more resilient against external shocks. Anane, (2020), emphasized that green procurement tends to benefit most organizations' performance but is mostly plagued by high costs and a lack of management support. This therefore elaborates on the need for collaboration among suppliers to overcome such barriers. On the other hand, in the apparel industry in Sri Lanka Dassanayake and Amarasena (2021), established that more technological innovation is facilitated when companies engage in process-based rather than product-based procurement. This would imply that, in an industry that is still product-based in procurement methods, such as tea export, the full innovation potential has not been realized. These comparative studies show that procurement processes would create more sustainable outcomes, but this approach is not yet well used within the tea industry.

Mohamad Bohari and Xia (2015) Observed a disconnection of policy design and implementation concerning Malaysia's construction sector, which faces the same problem as experienced in the tea export industry, where there is no presence of policy enforcement or adapting policies. Ortega et al. (2015), presented an integrated systematic model of green procurement. However, it does not apply to the Tea sector because of region-specific issues and challenges, and therefore adaptable and context-specific frameworks are highly necessary.

Overall, while GSCM practices contribute to better performance and greater innovation, there is also the need for continuous implementation and alignment at the strategic level. More specifically, barriers overcome through greater collaboration are necessary. Although progress has taken hold, considerable gaps persist in the formulation of region-based frameworks and in integrating policy. The discontinuity between policy formulation and its actual practice, particularly in the context of the tea export sector, about GSCM guidelines calls for further research. The review has pointed out certain thrust areas of future research, particularly in the formulation of frameworks suiting the specific conditions of the tea export industry more aptly.

2) Green Manufacturing: Green manufacturing is related to waste minimization and energy saving by the usage of environmentally friendly materials to have lesser environmental impact, assure better operational cost efficiency, and meet social responsibilities. Green manufacturing has become more important in Sri Lanka's tea export industry due to enormous tests against its sustainability. Jayarathne et al. (2020) Highlight the fact that renewable energy source panels and wide usage of energy-efficient technologies reduce environmental impacts and operational costs. This view is supported

by Sezen and Çankaya (2013), who show that green manufacturing enhances both ecological and social performance, responding to the call for international sustainability benchmarks. Despite these benefits, there are still some obstacles to its adoption. For instance, Paul et al. (2014) Have pointed out that high start-up costs and the need for special knowledge have posed a big challenge, especially to small-scale tea producers. Liang (2019) Suggests that CE would help in utilizing resources effectively and decrease waste, but the application of this model is still largely unexplored in Sri Lanka's Tea industry, thus calling for research.

There are also calls by Rehman and Shrivastava, (2013) for an integrated green manufacturing framework to ensure that implementation procedures are standardized across industries. According to Ghinmine and Sangotra, (2015), supportive legislation and consumer demand for such products are the two major driving forces behind the wider diffusion of green manufacturing. However, the lack of region-specific regulations addressing the sector of tea export encumbers the adoption process and hinders progress toward sustainability goals. D'Angelo et al. (2023), indicate that there is a sort of 'U-shaped' curve between green manufacturing investments and economic performance, where the level of investment must be balanced with a focus on maximizing profit while preserving the environment. Yet there is little indication of what "optimal" investment levels are for tea producers, serving only to heighten the need for practical, industry-specific guidelines. Though these studies pinpoint the role of green manufacturing for sustainability, some gaps need to be addressed, especially those regarding the development of region-specific strategies and usable guidelines that can be practically implemented. It is addressing such gaps that will be important in enhancing economic and environmental sustainability for Sri Lankan tea exporters and their alignment with global sustainability objectives.

3) Eco -Design: Eco-design is essential in promoting sustainability relevant to green supply chain management. Abdullah (2019) It finds wide application among Malaysian manufacturers and is more focused on green purchasing practices. Chepkoech et al. (2023) Note that while Eco-design enhances sustainable performance in Kenyan multinational tea firms, its level remains very limited; hence, regional differences exist in its effectiveness. Thamsatitdej et al. (2017) confirm that Eco-design is structurally crucial for sustainable supply chains, while Knight and Jenkins, (2009) and Vallet et al. (2013) Have signaled the problem of adapting Eco-design tools for industries. That means that there was a problem with adapting Eco-design to practical use for different sectors. Younis et al. (2016) Establish that at best, Eco-design can improve environmental performance in industries, while Erin and Jinjuan, (2015) Establish the adoption of cognitive frameworks as being important in the development of pro-environmental behavior and increase in uptake. This shows a disconnect between what Eco-design can achieve, theoretically, and the practicality of its application.

