



Title: Impact of green supply chain management on organisational performance: A case study of an engineering company in Sri Lanka

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Degree: Master of Applied Management

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**Impact of green supply chain management on
organisational performance: A case study of an
engineering company in Sri Lanka**

by

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Student Declaration

“I, Beshani Ekanayake, declare that the Master by Research Project entitled “Impact of Green supply chain management on organisational performance; A case study of ABC company” is my own work and contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this project is my own work. The ideas presented are my own opinions and not necessarily those of Southern Institute of Technology”.

Signature: Beshani

Date: 25 October 2023

Abstract

This exploratory study investigates the impact of Green Supply Chain Management (GSCM) on the organisational performance of engineering manufacturing company in Sri Lanka, using a case study approach. The study chooses mix-method approach for data collection with combination of semi-structured interviews and secondary data analysis. This study mainly analysed company performance metrics pre- and post-implementation of GSCM practices was conducted. Finding suggest the significant positive correlation between GSCM and environmental performance. Except the green logistic all other GSCM practices positively correlation with OP. Financial gains were evident in reduced costs associated with resource use, environmental accident, and transportation. Non-financial benefits, such as enhanced brand reputation, increased stakeholder satisfaction, wining international orders were also observed.

The results underscore the potential benefits for engineering companies in Sri Lanka to incorporate GSCM practices. Besides tangible financial gains, embracing sustainable and green initiatives can contribute to building a stronger, more resilient, and more respected business model in the engineering sector. Further research could explore challenges and barriers to adopting GSCM to support businesses in transitioning to greener operations.

Keywords: Green supply chain management, green supply chain management practises, Environmental performance, Operational performance, Financial performance

Dedication

To my dear mother Mrs, Sriyani and father Mr. Weeraseana whose unwavering faith in my abilities served as a beacon of hope in my darkest moments. This work is a testament to your love, guidance, and sacrifice.

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List of Acronyms

COD	Code Of Conduct
CSR	Corporate Social Responsibility
EI	Engineering Industry
EP	Environmental Performance
EI	Engineering Industry
FP	Financial Performance
GSCM	Green Supply Chain Management
GM	Green Manufacturing
GP	Green Purchasing
GL	Green Logistic
GHRM	Green Human Resource Management
GIT	Green Information Technology
ISO	International Organisation for Standardisation
OP	Operational Performance
RBV	Resource-based Theory
RBV	Resource-based Theory
TBL	Triple Bottom Line

Chapter 1. Introduction

1.1 Introduction

Sustainable business practices are gaining popularity among researchers and practitioners worldwide. This has been caused by numerous environmental concerns, such as global environmental rules, greenhouse emissions, sustainable purchasing, and climate change (Lee, 2015, p. 42). Therefore, to address numerous environmental concerns and regulatory pressure, organisations are keen to introduce the word “Green” into their supply chain activities (Vachon & Klassen, 2008). Green supply chain management (GSCM) practices helps to reduce pollution and other environmental impacts by implementing processes, technologies, and systems in their supply chain (Vachon & Klassen, 2008). Companies are accountable for the environmental pollution resulting from their own operations as well as their suppliers, highlighting the necessity for environmentally sustainable supply chain activities. According to recent research, 70% of greenhouse gas emissions are accounted from the companies’ supply chain, and main activities involve energy consumed for heating, lighting, and transportation (“EDF”, 2023). Respectively this has been reported as 25% from electricity generation, 14% GHG emissions from transportation, and 21% from the manufacturing industry, especially from cement and chemical (“EPA”, 2014). Furthermore, the international energy agency reported emissions from Asia's emerging market and developing countries, excluding China, jumped quicker than any other region in 2022 (IEA, 2023). Apart from that, globalisation increased the use of natural resources and transitioned them to energy for industrial consumption. According to the data on world energy consumption, the usage of fossil fuels for global transportation increased from 15% in 1965 to 25% in 2020 (Rodrigue, 2020). Therefore, this has been highlighted as a major concern that should be considered. Therefore, as a solution for environmental sustainability GSCM) has become an essential topic in business than ever before.

Green supply chain management helps to reduce waste, pollution, natural resource usage, and emissions. Previous literature shows that the benefits of GSCM are not only

for the environment but also for organisational improvement (Bahjat et al., 2020; Green et al., 2012; Khan & Qianli, 2017; Mitra & Datta, 2014; Yu et al., 2014; Zaid et al., 2018). This has been proven by many success stories that have implemented GSCM practices in their supply chain. IKEA introduced 35% more energy-efficient LED bulbs named “SOLHETTA” to reduce climate footprint, equivalent to saving 45,000 tons of CO₂ per year. By introducing this eco-design to the market, IKEA achieved 69.3 million sales. Ford increased their use of sustainable resources, with a focus on plastics, battery recycling, and responsible procurement to reduce landfill waste and consume fewer natural resources. As a renewable material, Ford introduced the use of soy foam, which has saved 5 million pounds of petroleum yearly since 2008 (Ford, 2023), and it saved approximately \$4.5 million (Noria, n.d). As such, GSCM is a win-win situation for both environmental and organisational.

However, greening the supply chain is not an easy task. It may require financial support, human resources, knowledge, and expertise. According to Zhu et al. (2005, p. 464), there are some internal barriers to implement GSCM, such as a lack of appropriate tools, managerial skills, and expertise, and, most likely, a lack of an economic justification in terms of performance. For example, Ford spent more than \$26 million to develop energy-efficient technologies at multiple North American manufacturing facilities, and they may be unable to recover installation costs within a short period (Ford, 2023). Another major problem is dealing with several parties to identify and execute the best GSCM practices. The numerous pieces of the literature showed that some parties drive GSCM implementation, such as government and legal parties, and policymakers; therefore, efficient communication and collaboration are required (Cahyono et al., 2020; Sajjad et al., 2020; Zhu et al., 2005; Zhu et al., 2007). Moreover, internal barriers such as lack of knowledge, expertise, training and assistance within the organisations are another obstacle to GSCM implementation (Mojumder & Singh, 2021, p. 12). Therefore, GSCM implementation is becoming increasingly difficult, and enterprises must comprehend the process's complexity and required knowledge.

1.2 Statement of the problem

The major problem that has motivated this research study is the lack of understanding and knowledge of GSCM practices in the Sri Lankan context. According to Jayarathna (2016, p. 16) the adoption of GSCM in Sri Lankan manufacturing organisations is still in the initial stage. Exploring the benefits that GSCM can provide to the manufacturing organisation has been studied by many researchers in developed and developing countries (Bahjat et al., 2020; Cahyono et al., 2020; Green et al., 2012; M. T. Khan et al., 2022; Khan & Qianli, 2017; Teixeira et al., 2016; Zhu et al., 2012). However, in the Sri Lankan context, relatively few research on the manufacturing industry have been undertaken, and there is no literature in engineering manufacturing company (Herath & Rajumesh, 2022; Priyashani & Gunarathne, 2021). Therefore, this research is to address the literature gap by addressing How GSCM impact on organisational performance on light engineering manufacturing company.

Light engineering manufacturing company is fast growing industry in Sri Lanka with a US \$275.76 million export value in 2022. However, it is also one of the greatest greenhouse gas emissions, and a heavy user of these natural resource in Sri Lanka. According to the data from CO2 country profile, Sri Lankan annual production-based CO2 emissions was 20.78 million tons in 2021, and it shows an upward trend (Ritchie & Roser, 2020). Therefore, it is crucial for the manufacturing industry to address this problem and develop a solution to reduce environmental effects while enhancing company performance. The major goal of applying GSCM practises is to improve environmental performance as evaluated by decreases in wastewater waste, solid waste, air emissions, and toxic material use (Green et al., 2012, p. 291). Nevertheless, there is a concern about whether the company will gain a competitive advantage or raise its profit or margin. Therefore, it is required to identify whether adopting environmentally friendly practices leads to an equitable outcome for supply chain partners or a compromise between environmental and economic nature.

Therefore, to determine whether GSCM practises increase organisational sustainability while also boosting organisational performance, this research is centred on

a single case study. This is an exploratory research design which is based on both qualitative and quantitative data. The chosen company (ABC) is a Danish-based light engineering manufacturing firm operating in Sri Lanka for over a decade. The key manufacturers include LPG gas machines and equipment that serve as a global energy solution. The data for the study will be collected from two main methods, interview, and document. This research mainly focuses on three performance variations of the organisation over six years, i.e., environmental performance, operational performance, and financial performance. The research will conclude whether GSCM impacts organisational performance by analysing changes in organisational performance before and after implementing GSCM.

1.3 Significance of the study

The overarching goal of this research is to determine the influence of GSCM practises on organisational performance. The findings of the study would contribute to the existing body of knowledge regarding GSCM practises and their impact on organisational performance. Sri Lanka is a developing country, and the second main economic contribution is industry. According to the statistical data, the industry contributed 29.79% of GDP in 2021 to Sri Lankan economic growth (Statista, 2023). Therefore, if the benefits of GSCM are discovered, firms will be able to improve their organisational efficiency, which may contribute to increased economic growth.

Furthermore, according to Jayarathna (2016, p. 16) the global market is demanding eco-friendly products and processes. Sri Lanka, like many other countries, is concerned about environmental degradation, climate change, and social responsibility (Ministry of Environment, n,d). Adopting GSCM practises demonstrates a commitment to long-term sustainability, which can aid in the development of stronger relationships with stakeholders and the community. Hence, GSCM implementation would help to achieve an international reputation. Therefore, by identifying a well-defined GSCM strategy aligned with the organisation's value, goals, and long-term sustainability objective organisations can increase their market value. Therefore, this study could benefit practitioners in implementing GSCM practises.

Moreover, this study provides how different GSCM's impact organisational performance in terms of environmental, financial, and operation. GSCM practises frequently result in cost savings through improving resource utilisation, waste reduction, and energy efficiency (Sahoo & Vijayvargy, 2021, p. 880). Organisations can gain operational efficiency and save money on energy, water, and raw materials by optimising operations and embracing sustainable solutions. Therefore, this would help industrial managers to make informed decisions on their organisation to improve their sustainability to gain competitive advantage, leading to increased market share and customer loyalty. When it comes to the literature of GSCM, there is only a few studies have been done in the Sri Lankan context, and many of them were focused on apparel manufacturing (Priyashani & Gunarathne, 2021; Susitha & Nanayakkara, 2023) and tea manufacturing industry (Jayaratne et al., 2011). Therefore, this study would supplement to engineering manufacturing industry to consider the adoption of GSCM.

There are several reasons that GSCM is related to applied management; one of the reasons is that the practical application of management principles and procedures to solve real-world business difficulties and improve organisational. GSCM is a combination of supply chain management and environmental sustainability and focuses on integrating environmental friendly supply chain from the product design stage to the end of its life cycle (Bhattacharjee, 2015, p. 14). This concept required management principles for the successful implementation of GSCM and monitoring their operation through its lifecycle. The second reason is that applied management emphasises strategic decision-making based on data analysis and critical thinking. Whereas the GSCM also requires managers to consider environmental implications/ alternative practises and make strategic decisions that are in line with the organisation's sustainability goals (M. T. Khan et al., 2022, p. 15).

1.4 Research question/aim and objectives

Research question: How does green supply chain management impact on organisational performance in terms of financial, operational, and environmentally?

Research aim: This research aims to investigate the relationship between GSCM practices and their effect on organisational performance. The objectives of the study are as follows:

Research Objectives:

1. To identify and understand GSCM practices implemented within the ABC company.
2. To investigate the influence of GSCM practices on the environmental performance of the organisation.
3. To explore the relationship between GSCM practices and the operational performance of the organisation.
4. To examine the impact of GSCM practices on the financial performance of the organisation.
5. To identify and analyse the challenges faced by the ABC company in enhancing its GSCM practices with the aim of improving overall supply chain sustainability.

1.5 Limitation of the study

One of the study's key limitations is the selection of a case study. This research is about one company which EI company, which supplies machinery and equipment for the LPG industry. As a result, the scope is limited to EI enterprises in Sri Lanka. Therefore, it may not be representative of other locations or situations in various settings or scenarios. The use of interpretivism as a research philosophy is a further limitation to this study. Because of this, the researcher's interpretation and data analysis heavily depend on this investigation. To lessen the researcher's assumptions, data will be triangulated by utilising a variety of data sources, including document analysis and interviews.

1.6 Structure of thesis

Starting from chapter two, the theory underlying the EI employed for this research will be discussed. Following that, a full industry analysis of the Sri Lankan context is conducted utilising modern strategic models such as Porter's five forces and PESTEL

analysis. A thorough literature analysis will be undertaken in Chapter Three to get a thorough comprehension of the ideas connected to a GSCM, sustainability, and competitive advantage. Chapter Four discusses the overall research philosophy, research design, data collection methods, and data analysis methodologies employed in this study. In Chapter Five, information acquired from all data sources is summarised and carefully reviewed to answer the study questions. The final chapter contains conclusions that represent the entire research and its contribution to field expertise, in addition to the study's limitations and implications for future research in the aforementioned area.

Chapter 2. Theory and Industry Analysis

2.1 Introduction

This chapter provides an in-depth analysis of the EI which is related to LPG sector in Sri Lanka. As this research aims to identify the impact of GSCM on organisational performance, in-depth research on the dynamics of the industry is vital to the project's success. It demonstrates that GSCM adoption leads to a competitive advantage to sustain in the market; thus, the implementation of GSCM become an important topic in every business. The theoretical analysis part is a brief description of the theoretical constructs that underpin this exploratory research design. The resource-based theory and the triple bottom line theoretical framework are utilised to outline the GSCM theoretical construct in this section. Additionally, the industry analysis is offered brief review of Sri Lanka's EI by using the PESTEL and Porter's five force of competition. The final section covers the essential insights that should be used and applied in the case study analysis.

2.2 Theoretical analysis

There are various theoretical foundations of GSCM, such as operations management, supply chain management, environmental management, and sustainability. How these various management can interact with the different GSCM-related theories are numerous. As stated by Sarkis et al. (2011, p. 12), an organisational theoretical lens to is used to guide the research, particularly with regard to the widespread implementation and development of GSCM practises. The resource-based theory and the triple-bottom line theory is most relevant for the GSCM in this research study. These constructs will provide the researcher with a framework for understanding how a firm's resources and competencies contribute to its competitive advantage. Therefore, these findings will play an important role in adopting GSCM in an organisation to achieve a competitive advantage.

2.2.1 Resource-based theory

Resource-based theory (RBV) is related to strategic management and has gained appeal in linked and complementary fields such as operations management and marketing (Hitt et al., 2016). RBV theory is more focused on creating a competitive advantage by focusing on sustainable supply chain operations (Touboulic & Walker, 2015). Thus Shibin et al. (2020, p. 303) argued that RBV logic can clarify the business's resource capability building and economic aspects. Given this context, firms can build distinctive and significant environmental resources and competencies in the framework of GSCM, providing a foundation for long-term competitive advantage. This can be included renewable energy sources, eco-friendly technologies, waste reduction practises, or green certifications such as ISO 14001, 45001. These practices can uplift the organisations reputation and assist organisations in developing and leveraging these environmental resources and competencies to improve competitiveness and market differentiation. Therefore, RBV theory is the foundation for organisations to identify their environmental resources and capabilities for the successful implementation of GSCM.

Furthermore, RBV theory highlights the valuable dynamic capabilities and their importance in driving organisational performance; these practices included integration, learning, and reconfiguration (Lin & Wu, 2014, p. 408). According to Barney (1991, p. 115), when items are valuable, rare, unique, and non-substitutable, they create a persistent competitive advantage. There are different levels of importance for the three competencies stated above. Khan et al. (2023) illustrated, integration capability helps firms to identify the nature of the external environment to decide the suitable operational strategy for integrating internal and external resources to implement GSCM. On the other hand, learning capabilities help organisations avoid repeating mistakes by leveraging lessons learned from previous experiences exploring new knowledge, and producing new technologies relevant to GSCM. Furthermore, by conducting seminars about GSCM, organisations can enhance employees' knowledge and improve their performance. Finally, reconfiguration capabilities will help organisations to identify market and technology trends to choose the most cost-effective process. Therefore, RBV

theory is important for this research, as it builds on effective resource management which is important to operational management.

Hart (1995) first developed a Natural- resource-based theory based on RBV and suggested that business and environmental sustainability can achieve with three strategies, pollution avoidance, product stewardship, and sustainable development. He emphasized that pollution should be avoided during the transformation process where raw materials convert to finish goods, rather than doing it “end-of-pipe”. Through product stewardship, companies can divest themselves of ecologically harmful businesses and differentiate new goods with lower life-cycle costs. For example, as an early mover to product stewardship BMW benefited from the cost-effectiveness of the “design for disassembly” recycling process. Finally, sustainable development is cooperated with different stakeholders to solve environmental problems. However, the new era has modified these practises to emphasise that corporations should address social and environmental issues and eliminates the negative consequences of their current operations. Thus, the study by Yunus and Michalisin (2016) illustrated how these three techniques serve as a framework for upstream, internal, and downstream GSCM practises.

2.2.2 Triple bottom line Theory

Figure 2.1

Triple bottom line

[Removed]

Note. Triple bottom line measurements. From *The Triple Bottom Line: How Today's Best-Run Companies Are Achieving.*, By Savitz, A., & Weber, K, 2006, Jossey-Bass, Copyright 2006 by John Wiley & Sons, Inc.

Triple bottom line (TBL) theory was first presented in the 1990s by John Elkington, a famous business consultant. This theory illustrates the economic, environmental, and social benefits of investment that may accrue outside of a firm's financial bottom line. This concept is also known as the 3Ps, referring to people, planet, and profit, which aims to better precisely value assets and utilise resources to use capital as efficiently and effectively as feasible (Elkington, 2004). This study is well aligned with the TBL paradigm, as GSCM has emphasised the importance of environmental, social, and economic factors in organisational decision-making.

TBL illustrates that the company's responsibilities include economic aspects of creating products and services that customers want, by regulatory standards, and at a profit (Hubbard, 2009, p. 180). This theory is to unpack the GSCM practises and discover which practises can reduce expenses, waste, and energy conservation in the economic dimension. According to the TBL theory, environmental performance generally refers to the resources (e.g., energy, land, water) usage of the company in its operations as well as the by-products of those operations (e.g., waste, air pollutants, chemical residues, and so on) (Hubbard, 2009, p. 180). Similarly, GSCM integrates with environmental sustainability by lowering carbon emissions, reducing waste output, preserving resources, and promoting sustainable product design and packaging. As the final factor, this study aligns with the social dimension of the TBL theory by considering the broader social impacts of supply chain activities. Hubbard (2009, p. 180) described, social dimension refers to a company's (and its suppliers') impact on the communities in which they operate. This might include assuring safe working conditions, assisting local

communities, encouraging responsible sourcing and fair labour practises. The application of TBL on GSCM practises and their influence on organisations has been widely discussed in the literature (Abdala et al., 2018; Burki et al., 2018; Khokhar et al., 2022; Singh & Misra, 2022). An empirical investigation by Singh and Misra (2022) discovered that most of the GSCM practises have a substantial association with the TBL. Therefore, the TBL theory is perfectly aligned with this research study, and it aids in determining which areas will be covered by GSCM in the organization's supply chain process.

2.3 Industry analysis

2.3.1 PESTEL analysis

The different models help to identify the key factors that affect to business directly and indirectly so that businesses can develop strategies to overcome the problems to hold a better position in the market (Johnson et al., 2020). PESTEL analysis is one of the most appropriate tools for external environment analysis, giving a broader picture of the business's situation (Gupta, 2013, p. 13). Furthermore, this tool will aid in the analysis of opportunities and threats, assisting in the identification of the industry's present market position and performance, as well as prospects for development (Perera, 2017, p. 1). This model incorporates political, economic, sociocultural, technological, environmental, and legal studies to evaluate the external macro-environmental elements that can have an impact on an enterprise or organisation (Perera, 2017). The PESTEL research below is focused on EI in Sri Lanka.

Political factors

Political factors have an important influence in establishing the business environment for Sri Lanka's EI. Companies must understand and monitor these aspects to predict changes, adapt to new rules, and make strengthened strategic decisions. The political considerations include environmental stability, government policies and regulations, and competitor political parties (Perera, 2017, p. 8). The Sri Lankan trade

policy is playing a virtual role in economic growth. Sri Lanka has membership in the South Asian Free Trade Area (SAFTA) and the Asia-Pacific Trade Agreement (APTA) which allows Sri Lanka to gain access to wider markets, and a more favourable trade environment by lowering trade barriers and granting tariff reductions, boosting international competitiveness (International Trade Administration, 2022). However, the current economic crisis in Sri Lanka raises questions about the government's legitimacy, causing investment uncertainty. Due to a scarcity of foreign currency, the government was forced to hold imported commodities (Le, 2022). Therefore, political unrest in Sri Lanka has posed challenges for the EI.

Geographically Sri Lanka is located at the intersection of key transport routes to South Asia, the Far East, and the European and American continents. It is an important port of call for shipping lines and airfreight services, with one of the top 25 container ports in the world (BOI Sri Lanka, n,d_a). Furthermore, Sri Lanka agrees with 45 countries to eliminate double taxation in international trade, thus promoting trade and investment opportunities (BOI Sri Lanka, n,d_a). Despite the political instability, all other factors have a favourable political environment that will positively affect on the engineering business in Sri Lanka.

Economical factor

The country's economy has a significant impact on business. Sri Lanka's economic freedom score is 52.2, ranking 136th in the 2023 Index (Economic Freedom, n,d). The country boasts different investment sectors, including manufacturing industries (Apparel, Electronic and Electrical, Food, Auto components), information technology, logistics, tourism, and pharmaceuticals (BOI Sri Lanka, n,d_b). In Q4 2022, there was a declined GDP rate which was -12.4%, due to the economic crisis in mid-2022 (Central Bank of Sri Lanka, n,d). However, Sri Lanka's new government is working to uplift GDP, and it can be seen positive outcome as Q1 2023 GDP is -11.5% which is 0.9% growth.