Boson et al. (2023) related Eco-design to improved organizational performance in the tea export sector, but challenges that take into consideration specific regions and their integration with other green practices were not discussed. These gaps are important and need to be addressed for regionally fitted strategies to achieve an optimal contribution of Eco-design in supply chains.

4) Green Distribution: Green distribution is a critical part of Green Supply Chain Management (GSCM) and plays a vital role in enhancing sustainability in the tea export

sector. Ajayi et al. (2021) demonstrate how green distribution improves environmental and operational performance in Nigerian SMEs, thus pointing toward its role in improving efficiency. The fact that it improves competitiveness and performance in the food and horticulture industries, according to Mwaura et al. (2016) and Kariuki et al. (2022), would indicate similar benefits in the tea sector. From this viewpoint, Deqqaq and Abouabdellah (2016) highlighted how green distribution networks must be optimized to balance economic and ecological goals. In their work, though, there is no region-specific guideline, which is of essence for transformation into practice on industries such as the Sri Lankan export industry in tea production. This indicates that what is needed is an implemented approach that is customized based on the prevailing conditions.

Panya et al. (2021) observe that two of the major enablers that have been critical in accomplishing the green distribution of merchandise, such as sugar and oil products, are regulatory support and policy alignment, respectively. This means that tea exportation regulatory frameworks are inadequate. Indeed, without regulations in place, the uptake of green distribution may be minimal across many industries that are at the center of pressure to enhance their standards for sustainability. Such wider benefits of green distribution systems in industries such as construction were presented by Gikonyo et al. (2022) and, therefore, raise a question as to whether their approaches can also be applied to tea exports. However, these studies do not develop how regional or sector-specific factors affect the implementation of green distribution in agriculture. While green distribution enhances sustainability and efficiency, several challenges are still associated with regulatory gaps and the absence of region-specific strategies that need to be effectively attended to. Future research will be required to develop policies and frameworks with a view to ensure proper integration of green distribution into the supply chain of tea exports.

5) Reverse Logistics: Reverse logistics is a key component of Green Supply Chain Management (GSCM), crucial for sustainability in the tea export sector. Mutingi (2014) identifies the potential of reverse logistics to improve environmental, social, and economic performance and goes further to demonstrate that strategic investments ensure rewarding long-term results. How such findings relate specifically to sectors such as tea, which has its characteristic logistic challenges, remains to be seen. Similarly, Sheu (2008) illustrates how reverse logistics can reduce environmental risks and costs within complex industries like nuclear power, but how far it may be applied to less regulated industries like tea is not clear. Arroyo et al. (2023) noted that reverse logistics contributes significantly to the attainment of sustainable development goals, but the deficient infrastructure with a corresponding lack of regulation remains one of the major barriers to proper implementation, especially in emergent markets. Richnák and Gubová (2021) establish that reverse logistics improves customer relations and corporate social responsibility in the automotive industry in Slovakia, though financial constraints prevent wider diffusion. This reflects challenges from the tea sector, where small-scale producers may have problems covering the costs of reverse logistics systems.

Mogeni and Kiarie (2016) illustrate how reverse logistics enhances supply chain performance among Kenyan multinationals and thus might also be helpful to tea exporters. Sector-specific issues, such as fragmented supply chains and differences in producer capacity, make the application of reverse logistics more complex in the context of the tea sector. While reverse logistics has promising potential to change the face of supply chains, in the tea export business, much is still pending in terms of cost and regulatory support issues. Such gaps in this sphere need to be rectified for them to have a full impact on

sustainability and long-term resilience. This, therefore, calls for focus in the future when researchers are devising context-specific strategies that could help overcome the identified barriers.