The manufacturing industry contributes a large portion, 29.79%, to the economic growth. The EI is one of the most important sectors that can significantly boost the Sri

Lankan economy. As a growing industrial destination, Sri Lanka hopes to capitalise on its access to key regional markets and trade blocs. According to BOI data, the EI shows strong export growth, US \$0.5 billion in 2022, and predicts US \$1 billion growth in 2025 (BOI Sri Lanka, n,d,c). Most of these manufacturers obtained ROHS/ISO complaints. By adhering to ROHS regulations, businesses ensure that their products do not include dangerous substances that could endanger human health or the environment, while ISO standards cover various aspects of quality, safety, and environmental management (BOI Sri Lanka, n,d,c). Companies who adhere to these standards demonstrate their commitment to responsible business practices while gaining a competitive advantage in the global economy. Therefore, this will be a golden cion for engineering organisations to make their presence in the international market.

Social Factors

Understanding and managing social factors is crucial for business. The main social factors include demographic, distribution, geography, and culture in which business operates (Johnson et al., 2020). Sri Lanka is currently home to 21.9 million people, with a population growth rate of 0.1% (Department of Census and Statistics, 2023). According to the world population review, Sri Lankan population is predicted to be 22.3 million in 2040 (World Population Review, 2023). The demographic variables could be viewed as a crucial determinant for the engineering sector when considering the working population. The growth of the population will be positive for the country if the majority are working people. According to world bank data, the working-age population in Sri Lanka is 52%, with 35% represented by the youthful generation, indicating a positive social component (The World Bank, 2022a).

Another important social factory is the education of the people and skilled employees. The adult literacy rate in Sri Lanka is 92%, which implies that almost everyone over the age of 15 can read and write to get by in their daily lives (The World Bank, 2022b). The literacy rate is an outcome measure used to assess educational attainment. This data can be used to forecast the quality of the future labour force and to ensure policies people's life skills. When it comes to the EI, 1000+ engineering graduates

are produced each year by government and private colleges to establish a strong engineering workforce and support technological advancement (BOI Sri Lanka, n,d). On the other hand, Sri Lankan CSR projects are aimed at educating people about how they may contribute to the environment in which they operate. These mentoring programmes incorporate GSCM-related practices such as public safety awareness, responsible marketing, health and environmental issues, and environmentally friendly businesses (International Alert., 2005). As a result, this is an asset for the engineering business as these positive social factors can impact the industry's growth and competitiveness in the worldwide market.

Technological Factor

The EI is highly based on technology, therefore technological factors play a vital role in this industry by improving the operational functions and market position. According to the global innovation index data, Sri Lanka excels 66 in knowledge and technology outputs (Figure 2.2) while positioning 5th place among the 10 economies in Central and Southern Asia (Global Innovation Index, 2022). Furthermore, Sri Lanka's national renewable energy development goal is to generate 70% of its power from renewable sources by 2030. To achieve this, Sri Lanka is working through a new strategy called “Energy Park” and this is accelerating with wind and solar energy (Sri Lanka Sustainable Energy Authority, n,d). Integrating renewable energy sources into the engineering business utilise their cost for electricity generation while lower their carbon footprint. Recycling and waste-to-energy processes, for example, can be incorporated into the supply chain to reduce waste output and optimise resource utilisation in Sri Lanka. Therefore, the advancement of technological knowledge will boost EI by improving efficiency and effectiveness.

Figure 2.2

Innovation Performance: Sri Lanka

[Removed]

Note. Innovation performance. From *WIPO*, 2022. by Global Innovation Index 2022, 2022 (https://www.wipo.int/edocs/pubdocs/en/wipo_pub_2000_2022/lk.pdf).

Environmental Factors

Environmental laws within the country act to reduce environmental impact from business, and every individual in the society. To address climate change, the National Environment Policies (NEP), which includes 11 principles, promote sustainable economic practices to preserve the country's natural resources and biodiversity (Mediwake, 2022). Furthermore, waste management policies promote waste reduction, reuse, and recycling, as well as minimising resource exploitation which is established in 2008 (WMA-WP, 2022). Therefore, EI must maintain internal policies that are consistent with these regulations. On the other hand, these policies align well with GSCM as practises such as green innovation, green manufacturing, and green transportation focus on solutions to minimise glasshouse gas emissions and cope with the effects of climate change. Therefore, environmental policies will have a favourable impact on the EI business, particularly when GSCM is implemented in the supply chain process.

Legal Factors

National Policy on Green Procurement (GPP) was established in 2006. Green procurement is the selection of commodities, works, and services that minimise environmental impacts while obtaining value for money. Procurement is a common process in every industry as it combines with every supply chain process directly or indirectly. However, according to the GPP, few steps should be taken by organisations when implementing these practices (The Ministry of Environment, n,d). Furthermore, the Government's industrial research and development institutes are appointed to ensure that businesses are geared to meet the technological needs of industries and assist them in

attaining the price, quality, and delivery standards required in international markets (Lawnet ministry of justice, n,d). This identification assists businesses in identifying opportunities for sustainable practises, aligning with society's expectations, and addressing any risks resulting from legislation changes. Therefore, legal factors are favourable with EI.

2.3.2 Porter's five forces

Porter's five forces model can be used to analyses the competing forces within the industry. Because the study is about the impact of GSCM, industry analysis will be focused on specifically relevant to GSCM context. According to (Porter, 1980, p. 3) industry competition depends on five basic competitive forces shown in figure 2.3. The effects of these factors on engineering manufacturing companies in Sri Lanka are addressed further below.

Figure 2.3

Porter's five forces factors

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Note. This model was represented by Porters in 1980. From *Techniques for analyzing industries and competitors.* by Porter, M. E, 1980. New York: Free. Copyright 1980 by Michael E. Porter

Competitive rivalry

The EI in Sri Lanka is mainly in two categories, engineering products & light engineering products (EDB Sri Lanka, n,da). In the light engineering category, there are around 500 manufacturing enterprises, comprising small and medium-sized companies as well as export-oriented ventures. The demand is determined by several end-user industries, including power, mining, consumer products, automotive, and general manufacturing (EDB Sri Lanka, n,db). The selected company (ABC) is included in the EI (LPG) where there are no players in the Sri Lankan market. The company that provides unique and specialised engineering services has a marketing edge over others. Moreover, Firms that invest in innovative technologies, technological advancement, and sustainable engineering practices may differentiate themselves from their competitors and attract international markets. When considering GSCM, only 150 companies implemented GSCM and approximately 32% represent EI (Priyashani & Gunarathne, 2021, p. 12). Therefore, competition within the industry is relatively low.

Bargaining power of suppliers

The EI has multiple options to purchase required raw materials and specialized equipment through the local market and international market. Therefore, the presence of multiple suppliers for the same product will reduce the bargaining power of the supplier. Furthermore, the development and standardisation of LPG-related product manufacture adheres to the highest standards, and they are key operations in the LPG sector. This includes correcting any inconsistencies between various standards, particularly those connected to International ISO and European CEN standards (WLPGA, 2023). Therefore, suppliers' impact in the local market may be strong due to the less supplier

base in local market who adhere to the requirements. Therefore, the bargaining power of suppliers might be relatively high.

Bargaining power of buyers

The market for global Liquefied Petroleum Gas (LPG) in 2022 was USD 250518.8 million and is estimated to develop at a compound yearly growth rate of 7.21% during the forecast period, reaching USD 380363.54 million by 2028 (MakrtWatch, 2023). Therefore, the fast growth of the LPG industry is boosting the EI industry to supply machinery and spare parts. However, there are several competitors' domains in this market. On the other hand, the ABC company is the main supplier of energy solutions and represents the LPG gas machines and equipment manufacturing industry, which is identified as a thrust sector with high export earnings potential. Furthermore, the Sri Lankan EI supplies goods for the mass market and niche markets (EDB Sri Lanka, n,d_b). Buyers may have more options and negotiation power if there are more buyers than enterprises supplying engineering products or services. However, since there are only a few manufacturing companies for LPG industry, the bargaining power of buyer of is low.

Potential of new entrants into the industry

There will be a chance for new players to enter the engineering industry easily as it is covering wider range of manufacturing products (EDB Sri Lanka, n,d_a). However, when it comes to LPG manufacturing, the possibility of new entrants is limited. This is because, the LPG industry is mostly rely on standards such as ISO and the European Committee for Standardisation (WLPGA, 2023). Furthermore, it will necessitate specialised training, skilled employees, and technical facilities. These requirements will make it difficult for the new entrance to the market. Moreover, According to WLPGA (2023), the LPG industry has formed new alliances with organisations such as natural gas associations, environmental non-governmental organisations, H₂ associations, and renewables industry associations. As a result of the business relationships with other parties, there is less potential for new entrants from outside the country to enter the LPG

market. As a leading gas provider, Sri Lanka is celebrating its 150 years of irreplaceable services.

Threat of substitutes

In Michael Porter's Five Forces Framework, the "threat of substitutes" refers to the possibility of new products or services that meet the same needs as a present product or service (Porter, 1980). Natural gas, as a cleaner and frequently cheaper fuel, offers a substantial threat to the LPG sector. As extraction techniques such as fracking have progressed, natural gas has become more readily available in many markets. For example, there are 3% threats from natural gas and 7% threats from other renewable energy (WLPGA, 2023). If the LPG is replaced with natural gas, there is a moderate threat for the machine and equipment as these can be replaced with renewable energy equipment such as solar panels or wind turbines. Furthermore, as modern technology such as 3D printing improves the ability to design complex shapes and interior systems, new product options emerge that can minimise waste, lower prices, and accelerate production timelines. Therefore, the threat of substitutes for the EI is moderate.

2.4 Summary

Industry analysis entails assessing its competitive dynamics and market conditions to have a better understanding of its profitability, growth potential, major success drivers, and hazards. The PESTEL and Porter's five forces analytical models are used in this study by focusing on EI which is facilitated for the LPG energy sector. LPG manufacturing has great potential to grow in the market and there are only a few players domain in the market. Through the PESTEL analysis, the researcher found that other than the political factors all other factors are favorable for the engineering manufacturing industry in Sri Lanka. Theories that give a conceptual foundation for understanding a topic are referred to as theoretical constructs. The key theories in the case of sustainable business in Sri Lanka's engineering manufacturing industry are the resource-based theory and the triple bottom-line theory. These ideas underline how the engineering manufacturing industry can strengthen its business by focusing on long-term business

practises such as GSCM. Investigation can address research problems in two ways through analysing industry and theory.

1. To identify the benefits, and drawbacks for company which can affect internally and externally.
2. How can GSCM help businesses grow or sustain their market presence?