C. Sustainability in the Tea Export Sector

Sustainability in the tea export industry is crucial because of the economic importance and environmental issues in most countries. Tea farming is labor-intensive, and that usually forms some small-scale livelihoods in most developing countries; sustainability would thus become important. Poor working conditions and low wages have been characterizing the sector with significant environmental degradation (Van der Wal, 2008). Zhang et al. (2024) emphasize that 'LCT adoption could promote carbon sequestration with a simultaneous reduction of fertilizer, pesticide, and non-renewable energy'. In contrast, Zaid et al. (2018) point out that GHRM needs to be integrated into practices on GSCM for effective sustainability and may also require an integrative approach for its effectiveness. Jayaratne et al. (2011) further mention that Sri Lanka emphasizes sustainability in supply chain management by innovating in risk management and technology. Another one is Das (2009), who claims that the Indian tea industry faces extreme threats from the economic downturn and climate change, thus still indicating challenges by region, which require different approaches. While Ahammed (2012), urges more investments in the Bangladeshi tea industry toward improving productivity and sustainability, Shrestha (2014) urges building relationships with stakeholders and developing policies on sustainable agriculture within its Nepalese tea commodity chain. Both support collaboration but fail to provide concrete ways of implementing it. Owuor et al. (2007) claimed that within Kenya, small-scale tea producers need production technologies that have their basis in research findings. However, Owuor et al. further indicated a research gap in how these technologies can be adopted in effective ways within local contexts. Collectively, these studies identify holistic GSCM practices that have the potential to enhance the sustainability and competitiveness of the global export sectors in tea. However, studies still have lacunae on exact implementation challenges that persist in varied regions. Therefore, these areas need to be addressed in developing strategies that make the industry resilient.

1) Environmental Sustainability in the Tea Export Sector : Environmental sustainability is crucial for addressing climate change, pollution, and biodiversity loss in the tea sector. It concerns the quality of tea as well as a healthy ecosystem. According to Ziaul and Shuwei (2023) Environmental initiatives, though important, are generally too costly and thus often have adverse impacts on economic performance. The same concern is echoed by Gatimbu et al. (2018), who point out that investments in environmental efficiency are vital to the long-term viability of the Sri Lanka tea industry, regardless of these costs. For this, government incentives in the form of subsidies and tax exemptions will be crucial in minimizing the financial burdens of such green practices. Lee et al. (2022) Waste-to-energy incineration as a green alternative to landfills could further reduce the environmental footprint of the tea sector in Sri Lanka. However, this technology requires further inquiry regarding long-term community effects.

Green innovations have become important for achieving a low carbon dioxide emission rate (Pachiyappan et al., 2022). The authors recommend that Sri Lankan producers will have to adapt to green innovations to be more sustainable and competitive, though resistance to such adaptation may arise because of pre-existing organizational

culture. This indicates a change in mindset by organizations in bringing improvement in environmental performance and thus may be useful for tea exporters. Hermawan et al. (2023) said that supportive regulations and eco-innovation hold the key to improved environmental performance and hence need support from the government. Brundage et al. (2018) proposed smart manufacturing and IoT technologies to integrate design and manufacturing processes with substantial benefits for Sri Lankan producers. However, Oláh et al. (2020) identify certain challenges in the implementation of Industry 4.0 technologies and gaps between potential benefits and practical application of the very same technology. Equally relevant is the green innovations training program on waste management and advancement of technology that will help foster a sustainable future for Sri Lanka's tea industry. However, there was still a need to identify certain gaps related to problems in implementing the strategies, which relate to poor available funds and infrastructure. Identifying these gaps will help to produce viable strategies to attain sustainability in the tea export sector.