Chapter 3. Literature Review

3.1 Introduction

This literature study examines various GSCM in the business and their impact on organisational performance in three areas: environmental, operational, and financial. Furthermore, this examines the motivators and challenges for GSCM enhancement and implementation. For this review, sixty peer-reviewed journal publications that covered the field of green supply chain management from 2005 to 2021 were collected. However, the discussion could not be narrow down the engineering industry, it may cover significance of a GSCM in different manufacturing industries in different nations. The main rationale for using this approach is that the researcher needs to have a thorough comprehension of these areas of study. This approach may aid in identifying literature gaps that will support and complement the overall research concern. As a result, some of the concepts or discoveries mentioned in this chapter may have been related to the research questions or objectives. This literature review focuses on three themes, green supply chain management practices, GSCM on organisational performance, and challenges and drivers to implement GSCM. The findings of this review will serve as a reference guide for the researcher while researcher analyses the findings of the ensuing case study analysis.

3.2 Green Supply Chain Management Practices

Green Supply Chain Management is defined as incorporating environmental considerations into supply chain management processes, such as product design, procurement and selection of materials, production, consumer delivery, and end-of-life management of the product after its useful life (Bhattacharjee, 2015, p. 14). GSCM is differ themselves from traditional supply chain management (SCM) by integrating environmental concerns with SCM (Sarkis, 2012, p. 202). Traditional supply chain

management often been ignored the environmental consideration and it only focused on transforming raw materials into final products and subsequently delivering them to the end customer (Deshmukh & Vasudevan, 2014, p. 29). Therefore, traditional SCM was only focused on cost effectiveness of the business. This led many numerous academics and theorists to modify the traditional SCM by incorporating sustainability and simplifying industries to be economically effective. According to Cahyono et al. (2020, p. 738) today's socioeconomic dynamics and regulatory factors are encouraging firms to be environmentally conscious in their product sourcing, operations, distribution, and logistics activities. The diagram below illustrates the extended supply chain activities in GSCM.

Figure 3.1

Environmental priorities in the extended supply chain

[Removed]

Note. Environmental priorities in the extended supply chain.. From Environmental management and operations management: introduction to part 1 (manufacturing and eco-logistics). by C. J Corbett & P. R Kleindorfer, 2001. *Production and Operations Management*, 10(2),), p.108 (doi.org/10.1111/j.1937-5956.2001.tb00072.x). Copyright 2001 by Production and Operations Management Society.

In existing literature, GSCM is mainly categorised into two, internal and external GSCM (Sarkis, 2012; Sarkis et al., 2011; Zhu et al., 2013). Internal GSCM activities are those that can be managed internally without the involvement of suppliers or customers,

whereas external GSCM activities interact with outside stakeholders such as suppliers and customers to some extent (Zhu et al., 2012, p. 1391). Appendix E contains the defined internal and external GSCM practices by Zhu et al. (2007, p. 1051).

Asif et al. (2020) carried out a semi-systematic literature study of 25 papers focusing on the application of various green practises in emerging economies. According to his study below is the frequency of applying of GSCM practices.

Figure 3.2

Frequency of GSCM practices implementation in developing countries

[Removed]

Note. Frequency of implementation of GSCM. From Adoption of green supply chain management practices through collaboration approach in developing countries e From literature review to conceptual framework, by Asif, M. S., Lau, H., Nakandala, D., Fan, Y., & Hurriyet, H. 2020, *Journal of Cleaner Production*, 276, p.4 (doi.org/10.1016/j.jclepro.2020.124191). Copyright 2020 by Elsevier Ltd.

3.2.1 Upstream green supply chain management

Sarkis (2012, p. 203) suggested internal and external GSCM practices can greening the supply chain mainly in three domains, upstream, downstream, and internal organisational operations which is illustrated in figure 3.3. Upstream activities include purchasing and procurement functions. Green purchasing (GP) is a collection of activities connected to sustainable procurement that can help to reduce environmental effect (Kalyar et al., 2020; Lo & Shiah, 2016; Muma et al., 2014; Vijayvargy & Sahoo, 2021).

GP practices include, a supplier audit for ISO 14001 requirement, adopt just in time logistic, provide specification to supplier about environmental requirement for purchase product, collaboration with suppliers to meet environmental goals, and supplier selection based on environmental factors (Yu et al., 2014; Zhu et al., 2012).

Figure 3.3*Supply chain main domains*

[Removed]

Note. Green supply chain diagram with stages and relationships. From A boundaries and flows perspective of green supply chain management, by J. Sarkis, 2012, *Supply chain management: an international journal*, 17(2), p. 204 (DOI 10.1108/13598541211212924). Copyright 2012 by Emerald Group Publishing Limited.

3.2.2 Internal green supply chain management

Internal supply chain management (IEM) refer to the operation and production management. Research and design, quality, inventory, materials, and technology management within an organisation are included in this category (Sarkis, 2012, p. 203). The process of creating products with reduced material and energy consumption, recyclability and component recovery, and possible utilization of hazardous sources or processes is known as eco-design (Bahjat et al., 2020; Green et al., 2012; Kalyar et al., 2020; Khan & Qianli, 2017). This can be achieved by working closely with suppliers in product design, decreasing waste in collaboration with suppliers, and delivering product related environmental information to customers (X. Liu et al., 2012, p. 6). According to Salonitis and Ball (2013, p. 635) the conversion of raw materials into consumer goods is also a major source of pollution. A large number of empirical studies in the manufacturing industry have discovered that green manufacturing (GM) can minimise environmental polluting activities and contribute to greening the internal supply chain (Kalyar et al., 2020; Khan & Qianli, 2017; Muma et al., 2014). This process include covering of manufacturing issues 6Rs namely reduce, reuse, recycle, recover, redesign and remanufacturing (Jawahir et al., 2006). According to Salonitis and Ball (2013, p. 635) a sustainable production process involving energy efficient, quick and reliable production equipment is necessary to reduce waste and increase productivity. However, business need continuous environmental action, such as gaining ISO14001 accreditation and implementing cleaner production auditing, is indeed necessary to control these internal practises (X. Liu et al., 2012, p. 6). Figure 3.4 illustrates the conversion of traditional manufacturing into GM.

Figure 3.4

Manufacturing decision making attributes evolution.

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Note: Evolution of green manufacturing. From Energy efficient manufacturing from machine tools to manufacturing systems, by Salonitis & Ball, 2013 (cited as Chryssolouris, G. 2006), *Procedia Cirp*, 7, p. 635 (doi.org/10.1016/j.procir.2013.06.045). copyright 2013 by Konstantinos Salonitis and Peter Ball.

3.2.3 Downstream green supply chain management

Greening the downstream SC includes outbound logistics and transportation, marketing, distribution, packaging, and warehousing (Sarkis, 2012; Zhang & Zheng, 2010). Greening the outbound logistic known as green (GL) practices and includes sustainable energy, recycling, sustainable transportation and distribution, sustainable warehousing and green product packaging (Agyabeng-Mensah & Tang, 2021; Lai & Wong, 2012). Reverse logistic incorporates practises such as return of waste product and packaging for recycle, reuse and disposal (McKinnon et al., 2015, p. 13; Muma et al., 2014). In this process green packaging is important and it promotes the use of biodegradable packaging materials, the avoidance of complicated packaging designs, and the recycling of packaging, all of which lead to increased efficiency (Zhang & Zheng, 2010, p. 292). Marchant and Baker (2010) suggested the process of green warehouse in three phases, 1. saves energy by using energy-efficient heating and cooling system, LED lighting, and proper waste disposal method and follows basic rules. 2. set up a low-emission and green vitality warehouse. 3. renewable sources such as sun-based boards, winds turbines, and biomass. Furthermore, when the supply chain come to end-user, there is a growing interest among consumers regarding importance of caring for the earth and maintaining its cleanliness and well-being (Ali et al., 2019; Dangelico & Vocalelli, 2017; Mishra & Sharma, 2010). According to Mishra and Sharma (2010) many people are happy to spend extra money to keep the environment clean and promote sustainability. Therefore, businesses are focused green marketing which include product modification, changes in production, eco-labelling, and modification of promotion of product and services (Ali et al., 2019, p. 78).

3.3 GSCM on organisational performance

Organisational performance is critical to any organisation because it allows enterprises to have an objective assessment of the outcome of combining both financial and nonfinancial resources in attaining their goals. According to Carter and Rogers (2008, p. 377) TBL strategies, which consider an organisation's social, economic, and environmental performance, can be used to assess the success of the business in terms of environmental (Bahjat et al., 2020; Green et al., 2012; Kalyar et al., 2020; Khan & Qianli, 2017; Zhu et al., 2008), financial (Green et al., 2012; Khan & Qianli, 2017; Lo & Shiah, 2016; Trujillo-Gallego & Sarache, 2019; Vijayvargy & Sahoo, 2021), and operational performance (Bahjat et al., 2020; Darnall et al., 2008; Gunarathne et al., 2021; Khan & Qianli, 2017; Lai & Wong, 2012; Sajjad et al., 2020; Vijayvargy & Sahoo, 2021). Therefore, the primary criteria for assessing the organisation's success in this study were the three performance dimensions of financial, operational, and environmental performance.

3.3.1 GSCM on Environmental Performance (EP)

According to Zhu et al. (2007, p. 1047) EP is defined as a company's ability to reduce pollution, solid waste, and the usage of hazardous materials and the occurrence of environmental injuries. This study used EP indicators that include the decrease of pollutants in the air, energy consumption, the transfer of hazardous materials affecting soil and water quality, and compliance with environmental requirements as this has been widely used in existing literature (Bahjat et al., 2020; Green et al., 2012; Hasan et al., 2022; Lee & Choi, 2021; Zhu et al., 2012).

The effects of GSCM on an organization can differ according to their process. The literature suggests that integrating eco-design initiatives into internal organizational processes might help enhance EP (Bahjat et al., 2020; Green et al., 2012; Kalyar et al., 2020; Khan & Qianli, 2017). Zhu et al. (2008, p. 271) showed that the eco-design activities like reduction of energy and material usage, design recyclability product reuse of materials, reduce use of hazardous materials improved EP. The relationship between

GP and EP is rely on cooperating with suppliers to ensure that purchasing process work towards to minimise environmental pollution. Thus, GP is positively impacted on EP (Kalyar et al., 2020; Lo & Shiah, 2016; Muma et al., 2014; Vijayvargy & Sahoo, 2021). Existing literature suggest that GL promptly improve organisational EP (Muma et al., 2014; Trujillo-Gallego & Sarache, 2019). On the other hand, greening production is widely acknowledged to have a positive impact on the environment by reducing environmental pollution activities (Kalyar et al., 2020; Khan & Qianli, 2017; Muma et al., 2014). Most importantly companies' internal environmental management system also positively impacts on organisational EP as it focused on environmental goals thus implement their own rules and regulation within the company (Lo & Shiah, 2016; Trujillo-Gallego & Sarache, 2019; Vijayvargy & Sahoo, 2021). Therefore, as proved in the literature almost every GSCM practices positively impact organisation's EP.

3.3.2 GSCM on Operation Performance (OP)

Operational performance (OP) refers to a company's ability to reduce management expenses, order time, lead time, improve raw material utilisation, and distribution capacity (Zhu et al., 2013, p. 116). The literature suggests that quality, delivery, flexibility, and cost are the fundamental and most frequently mentioned competitive areas in operation performance (Bahjat et al., 2020; Sahoo & Vijayvargy, 2021; Yu et al., 2014).