2) Social Sustainability in the Tea Export Industry of Sri Lanka: Social sustainability is a central perspective in sustainable development and focuses on those capacities that societies would have to develop to ensure, for present and future generations, a better quality of life. It aims at fostering inclusive and equitable societies for the harnessing of shared benefits of economic growth. Social sustainability initially received little attention compared to ecological and economic concerns but was later considered critical for holistic development. Vallance et al. (2011) identify three dimensions of social sustainability as follows: "development sustainability" refers to the concerns of basic needs and social justice; "bridge sustainability" is that which is linked to the change in behavior necessary for the attainment of environmental objectives; and "maintenance sustainability" preserves sociocultural identities against the forces of change. Of these, identification can be of particular importance for reviewing social sustainability in Sri Lanka's tea export industry.

In the tea industry, these issues of urban inequality, displacement, and accountability are crucial, especially in upgrading conditions for the most vulnerable workers. Romero and Stahre (2019) mention how social sustainability is far to come amidst technological and demographic changes; enabling work contexts to acquire skills is needed. The enactment of such provisions may remain partial, thus drifting from the theoretical. Kamalakkannan et al. (2020) discussed labor shortage and workforce migration and integrated solutions that bring together environmental and social initiatives. However, results do not illustrate how these solutions can be tailored to the specific challenges that Sri Lankan tea growers are facing, thus indicating a need for localized research. Eizenberg and Jabareen (2017) suggest an equity-safety-resilience frame that might help guide socially minded approaches for the Sri Lankan tea sector. Ferreira et al., (2023) outline that digital technologies also enable big data analytics and AI to improve working conditions. However, the gap in digital literacy among smallholder farmers is one of the barriers to their effective implementation. Munasinghe et al. (2017) focus on labor practices and gender relations as significant social issues and suggest that longer-term education, equitable trade arrangements, and involvement of the stakeholders are necessary. These suggestions may sound attractive; however, their implementations can differ from place to place. Despite these insights, important knowledge gaps remain on how these frameworks could be applied to the tea sector in Sri Lanka. More systematic research is needed to find the main human-caused barriers to social sustainability and,

equally, the innovative practices that guarantee equity and a certain quality of life. Success in social sustainability in the tea sector would set a model for balancing economic growth with social well-being and thus would set the course toward a more sustainable industry.

3) Economy Sustainability in the Tea Export: Economic sustainability is crucial for the long-term success of Sri Lanka's tea export sector, balancing economic growth, environmental protection, and social welfare. According to Spangenberg (2005), economic sustainability is indispensable in society since it is a social, environmental, and institutional variable. This therefore calls for a balanced approach in the tea industry in Sri Lanka. Experiences from China show that even when domestic tea consumption may be lucrative, environmental hazards come along with it. Xu et al. (2021) highlighted the increasing resource efficiency and renewable energy in the Sri Lankan tea industry. Conversely, Hami et al. (2015) manifest that a sustainable manufacturing process integrated with process innovation contributes much to economic performance, thus arguing that similar strategies might be adopted by Sri Lankan exporters.

Basiago (1998), explains holistic planning in the context of urban sustainability based on some principles, which could inspire adaptive policies in Sri Lankan tea plantations. In promoting economic sustainability, Doane and MacGillivray (2001) an overview of the challenges entailing managing a triple bottom line, with a focus on brand management and intellectual capital for competitiveness. The works of Ahmed et al. (2018) establish how green supply chain management is well placed to improve both green and economic performance, stressing that there has to be appropriate leadership and supportive policies in place. In practice, though, the actual implementation of the policies might differ considerably, especially by scattered small-scale producers. Deka and Goswami (2021) suggest organic tea cultivation for Sri Lankan producers. Van Der Vossen (2005) explains how organic production can improve sustainability using best practices. The organic way of cultivation needs a more resource-consuming process, which in turn requires more support. The insights provided were indeed invaluable, but there are still gaps in how these strategies effectively could be put into practice within the specific socio-economic context of Sri Lanka. More research is needed to answer resource-access and innovative-practice adoption challenges faced by small-scale growers. Economic sustainability in the tea sector of Sri Lanka can thus be achieved only through a holistic approach: innovations must be combined with support for smallholders toward sustainable growth and equitable economic development.