The GSCM impact on OP has been studied by Yu et al. (2014) and Zhu et al. (2013) found that internal GSCM and supplier and customer related GSCM positively associated with OP. This finding is corroborated by Bahjat et al. (2020) who shown that internal GSCM such as eco-design are positively connected with OP by reducing the use of superfluous materials and providing reusable materials, hence lowering inventory levels and associated costs. Yu et al. (2014) also proposed that IEM can boost OP by implementing methods to reduce energy consumption, production time, material utilisation, and product value. In contrast, Santos et al. (2019, p. 16) posited GL do not have significant direct impact on OP, while Sajjad et al. (2020, p. 14) argued GL increase OP by consolidation of warehouse and freight, driver training for fuel efficiency. The

impact of GP on OP studied by Bahjat et al. (2020, p. 503) in 215 different manufacturing industries in Jordan and posited GP have positive impact on OP. However, numerous literatures revealed non-significant improvements of GP on OP (Luthra et al., 2014; Raut et al., 2019; Sahoo & Vijayvargy, 2021). Differently literature found positive relationship between GM and OP (M. T. Khan et al., 2022; Khan & Qianli, 2017; Raut et al., 2019; Rehman et al., 2016; Rusinko, 2007), while also reverse logistic positively impact on OP (Rehman et al., 2016; Rogers & Tibben-Lembke, 2001).

3.3.3 GSCM on Financial performance (FP)

There are several financial performance (FP) indicators in existing literature and organisational key performance indicators (KPIs). According to Tippayawong et al. (2016, p. 6) return on investment, gross profit margin, and asset turnover ratio are indicators of a company's financial performance. Differently, Sarkis et al. (2011) showed that economic performance refers to financial benefits such as increased profitability, sales, and market share. However, the general agreement of the literature is financial performance also can be measured by the decrease of the cost for purchase material, waste treatment, waste discharge, and decrease fine for environmental accidents (Green et al., 2012; Kalyar et al., 2020; Zhu et al., 2013). This study will follow (Zhu et al., 2013) KPIs for performance measurements.

The impact of GSCM on organisational FP has been widely studied in literature based on manufacturing industries. According to Agyabeng-Mensah et al. (2020, p. 10) GL do not have direct significant effect on FP, however, EP mediate the relationship between GL and FP and it was significant positive impact on financial performance. Similarly, Khan and Qianli (2017, p. 1638) argued GP on FP is negative due to the fact that GP operations raised overall prices as a result of expensive green products, practices, levies, and government regulations. On the other hand, while eco-design practices increased the cost of the finished product in terms of eco-friendly materials, they have little to no financial improvement for businesses (Green et al., 2012, p. 298). Similarly, GP,GM, green information negatively impact on FP (Kalyar et al., 2020). In contrast Rehman et al. (2016, p. 28) argued that GP and green marketing leads to FP, and GM can enhance FP

(Khan & Qianli, 2017; Rehman et al., 2016). Furthermore, Afum et al. (2021, p. 3092) showed in his study that if firms implement IEM and green human resource together, it will lead to financial performance. On the other hand some studies shows that even there is no short term financial benefits from GSCM practices, there are long term benefits such as increased level of sales, product price, profit margin, market share and new market opportunities (Khan & Qianli, 2017; Lee, 2013). However, present literature suggests that the direct impact of GSCM on FP is modest, but OP and EP can favourably mediate the relationship of GSCM on FP (Agyabeng-Mensah et al., 2020; Feng et al., 2018; Green et al., 2012; Kalyar et al., 2020).

3.4 Challenges to implement GSCM.

Manufacturing industries span a wide range of business sectors, therefore greening the manufacturing industry may help to minimise environmental effect; nonetheless, manufacturing industries face numerical challenges while implementing and improving GSCM. According to Rahman et al. (2020, p. 19) challenges found in Bangladesh's plastic manufacturing businesses are inadequate organisational and operational policies, a lack of information and guidance, and budgetary limitations. Similarly, insufficient environmental awareness ranked as the major hurdle in data presented by Mathiyazhagan et al. (2013, p. 13) an Indian auto component manufacturing company, followed by a lack of experienced personnel and poor supplier assistance. Internal challenges to GSCM implementation in Chinese manufacturing and processing industries, include a lack of adequate tools, managerial skills, and experience, and, most likely, a lack of an economic justification in terms of performance (Zhu et al., 2005, p. 464). Furthermore, Luthra et al. (2011, p. 248) and recent study by Nteta and Mushonga (2021, p. 13) found that typical impediments in cement manufacturing enterprises in Africa and India, respectively, cost constraint, lack of knowledge, and market competitiveness and uncertainty. Samarasinhe and Haijun (2019) investigated barriers to implementing reverse logistics in the Sri Lankan setting, but no study investigated complete challenges to implementing total GSCM practises. Thus, this study will address a gap in the literature about challenges to implement and improve GSCM in the

engineering business in Sri Lanka.

Topic	Sub-topic	Core Authors	Significant
GSCM practices	Upstream GSCM	(Sarkis, 2012) (Kalyar et al., 2020) (Lo & Shiah, 2016) (Muma et al., 2014) (Vijayvargy & Sahoo, 2021) (Yu et al., 2014) (Zhu et al., 2012)	Green purchasing is the main GSCM practises in upstream supply chain. This includes all the process that involve with supplier handling.
	Internal GSCM	(Sarkis, 2012) (Bahjat et al., 2020) (Green et al., 2012) (Khan & Qianli, 2017) (Kalyar et al., 2020) (Liu et al., 2012) (Salonitis and Bal, 2013) (Muma et al., 2014) (Jawahir et al., 2006)	This mainly include GM, IEM, Eco-design. These practices are mainly control inside the organisation.
	Downstream GSCM	(Sarkis, 2012) (Zhang & Zheng, 2010) (Agyabeng-Mensah & Tang, 2021) (Lai & Wong, 2012) (McKinnon et al., 2015) (Muma et al., 2014) (Marchant and Baker, 2010) (Ali et al., 2019) (Dangelico & Vocalelli, 2017) (Mishra & Sharma, 2010)	SCM includes outbound logistics and transportation, marketing, distribution, packaging, and warehousing.
GSCM on organisational performance	GSCM on EP	(Zhu et al. 2007) (Pasqualini Blass et al. 2016) (Bahjat et al., 2020) (Green et al., 2012) (Hasan et al., 2022) (Lee & Choi, 2021) (Zhu et al., 2012) (Khan & Qianli, 2017) (Kalyar et al., 2020) (Lo & Shiah, 2016) (Muma et al., 2014) (Vijayvargy & Sahoo, 2021) (Trujillo-Gallego & Sarache, 2019)	Internal GSCM Eco-design, IEM, GM has a positive impact on EP. EP may also be impacted by external actions like GP, GL, and collaboration with suppliers and customers.
	GSCM on OP	(Zhu et al., 2013) (Bahjat et al., 2020) (Sahoo & Vijayvargy, 2021) (Yu et al., 2014) (Santos et al., 2019) (Sajjad et al., 2020) (Bahjat et al., 2020) (Raut et al., 2019) (Rehman et al., 2016) (Rusinko, 2007) (Khan & Qianli, 2017) (Khan et al., 2022)	Internal GSCM Eco-design, IEM, GM has a positive impact on OP. External activities such as GP, GL, and cooperation with customers and suppliers' impact on OP is still in debatable. However, the impact of reverse logistic positively impact on OP.
	GSCM on FP	(Sarkis, 2012) (Tippayawong et al., 2016) (Green et al., 2012) (Kalyar et al., 2020) (Zhu et al., 2013) (Agyabeng-Mensah & Tang, 2021) (Khan & Qianli, 2017) (Rehman et al., 2016) (Afum et al., 2021) (Feng et al., 2018)	Almost every GSCM do not have direct impact on financial performance, however literature argue EP and OP can mediate the relationship between GSCM and financial performance. The impact of GP and GL are still in debate.
Challenges and drivers to implement GSCM	Drivers to implement GSCM	(Ojo et al., 2014) (Zhu et al., 2005) (Cahyono et al., 2020) (Sajjad et al., 2020) (Zhu et al., 2007) (Agi & Nishant, 2017) (Aries et al., 2019) (Zhu et al., 2005) (Walker et al., 2008) (Wu et al., 2012) (Jayarathna, 2016)	Common external drivers include legal, environmental practises of competitors, and marketing factors. Most important internal driver is top management involvement.
	Challenges to implement and improve GSCM	(Rahman et al., 2020, p. 19) (Mathiyazhagan et al., 2013) (Zhu et al., 2005) (Luthra et al., 2011) (Nteta & Mushonga, 2021) (Samarasinhe and Haijun, 2019)	Challenges to implementing GSCM depend on the industry. Nonetheless, the primary obstacles in the industrial sector are ability, expertise, and financial considerations.

3.5 Summary Table for literature review

Research gap

The researcher discovered that the one of the main literature gaps is that no study has been undertaken focusing EI in Sri Lankan context. Secondly, according to the previous findings the impact of external activities such as GP, GL on OP & FP are still in debatable. Furthermore, collaboration with customers and suppliers on OP is still contested. As a result, this study fills a vacuum in the literature by focusing on the total impact of GSCM on EP, Op, and FP. Finally, the challenges of implementing GSCM vary by industry and country. As a result, there is a literature gap in this setting because no study has been conducted for this specific industry.

Chapter 4. Methodology

4.1 Introduction

This chapter aims to introduce the overall research philosophy and research methods adopted for this study. The initial part delves into the foundational research framework guiding this investigation and the strategy adopted to formulate theories pertaining to the research aims. Following that, the broader research structure is addressed, which includes the methodological approach, analytical tools, and a brief assessment of the strengths and weaknesses of the data used for this investigation. The research methodology section explains the study's guidelines, data collection methodologies, data structuring methods, and analytic procedures. The following sections give information on the study's potential limitations as well as its ethical considerations.

4.2 Research philosophy and design

A research philosophy is a set of beliefs and assumptions regarding the progression of knowledge. This knowledge development begins with a number of assumptions and these assumptions will underpin the research strategy, method, and how to interpret the findings (Saunders et al., 2012, p. 128). These assumptions include ontological- the facts that discover during the search, epistemological assumptions- about human knowledge, axiological assumption- in terms of how and to what extent your own values influence your research approach (Saunders et al., 2012, p. 130). The philosophical position becomes fundamental for research design as it gives appropriate direction for correct methodology, strategy, data collection, and analysis techniques, therefore in-depth understanding of the chosen research philosophy is crucial (Bhatta, 2018, p. 73). Figure 4.1. below the overall philosophical approach and design on which this study has been constructed.

Figure 4.1*Research Philosophy and Design*

Overall Approach	Design	Role of researcher	Kind of data collected	Method(s)	Analysis Approach
Exploratory	Case study	Involved	Mixed methods approach	Interviews Document analysis	Inductive

Interpretivism

According to Saunders et al. (2012) there are five major philosophies be related to business and management research and the main two philosophies are positivism and interpretivism. Positivism is a philosophical viewpoint associated with natural scientists that entail working with social reality as it is observed to develop law-like generalisations. This underlines the positivist emphasis on purely scientific empiricist methods that produce pure data and facts free of human interpretation or bias (Creswell, 2014; Saunders et al., 2012). Interpretivism underlines that humans vary from physical occurrences in that they generate meaning. For example, people can vary cultural traditions, therefore, make different meanings under various conditions and at different times. Thus, create and experience different social realities. Therefore, the goal of interpretivism research is to develop new, more comprehensive understandings and interpretations of social environments and settings (Saunders et al., 2012, p. 148).

For business and management studies, this entails viewing companies through the eyes of various groups of individuals (Saunders et al., 2012). This study is founded on the interpretivism research philosophy and data gathered from individuals in various departments, since the writer believes that individuals do not possess the same views and experiences. In an interpretative study, the researcher collects and analyses data while also actively interacting with participants to acquire a better understanding of their personal observations (Creswell, 2014, p. 38). Nevertheless, according to Saunders et al.

(2012, p. 149), the goal of interpretive research is to foster a more thorough understanding and insight into social circumstances and surroundings by taking into account the perspectives of various individuals. Furthermore, Creswell (2014, p. 24) posited that interpretivism stance researchers involved with the procedure of the research from data collection to data analysis and presenting them to the audience. Therefore, the researcher's role is to actively participate in this study.

Overall approach- Exploratory research

As there has been no previous research on GSCM and its impact on the engineering manufacturing industry in the Sri Lankan context (Gunarathne et al., 2021; Herath, 2021; Herath & Rajumesh, 2022), this research overall approach can be categorised as exploratory research. According to (Collis & Hussey, 2014) in the absence of prior research or limited existing studies, exploratory research is conducted to identify trends and concepts rather than formulating and evaluating hypotheses. Furthermore, one of the primary benefits of exploratory research is the fact that it permits the researcher to change direction when novel evidence emerges through the investigation of literature and new insights come to the researcher. For example, this study was able to assess the various GSCM practices that exist in the literature and see if the same approach is followed in the ABC company while also identifying new practises that differ from the literature. Thus, the researcher was able to explore new ideas and practices in ABC company.

Research Design- Case Study

According to Yin (2018, p. 8), a case study is useful in the exploratory phase of research. One purpose of the exploratory case study was to identify the specific practices. Another goal was to operationalise the actual organisational changes associated with the routinisation process. Stake (1995) posited there are different types of case studies exist in research design, namely single instrumental case study, the collective or multiple case study, and the intrinsic case study. In a single instrumental case study, researchers take a particular case and determine what it accomplishes rather than how it differs from others

(Stake, 1995, p. 8). For example, This study looks at what particular GSCM practices are implemented in ABC company and how it impacts on organisational performance rather than looking at how ABC company's performance differs from other organisation after implementing GSCM. Therefore, the researcher chooses a single case study to answer the research question.

Creswell (2014, p. 74) illustrated, when research is centred on a single organisation, it is referred to as a single instrumental case study. Furthermore, According to Yin (2018) case studies are preferred when the relevant behaviours cannot be controlled and when it is desired to study a recent incident or series of events. Thus, this single case study focused on changes in supply chain practices in ABC company over six years period. Yin (2018) described the preferred research approach for case study questions will begin with "How" and "Why" questions. This is because such challenges need the tracing of operational processes through time, rather than fundamental frequencies or incidence. In essence, the questions of "how" and "why" offer a framework to understand, implement, and assess GSCM practices in a particular organisation.

Approach- Mix method

Therefore, the researcher sought to study the cases by using mixed-method data collection. One of the main reasons for taking a mixed-method approach for this study was that it is exploratory research. Using a single data collection method may not give a broad view of the study. According to Creswell (2014, p. 14) research approaches as quantitative, qualitative, or mixed methods, with mixed methods ideally suited for case study research. He further illustrated that mixed methods research is an approach to inquiry that involves gathering both quantitative and qualitative data, integrating the two types of data, and employing separate designs that may include philosophical assumptions and theoretical frameworks. Thus, this study conducted semi-structured open-ended interviews with different department heads to gather qualitative data, while collecting quantitative data by assessing reports that gives KPIs information for

performance evaluation. These two types of data facilitated to answer define five research objectives more accurately.

Another reason is, the underlying assumption of the method of inquiry is that combining qualitative and quantitative approaches provides a more comprehensive understanding of a research subject than either way alone (Creswell, 2014). For example, a study that simply collected a macro image of performance measurements via quantitative data collecting might fail to recognise what types of elements influence performance. Therefore, a qualitative component is used to investigate the experience of individuals regarding GSCM practices and their challenges. Perhaps, using different database enable the researcher to confirm the findings and increase the validity of the data (Halcomb & Hickman, 2015). Finally, according to Halcomb and Hickman (2015) (cited as Hall, 2020) each approach has its own strengths and weaknesses, therefore mixed methods allow each quantitative and qualitative data collection method to complement each other. Thus, the findings of the study give meaningful outcomes as qualitative data can provide explanations, narratives, and context for quantitative findings.

Data collection methods

According to Creswell (2014, p. 73) the researcher must focus on several sources of information to undertake an in-depth analysis. Nonetheless, Yin (2018) argued that case study features and core characteristics, such as the requirement for defining a "case", triangulation among multiple sources of evidence, and the ability to rely on quantitative data, appear to push case study research beyond being a type of qualitative research. Therefore, this study will mainly rely on two data collection methods, interviews, and document analysis.

Advantage and disadvantage of data collection methods

Saunders et al. (2019, p. 397) discussed data quality issues associated with semi-structured interviews. He illustrated there may be reliability/dependability concerns due to a lack of standardisation. He further showed three types of bias can exist namely,

interview bias, interviewee or response bias, and participation bias. On the other hand, the advantages of semi-structured interviews outweigh the disadvantages. According to Bryman and Bell (2007, p. 476) semi-structured interviews are more flexible than other types of interviews. The interview questions were designed with a general format that covered different themes related to research objectives and it may cover to some extent. However, it gives the researcher to ask questions that are important and pick up on things said by the interviewee. On the other hand, this allows participants to express views, experiences, and feelings in their own words, which offers richer data (Kvale & Brinkmann, 2009). Another important advantage of this method is answers can be clarified or validated immediately (Creswell, 2014; Kvale & Brinkmann, 2009). If there is something that is not clear, the interviewer can ask another question to clarify the answer (Rubin & Rubin, 2011, p. 32).

According to Saunders et al. (2019, p. 330) main advantage of secondary data is saving time and money as they are readily available. Furthermore, these data facilitate to undertaking of longitudinal analysis as it facilitates to use of existing multiple-source data sets to create our own. On the other hand, this may allow us to triangulate research findings. Nevertheless, the major disadvantage of the secondary data is data might have been collected for organisational purposes and it might differ from the research questions or objectives (Denscombe, 2007). Therefore, data might be inappropriate for the research study.

Approach to analysis

Denscombe (2007, p. 38) described case study research as mostly being employed in the context of finding information (through inductive logic) and they have been used less frequently in theory testing (following a deductive logic). Therefore, this study was based on an inductive approach. According to Collis and Hussey (2014, p. 7) inductive enquiry begins with specific findings and progresses to a broader understanding of theories. The researcher looked at the present practises and measured performance disparities in this investigation. The goal of open-ended interviews and document analysis was to develop new ideas without relying on pre-existing theories and assumptions. This approach was

crucial for this study as there is less literature on this topic. Moreover, Saunders et al. (2019, p. 155) posited inductive approach is more appropriate for a small sample as inductive reasoning research is likely to be particularly interested in the context in which such events occur. Thus, the inductive technique is preferable because the number of participants in this study is minimal.

4.3 Method 1: Interviews

4.3.1 Purpose of interviews

In this research, the primary method of gathering data was through interviews. The goal of this research was to investigate the ABC company's GSCM practises. To accomplish this goal, conducted interviews with different department executives to get knowledge on various GSCM implementations/challenges they faced and GSCM impacts. The goal of interview data collection was to cover all five objectives of this research. According to Kvale and Brinkmann (2009, p. 26) interviews enables the researcher to support or challenge existing theories, as well as produce new ideas from an individual's point of view, all while contribute to the overall breadth and credibility of the research. Another benefit for doing interviews is that they allow the interviewer to enquire further and seek clarification on the answers offered (Bryman & Bell, 2011; Kvale & Brinkmann, 2009).

4.3.2 Interview design

Saunders et al. (2019, p. 391) discussed different interview designs and one common typology include structured, semi-structured, and unstructured interviews. Semi-structured interviews were used in this study to cover topics pertinent to the research aims while collecting personal perspectives. In a semi-structured interview, the researcher can follow an interview guide that covers a specific topic while allowing the interviewee to reply in any way they believe is appropriate (Bryman & Bell, 2011; Saunders et al., 2019). This study's main focused build on impact of GSCM on environmental, financial, and operational performance. Therefore, this semi- structural interview questions include

16 general questions which cover 5 main research objectives. Participants can choose what to answer and not, based on their knowledge and experience in particular area. D O'Gorman and MacIntosh (2015) illustrated by allowing participants to communicate their experiences and ideas, the interviewer can collect extensive responses and valuable information. Furthermore, Saunders et al. (2016, p. 392) posited in an exploratory research study semi structured interview is appropriate as it provide background to the study. The copy of the interview questions is attached to Appendix D.

4.3.3 Pilot testing

Pilot testing, sometimes known as a "dry run" of a research study and it is an important part of the research process. The one of the main reason is pilot testing helps researchers improve the clarity, relevance, and effectiveness of their data collection techniques (Van Teijlingen & Hundley, 2002). Furthermore, this aids in identifying and correcting unforeseen hurdles, logistical issues, or ambiguities in directions (Sampson, 2004). As a result, before conducting final interviews, the researcher conducted a pilot study for interview questions to identify potential issues. This pilot study was conducted with one company participant by informing the purpose. In this pilot study, the researcher determined that some of the questions should be changed to be more time sensitive. Furthermore, participant recommendations, thoughts, and comments were gathered to modify the identified questions.

4.3.4 Procedure

Employees with comprehensive expertise in the supply chain, human resources, compliance, and finance are selected to respond to these interviews. First, contacted the company's assistant general manager to obtain their permission to select the company for this study. After that, request the contact person details, including the e-mail address who are deciding their departments. Then, contacted six participants via e-mail and asked about their interest in participating in this research and collected all signed consent forms before data collations. Individual interviews are conducted for 40 minutes via team-meeting within three weeks and all interviews are recorded and stored in a password-

protected computer. Then, used Revoldiv (<https://revoldiv.com/>) software to transcribe all interviews.