D. Green Supply Chain Management and Sustainability in the Tea Export Sector

Sustainability in the tea export sector is important due to its enormous economic and ecological impacts. GSCM practices are supposed to reduce waste, emissions, and energy consumption along all levels of the supply chain, hence contributing to better performance of sustainability. Chin et al. (2015) Highlight that though environmental collaboration, internal environmental management, and green product design are important and have significant effects on sustainability, supplier selection and evaluation have less influence. The discrepancy thus indicates that nuanced variances in supplier engagement exist for maximum sustainability outcomes and may be an affirmation of how improvement in the realm of supplier relationships might bolster better effectiveness in GSCM practices. The preceding discussion can be supported by studies such as Ahmad et al. (2022), which exhibits that GSCM practices, within the spectrum of green manufacturing, green

purchasing, and Eco-design, offer a great deal of sustainability enhancement for industries such as textiles, automobiles, and tobacco. Inversely, Zaid et al. (2018) Also note that integration of Green Human Resource Management into GSCM has a positive impact on three dimensions: environmental, social, and economic sustainability. Though beneficial, this may not delve deeper into the challenges faced at industry levels, in this case, the tea export industry in Sri Lanka. This therefore means that it calls for tailored strategies that take into consideration the socio-economic and unique cultural contexts that surround the tea industry.

Thoo et al. (2013) continue to indicate that entrepreneurship can act as a moderator between GSCM practices and sustainability within the Malaysian manufacturing sector. Such findings have implications for pathways to innovation which might be applied across to Sri Lanka's tea industry. At the very same time, however, such findings are not known to apply within the Sri Lankan context - a concerning contradiction between general strategies of entrepreneurship and their actual effectiveness within specific agricultural contexts. Zaid and Sleimi (2023) note that TQM is a significant factor for developing countries in enhancing GSCM practices and business sustainability and requires strategies tailored to the prevailing local conditions. Among the options that can facilitate making the industry sustainable are green packaging, Eco-design, and recycling in the tea export sector. Evidence can be seen in the work of Thiro et al. (2023), as they illustrate at Nyerere County in Kenya. This comparison serves to illustrate the need for a more localized understanding of GSCM practices.

Moreover, the role of OCBE in moderating GSCM practices indicates that internal environmental engagement is particularly crucial. Highlighting the importance of environmental engagement within firms (Azam et al., 2022). In the Indonesian textile industry, green manufacturing, green design, green distribution, and Eco-design positively impact sustainable performance, emphasizing the broader relevance of GSCM practices across industries (Srisawat and Srisawat, 2020). Overall, comprehensive GSCM practices are vital for enhancing sustainability and competitiveness in the tea export sector and beyond. The table below summarizes indicators of the GSCM practices of count five and the dimensions of count three of the sustainability performance identified from the literature review.

Table 1. Summary of Literature Findings

Themes	Codes	Reference
Green Supply Chain Practices	• Green Procurement • Green Manufacturing • Green Design • Green Information Systems • Regulatory Compliance • Corporate Social Responsibility (CSR)	Nguyen and Le, (2020) Sezen and Çankaya, (2019) Che Razak and Ibrahim, (2020) Moenga, (2016) Duarte et al., (2023) Ashoka et al., (2023) Saxena and Arya, (2024) Zhaolei et al., (2023) Mishra and Bhakay, (2021)