4.3.5 Participants

This study has chosen six participants as mentioned in figure 4.2. This study used maximum variation sampling to select participants, therefore participants were selected according to the researcher's judgment and considered decision-making managers or executives in a different department who have held their experience for at least 5 years. Saunders et al. (2016, p. 301) described maximum variant sampling is not a statistical sampling and it relies primarily on the researcher's judgment to select participants with sufficiently various characteristics to capture the greatest variety possible in the data obtained. This enables to discovery key themes in the research objectives.

Figure 4.2

Summary of interview participants

P1	Male, early 50s, thirteen years' experience. Position- Assistant General Manager- Operation
P2	Male, early 40s, eight years' experience. Position- Assistant Manager- Logistic
P3	Male, 50+, fifteen years' experience. Position- Assistant General Manager – Integrated Systems
P4	Male, early 50s, fifteen years' experience. Position- Manager - Finance
P5	Female, early 30s, five years' experience. Position- Senior Executive-Purchasing
P6	Female, early 50s, thirteen years' experience. Position - Assistant General Manager

4.4 Method 2: Document Secondary Data

4.4.1 Purpose of the document analysis

Bryman and Bell (2011, p. 566) highlighted that within case study research, documents play a crucial role in understanding a company's landscape. They offer perspectives on past management choices, initiatives, and transformations. Therefore, this study used document analysis to identify GSCM guidance for enhanced organisational performance and performance variations over the time. Another reason is that documents can assist the researcher in obtaining rich information. Perhaps Bowen (2009, p. 30) showed documents facilitate the monitoring of change and progress, as well as bringing up new questions that must be considered. This study document was intended to record the performance differences that occur after the adoption of GSCM and organisational supply chain adjustments, as well as to determine the guidelines of GSCM and what it provides to the company. Bowen (2009, p. 30) emphasised the significance of documents, explaining that document analysis promotes the acquisition of a wide range of details. This enables researchers to examine both periodic and definitive reports, gaining an accurate picture of an organization's or program's evolution throughout time. In light of this, the researcher reviewed audit reports, performance appraisal reports, and financial statements from the years 2017-2020 (before to the adoption of the GSCM) and 2020-2023 (post-GSCM integration). This information is divided into three categories: environmental, operational, and financial performance, and evaluated according to the defined KPIs.

4.4.2 Procedure

Access to the corporate audit reports, performance evaluation reports, and financial documents was sought and granted by the corporation. According to Saunders et al. (2016, p. 330) it is difficult to locate data maintained by the organisation. Consequently, special access should be allowed, and the appropriate person should be contacted to get accurate data. Because these secondary data were not available in the company's online database, the operational head of the company contacted to obtain soft

copies of the documents after access is permitted. The researcher aims to examine a document that spans six years (2017-2023) since they anticipate major swings in organisational performance.

4.4.3 Data analysis

For the qualitative data analysis, this study used thematic analysis. To do a successful analysis the researcher used six phases which described by Braun and Clarke (2006, p. 87). The first step was to read the data to familiarise it and identify common codes. The researcher looked for a pattern of specific facts to draw a relationship between different GSCM practices and their contribution to the organisation when searching the topics. Then, developed titles and themes to aid in identifying the broader story behind the data. In the end, data is synthesized to produce a report that aligns all discoveries with the research goals. This method facilitated to gathering of identified data around main three themes, GSCM impact on environmental performance, GSCM impact on operational performance, and GSCM impact on financial performance. To triangulate the data, the researcher used documentation findings. Here to measure organisational performance the researcher used key performance indicators (KPIs) as shown in Figure 4.3 adopted by Zhu et al. (2013). Through an inductive approach, thematic analysis will be employed to select relevant themes that might hold significant relevance to the issues raised by the participants. As such, this study employed an inductive approach because of the themes discovered from data collected particularly for the project.

Figure 4.3*Key performance indicators*

Environmental	Financial	Operational
Reduction of wastewater Usage of ground water	Decrease of cost for materials purchasing	Increase amount of goods delivered on time.
Reduction of solid wastes	Decrease of cost for energy consumption	Decrease inventory levels.
Reduction noise	Decrease of fee for waste treatment	Decrease scrap rate.
Decrease of consumption for hazardous/harmful/toxic materials.	Decrease of fee for waste discharge	Promote products' quality.
Decrease of frequency for environmental accidents.	Decrease of fine for environmental accidents	Increased product line efficiency
Improve a company's environmental situation.	Decrease cost for logistic	Improved capacity utilization

Note. Reprinted from *Journal of Purchasing and Supply Management*, (Vol. 19, p. 115) by Zhu et al, 2013.

4.5 Limitations, reliability, and bias

Regardless of the methodologies used, each study has its own set of limitations, and it is the nature of the scientific process. Recognising and describing these limitations can assist readers in understanding the breadth and relevance of the research, and it is also a sign of an honest and self-reflective researcher.

One of the study's key limitations is the selection of a case study and the scope is limited to an EI in Sri Lanka. As a result, the study's generalizability is restricted, and it may not be applicable or predictive of other regions or situations. Another limitation is the use of secondary data for document analysis. The aim of the facts supplied in secondary sources may be influenced by a variety of factors. For example, corporation audit reports utilised for internal factor analysis. As a result, the parameters they employed may differ from those required for this investigation. Furthermore, the

researcher has not been permitted to reach the full financial details of the company because of confidentiality. Therefore, the study's scope is confined to the selected financial facts. Likewise, the ability to influence the quality of secondary data is limited, and the researcher needs to take extra caution when analysing secondary sources (Saunders et al., 2016, p. 334).

Yet another drawback of this study is the adoption of the interpretivism research philosophy, which places a significant emphasis on the researcher's interpretation of data analysis. To mitigate the researcher's preconceptions, this research used mixed method approach which integrated of qualitative and quantitative as this method can serve as form of triangulation. This also enhance creditability of the results. Furthermore, the researcher conducted pilot study by refining instruments and procedures based on pilot findings and it facilitated to improve reliability and validity of the main study. Moreover, this study debriefed by the peer who is not participating in the study analyses the techniques, coding schemes, and outcomes to provide an outsider's perspective. Thus, the researchers improved the trustworthiness and credibility of the research findings.

Participants' bias was minimised by informing them that their responses would remain anonymous. When people believe their responses cannot be linked back to them, they are more likely to be truthful. Furthermore, to eliminate participant bias, this study contained open-ended questions in interviews that participants could freely answer. On the other hand, to eliminate researcher bias, the researcher ensures that questions are clearly phrased and do not navigate participants towards a specific answer.

4.6 Ethical considerations

4.6.1 Method 2: Interviews

This research is based on interviews and secondary data. Since the study is based on human participants ethical consideration is needed. To begin with the research, participants provided an information sheet with details of the research and consent forms (Appendix C). Oral affirmation was sought to ensure that all participants were adequately

briefed, aware of their role, and recognized that their involvement was wholly optional. The participant data are fully confidential and anonymous and couldn't identified in the data or final report. All the recorded interviews and transcribes are stored in a password-protected computer. The approved ethics application can be found in Appendix A.

4.7 Summary

This exploratory study was designed employing mixed-method analytic approaches under the interpretivism paradigm. An inductive technique was utilised to develop a theoretical framework for the study's findings. This project's research strategy was a single case study analysis with multiple data sources. The researcher was aware of the constraints associated with employing a case study and use of secondary data source. To overcome limits, credibility, and bias-related difficulties, multiple sources of data and numerous data analysis methodologies, including interviews and analysis of company documents were used.

Chapter 5. Findings and Analysis

5.1 Introduction

The emphasis in this important chapter is fully on unfolding the research findings and presenting a collection of data summaries. This chapter provides a full explanation of the research question: How does GSCM effect organisational performance? using both descriptive and inferential data analytical methodologies.

A mixed methods approach was used to strengthen the robustness of this study. By utilising both quantitative and qualitative research methods, this ensures a balanced and full investigation of the topic. The quantitative section of the study gathered data through the organisational document, ensuring statistical depth and breadth. In addition, the qualitative section went deeply into the intricacies of GSCM's impact on organisational performance by interviewing 6 participants from various departments to provide a more textured, narrative-driven viewpoint.

This chapter has a distinct purpose: to visually illustrate and offer insightful interpretations of the research results. By doing so, it aims to ascertain the ways through which GSCM influences organisational performance. The data reveal five distinct themes, offering light on how diverse GSCM activities impact organisational improvement and what challenges that organisation face when implementing and advancing these practices. The emergence of these findings has a significant impact on the overall conclusions of this investigation. Furthermore, they lay the groundwork for a comprehensive, informed, and critical discussion of these findings, which will be the focus of Chapter Five. By reading this chapter, readers will understand the deep connection between GSCM and organisational performance, laying the groundwork for further discussions based on the findings.

5.2 Results

5.2.1 Method 1: Interview

This table represents the GSCM practices currently practicing in ABC company. The individual participants responded the following practices according to their experience and scope.

Figure 5.1

Participants discussion on GSCM

Participants	Eco-design	Green Purchasing	Green Manufacturing	Green Logistics	GHRM & IEM	Green IT
P1	✓	✓	✓	✓	✓	✓
P2		✓		✓		✓
P3			✓		✓	✓
P4	✓	✓	✓	✓		
P5		✓	✓			✓
P6					✓	✓

Green practices

Based on the response from the participants, the GSCM practices adopted by the organisation are mainly classified as Eco design, Green Purchasing, Green Manufacturing, Green Logistic, Green Human Resource & Internal Environmental Management System, and Green Information Technology. The brief discussion of each of these practices are given below and company practises are presented in detail.

Figure 5.2

Definitions of GSCM

Green Practices	Definitions
Eco-design	Eco-design refer to manufacture products that use less material and energy, allow for the reuse, recycling, and recovery of component materials and parts, and eliminate or reduce the usage of hazardous goods during the production process (Zhu et al., 2008)
Green purchasing (GP)	Green purchasing refer to involves collaborating with suppliers to generate ecologically sustainable products (Zhu et al., 2008)
Internal environmental management (IEM)	Internal environmental management is the practise of establishing green supply chain management as a strategic organisational necessity through senior and mid-level management commitment and support (Zhu et al., 2008)
Green information technology (GIT)	Green information systems are customised information systems that are used to monitor environmental practises and outcomes. (Esty & Winston, 2006)
Green manufacturing (GM)	Manufacturing planning and control, minimising energy use and material exploitation, and eliminating waste throughout manufacturing processes are all part of GM (L. Liu et al., 2012)
Green human resource management (GHRM)	Making use of a company's human resource policy to promote and achieve ecologically sustainable goals (Labella-Fernández & Martínez-del-Río, 2019)

Eco-design

Product

- Use eco-friendly material.
- Design long lasting product
- Use high efficiency motors in order to have less power consumption.
- Design solar machines to less power

Company

- Factory buildup to use more sunlight during daytime.
- Natural air ventilation systems to minimize air-conditions.

Green Purchasing

- Supplier selection according to environmental standards.
- Signed code of conduct contract with all suppliers (Environmentally friendly practices in supplier end).
- Visiting suppliers in regular intervals.
- Inform and encourage suppliers for environmentally friendly practise.
- Supplier evaluation once a year to avoid environmental pollution.