Green Procurement	• Percentage of suppliers with environmental certifications (e.g., ISO 14001) • Use of environmentally friendly raw materials • Supplier adherence to environmental regulations and standards	Amemba et al. (2013) Shaharudin et al. (2021) Anane (2020) Dassanayake and Amarasena (2021) Mohamad Bohari and Xia (2015) Ortega et al. (2015)
Green Manufacturing	• Reduction in waste generation and resource consumption • Implementation of energy-efficient technologies • Use of renewable energy sources in production	Jayarathne et al., (2020) (Paul et al., 2014) Liang, (2019) Rehman and Shrivastava, (2013) Ghinmine and Sangotra, (2015) D'Angelo et al. (2023)
Eco – Design	• Incorporation of recyclable or biodegradable materials in product design • Design for disassembly (ease of recycling) • Reduction in material usage through efficient design • Lifecycle assessment (LCA) scores	Abdullah et al., (2019) Chepkoech et al., (2023) Thamsatitdej et al., (2017) Knight and Jenkins, (2009) Vallet et al., (2013) Younis et al., (2016) Erin F. and Jinjuan, (2015) Boson et al., (2023)
Green Distribution	• Reduction in the carbon footprint of logistics operations • Use of eco-friendly packaging materials • Adoption of fuel-efficient or alternative-fuel vehicles • Optimization of transportation routes to minimize environmental impact	Ajayi et al. (2021) Deqqaq and Abouabdellah (2016) Mwaura et al. (2016) Kariuki et al. (2022) Panya et al. (2021) Obiso et al. (2023) Gikonyo et al. (2022)
Reverse Logistics	• Volume of products returned for recycling or disposal • Efficiency of recycling processes • Rate of product refurbishment or remanufacturing • Cost savings from reuse and recycling initiatives	Mutingi, (2013) Sheu, (2008) Banguera et al., (2023) Richnák and Porubanová,(2021) Mogeni and Kiarie, (2016)
Sustainability	• Environmental Sustainability • Economic Sustainability • Social Sustainability	Van der Wal (2008) Zaid et al. (2018) Zhang et al. (2024) Jayaratne et al. (2011)

		Das (2009) Ahammed (2012) Shrestha (2014) Owuor et al. (2007)
Environmental Sustainability	• Reduction in greenhouse gas emissions • Conservation of water and energy • Biodiversity conservation efforts • Compliance with environmental laws and regulations	Shuwei, (2023) Gatimbu et al., (2018) Lee et al., (2021) Pachiyappan et al., (2022) Rajala et al., 2016) Hermawan et al., ((2023) Oláh et al., (2020) Brundage et al., (2018)
Social Sustainability	• Improvement in working conditions and labor rights • Community engagement and development initiatives • Health and safety standards for employees	Vallance et al., (2011) Romero and Stahre, (2020) Kamalakkannan et al., (2020) Eizenberg and Jabareen, (2017) Ferreira et al., (2023) Munasinghe et al., (2017)
Economic Sustainability	• Cost savings from sustainable practices • Increase in market share due to green branding • Long-term profitability and financial performance • Investment in sustainable technologies and practices	Spangenberg, (2005) Xu et al., (2021) Hami et al., (2015) Basiago, (1998) Doane and MacGillivray, (2001) Ahmed et al., (2018) Deka and Goswami, (2021) Van der Vossen, (2005)

Source: Author's Compilation.

IV. RESULTS AND DISCUSSION

The results of this research point out the different levels of GSCM practices adoption in the tea exporting sector in Sri Lanka, as supported by the literature. The first Sri Lankan tea export company in the world to achieve carbon neutrality for tea goods, demonstrating a strong commitment to sustainability. The company has been able to make strides in green manufacturing, green distribution, and green purchasing. It also adopts biodegradable packing materials like Tea Exports, employs an ISO 14001 certification, and places a high focus on the use of solar energy in the production unit, while effective waste and emission control is aided by incorporations of modern ERP technology. This argument is also supported by the literature, which states that green innovation has begun to be practiced in Sri Lanka's tea export industry. In similar studies, researchers such as Jayarathne et al. (2020) have advocated for the implementation of energy-efficient technologies as well as the use of renewable sources of energy. Most of the tea export businesses still face such issues as high costs of technology and aversion to risk even with the advancements.

Additionally mentioned the resource-intensive nature of personnel training and new machinery. This is an Observation of Nguyen and Le (2020) regarding the obstacles to implementation in underdeveloped countries. The interviews provide evidence that, over time, GSCM procedures have resulted in cost reductions, particularly through decreased energy and trash use. As an illustration, the use of the training of workers and preventative maintenance strategies have enabled tea-producing organizations to reduce waste, especially in the process of tea bagging. Furthermore, studies show that the design for the environment and green fabrication have the potential to enhance the profit margins of businesses in the long run by decreasing operational costs. Many companies have been able to reduce their environmental impact thanks to the creation of carbon-negative and plastic-neutral products. Instead, it places a strong emphasis on keeping an eye on emissions like noise and dust levels and making sure that all trash is handled responsibly.

According to Moenga (2016), GSCM can improve supply chain sustainability by making operational changes. The results indicate that GSCM practices are gradually becoming embedded in the operations of leading tea exporters in Sri Lanka, providing environmental, social, and economic benefits. These findings are highly relevant to the Sri Lankan tea sector, which is a crucial part of the country's economy. In the case of Sri Lanka, we have come to understand that green procurement incorporates the pedigree of the suppliers and their environmental friendliness. Both companies prefer suppliers who are attested by ISO 14001 and are certified by the Rainforest Alliance. This is in tandem with the literature; in this regard, Amemba et al. (2013) observe that green procurement practices help in attaining long-term sustainability, especially in industries such as tea, which rely heavily on raw materials. Even the incorporation of solar power and the use of energy-efficient machines in certain Sri Lankan tea export businesses bear witness to the role of energy management in GSCM. The development of renewable energy as explained in the interviews advances the green manufacturing literature, which argues that energy consumption must be cut down for economic and ecological sustainability.

The concepts of preventive maintenance and elimination of defects employed in the Sri Lankan tea exporting industry reflect the call by Rehman and Shrivastava (2013) for a single green manufacturing paradigm to ensure proper execution of the strategies. One of the constraints of the Sri Lankan tea industry concerning tea waste recycling is that the products themselves do not accommodate such systems. In Sri Lanka, some recycling of packaging materials occurs; reverse logistics for product returns is not feasible due to the food safety concerns in the tea industry. This corresponds to the findings of Mutingi (2014), who notes that reverse logistics faces particular challenges in food-related industries. The implications of these findings are very important for the Sri Lankan tea export sector. With the growing trend on the part of companies to implement GSCM, Sri Lankan tea could market itself as a sustainable green product in international markets. The success of Sri Lanka's green concept tea company is an example of how GSCM can be leveraged for a competitive advantage. Additionally, the way some companies have approached green logistics and eco-design for instance shows how investing in sustainable practices can bear fruit after some time.

V. CONCLUSION

In conclusion, the implementation of Green Supply Chain Management (GSCM) practices towards sustainability in the tea export sector is becoming more prominent, as shown in this detailed review. This study emphasizes the importance of GSCM as an integral component in promoting environmental, social, and economic sustainability in

the tea sector. In the modern world where consumer habits as well as global regulations are moving towards the adoption of environmental practices, GSCM can no longer be an option but rather a necessity in the tea export business. It is very clear from our analysis that GSCM activities such as sustainable sourcing, waste management, green production, and green purchasing, among others, tend to have positive effects on sustainability. These measures reduce the environmental impact of business activity and at the same time help in saving costs and improving efficiency. In addition to that, GSCM activities enhance social sustainability by ensuring safe work environments, ensuring justice in employment opportunities, and encouraging development in society- at large.

However, several limitations in the tea export industry prevent the full optimization of GSCM practices. Such limitations include expensive green measures, the absence of strong regulatory frameworks, and limited education among stakeholders. This challenge can be tackled only if there is togetherness among government, both national and regional, industry associations, and individual companies in making the environment more conducive for GSCM practices. Given its great economic and social values, the tea export sector makes a perfect example for an analysis of the effectiveness of GSCM practices. Practicing GSCM would not only be effective in assisting tea exporters to adhere to the existing sustainability requirements but would also help them address the recent increase in demand for tea. This study addressing these aspects in Sri Lankan exports is few, and there is an urgent need to fill this gap.

This research addresses these pertinent issues and very much complements the existing research on GSCM and tea in Sri Lanka especially; looking at the often-researched practices in emerging economies, very little has been explored about the sustainable supply chain management practices and their effects on the sustainability of the tea export sector in Sri Lanka which is the focus of this paper. So, this study not only expands the literature base concerning GSCM in Emerging economies but also offers practical implications for stakeholders in the related industry. The results provide a means for the tea sector in Sri Lanka to improve its sustainability performance hence aligning with the environmental objectives and enhancing competitiveness in the global market.

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