Green Manufacturing

- Noise reduction
- Reduce use of chemicals and proper chemicals disposal methods
- Use of efficient noise reduction tools
- Use of soundproof cabins.
- Reuse packing materials, use bio-degradable packing materials.
- Reuse water for machine testing after purification.
- Lean approaches to utilize space, manpower and reduce waste.

- Reduction of paper usage.

Green Logistic

- International transportation- Sea freight use than Air- freight
- Local transportation- Use of rail, centralized transportation system
- Shipment consolidation
- Advise for bio- degradable packing.
- Reuse packing materials

Green HR

- Induction training for new employees- Environmental, Safety and Quality
- Regular awareness program for all employees
- CSR projects- Tree planting programme, Environmental cleaning
- Audit program.
- Vehicle check list
- Work permit for contractors

Green IT

- B2B system for supplier handling
- E- document system for logistic
- Monitor the performance of all implemented GSCM practices.

Impact of GSCM on Environmental performance

ABC company is an ISO-certified company and company has an environmental vision from which ultimately all activities are derived.

We are committed to protecting natural resources, enhancing our surroundings, and mitigating adverse environmental impacts, including innovation that aims towards zero-emission solutions. Our minimum compliance obligations are requirements of ISO 14001:2015 and customers' requirements.

Starting with their company policy, ABC company has a wide range of GSCM practices that help them to strengthen their competitive edge and secure their market position. According to all participants in this study, identified GSCM practices positively impact an organisation EP. The question regarding the impact of GSCM on EP is positive because these practices eliminate waste from their supply chain and minimise environmental pollution activities. Bellow analysis shows how different GSCM practices improve EP.

Eco- Design

P1 stated,

Our machines are made using eco-friendly materials. Therefore, in case the machines need to be disposed of after use, you don't have much trouble to dispose of these things and it will not make any impact to environmental.

ABC company is working through its product's material to minimise their impact on the environment. Specially, the use of eco-friendly materials is one of the insightful features of their products. Furthermore, these features are not only for the product, but it has also started from the factory layout. As P1 indicates,

At the time of design of our factory and factory layout itself, we trust for having a green and environment-friendly setup for this production facility, such as the use of sunlight during the daytime. So, we have some of the

activities that you can see some gas windows and the glass surroundings to get maximum daylight. Also, to the proper way to dispose of wastewater, especially solid waste.

Green Manufacturing

GM's goal is to encourage a more responsible and sustainable manufacturing approach that helps both the environment and businesses. This is one of the key supply chain practices that can have a negative influence on polluting the environment if no precautionary measures are taken. Some of the action that has been taken by company management include, reducing water usage, proper disposable method for chemicals, highly efficient noise reduction tool, soundproof cabins, and most importantly as P3 responses “We are using the minimum amount of chemicals in our manufacturing processes. For example, even in the disposal of this chemical, empty chemical vessels or cans and tins, we try to do it responsibly way.”

Reusing packing materials is another option for reducing solid waste on factory premises. According to P3, this company exports its product utilising its received packing material. “We use wooden pellets to transport our equipment. So as much as possible we try to reuse them.”

Green Purchasing

Green purchasing activities are highly influenced by external stakeholders. This is the moment at which a manufacturer can reduce its solid waste from outside sources. As a result, ABC firm has its own systems in place to remove solid waste from the supply chain and negotiate environmentally friendly supply practices with their external parties such as suppliers. ABC company has a contract with a code of conduct (COD) that encompasses safety, regulatory, and environmental compliance. Every ABC company's supplier should be given this signed COD before they begin doing business. P5 stated.

We give priority to closer suppliers and suppliers who adhere to environmental regulations and policies. dealing with suppliers to avoid environmental pollution. In supplier selection processes we consider ISO

14001 for environmental certificates. We conduct supply evaluations once a year to make sure they are also following basic quality and environmental standards. Also, we do regular supplier audits. In this process, we are visiting some select suppliers and evaluating their certification. We have informed suppliers to use biodegradable materials for packaging and finally we have encouraged suppliers for environmental sustainability.

Green Logistic

ABC company exports 80% of its items outside of Sri Lanka. As a result, logistics plays an important role in their business. P1, 4, and 5 stated “We are trying to have sea freight always. And for this one, we are trying to consolidate many goods from one country and make one shipment rather than making many shipments”. Similarly, P2 stated that an increase in marine cargo will have a good influence on the environment. “Because when we consolidate and ship the carrier, the carbon emission is very less. But if we send them as small air creates and so the impact to the environment is high”.

Furthermore, they employ certified carriers for transportation since certified carriers set and maintain requirements for their vehicles and facilities in terms of expected environmental performance, such as low emissions and energy consumption. In fact, they are advising their suppliers to use environmentally friendly packing materials. P4 stated, “We are trying to use bio-degradable packing materials and reuse the packing materials such as paper packing, stuffing, and pallets to re-ship our final products”. By doing these practices P5 responded they can reduce packing costs as well as solid waste.

Green Human Resources

ABC company considers employees' knowledge to be valuable regarding company practices and new technologies. Therefore, the HR department conducts an awareness program for all new employees and regular meetings with them to share information and educate them about environmental sustainability. P6 stated,

We are giving them some idea about environmental and quality control and health and safety, proper usage of chemicals, good practices like energy

saving and all the chemical related safety practices. Also, we have some training because some regulations are regularly changing.

These programmes are beneficial not just to the firm but also to the individuals. “The way people work also has changed because there's a cultural change and the approach of the people also has changed. Those are positive and that cannot be measured in terms of finance” said P4.

Aside from that, they have environmental KPIs which are parallely implemented with the CSR program. Tree planting programmes and cleaning programmes are held once a year to improve the company's environmental position. P1 responded. “So as of now, we have made around 3000 plus trees for the last three years. So, we are having this as one of the major CSR projects.”

Green IT

To truly harness the benefits of Green IT, organisations must take a comprehensive approach. This entails looking beyond direct IT operations to evaluate the complete lifecycle of IT products as well as the broader impact of digital processes and infrastructure. As a major benefit P2 stated, “Actually sometimes for a single shipment we may use 20 to 25 A4s sheets but when we use e-platform we don't need any paper”.

In addition, P6 demonstrated how they dispose of e-waste in an environmentally acceptable manner.

E-waste comes with electronics. There are many harmful things, parts like LED and mercury that should not go in any environment. So due to that we are giving much attention to e-waste. For this EVS disposal, we have having agreement with one of the most reliable companions in Sri Lanka and they are licensed under the environmental authority of Sri Lanka. So, they are accredited as an EVS manufacturer, and they can give a certification for us that it has been done in the proper and effective way.

GSCM practices on operational Performance

Eco- Design

The impact of eco-design on organisational OP is positive. Because Eco-design takes a comprehensive approach to product or service creation. By implementing eco-design, the company may optimise operational performance, decrease costs, manage risks, and capitalise on new market opportunities by accounting for environmental consequences over a product's whole life cycle. P1 stated,

Our machine's general lifetime is 10 years approximately. So, by design itself, it is a long-lasting machine. Our machines and everything are designed to have a robust look and the robust used, High-efficiency equipment such as motors and other equipment to have less power consumption at the time of operations.

Green Manufacturing

Green Manufacturing increased the OP of ABC company by optimising waste from the different manufacturing stages. P1 discussed the importance of GM as they implemented some lean approaches to environmentally friendly manufacturing processes which also positively impacted OP. He stated “We have made some of the lean approaches and good practices and engineering controls in our production. Due to that, the manpower utilisation always keeps 90 plus”.

This has been proved by the P4,

One is improving energy efficiency within the company and providing our end- product to improve the energy efficiency for our end customers. So, both ways we are looking at. So, to improve the energy efficiency in our company, we are using daytime solar lighting for the manufacturing processes and all our equipment are very energy efficient and from end customer point of view we are using high-efficiency motor.

Green Logistic

GL's major practices are increased maritime transport and cargo consolidation. These practices have a negative impact on OP. According to P2 “Sometimes negative impact for the operational performance, lot of consolidation can lead additional delivery delays and production team preferred sooner delivery, but if you are going to get them by see that might take some time”.

Another unfavourable outcome was obtained from P5. “Because of higher transit time of sea shipments, we may have to face like out-of-stock situations, causing difficulty in adopting certain changes in demands”.

Green IT

ABC company recently transitioned from manual documentary to e-documentary, which boosted employee efficiency. The P3 said, “After they adjusted to this electronic documentation, now they prefer it because they know they have seen the positive things about using electronic documentation”. P1 said “We use IT practices like e-platform, which facilitate efficient system and minimize paper usage”.

GSCM practices on financial performance

Eco- Design

Because of the cost of eco-friendly materials, eco-design is not financially advantageous for the company. It is also costly to train employees for eco-design products. P4 stated “One and a half times, we used to do training for the eco-design products, so that's increased cost”.

However, P1 mentioned some positive aspects, such as how the eco-design of the factory layout allowed them to enjoy maximum daylight during the day, reducing electricity consumption. Furthermore, they implemented natural air ventilation systems in both the factory and the office, which assisted them in reducing their reliance on air

conditioning. In the financial aspect they are positive eco-design implementation as end of the day it's all about electricity cost.

Green Manufacturing

GM practices are one of the most important in business, and companies must also deal with many sorts of waste. These are primarily chemical and hazardous waste disposal. Participants 1 and 3 have the same idea regarding waste disposal costs.

We are having a cost for the disposal of special parts. So, country like Sri Lanka, we don't have any proper systems or any strong support from the government for disposed chemicals. So, dispose of these chemicals and other things, company has to spend much money, and we had to deal with private third parties.

Furthermore, as part of their GM practices, they employed eco-friendly polythene for packaging. P3 stated, "I mean it is more environmentally friendly compared to normal polythene. So, it is a bit costly but again our group we have decided on this packing material".

Green Purchasing

Three participants agreed that GP raises overall costs. Because few suppliers in the market meet their environmental standards, they have lost their bargaining power.

- **P5**

I wouldn't say that it's profitable because choosing a supplier with additional requirements like obtaining an ISO certification may impact to reduce our bargaining power. The reason for that is there are fewer suppliers based on our products who also have these environmental requirements. And on the other hand, when suppliers go for biodegradable materials, it increases the final cost of the product.

- **P4** "There are few numbers of supplies, so we can't go on bargaining for lower prices and get competitive votes".

- **P1 stated** “When we demand the GP, the cost of the raw materials is slightly high rather than the open market”.

Another reason is that GPs incur additional costs for the company in the form of inventory holding costs. Because they employ sea freight the majority of the time, they must keep a safety stock on hand. Participants 1 and 4 stated, “Even though we don't have orders, we have to keep the stock, maintain stock, and inventory holding cost is much higher”.

Green Logistic

The impact of GL on the financial performance of the organisation appears to be profitable. This is because maritime freight is substantially cheaper than air freight. It resulted in a reduction in transportation costs. Also, adopting a centralised collecting method is efficient and economical because it allows them to reduce the number of shipments from a single location. P1, 2, 4, and 5 had a similar perspective regarding the cost of transportation after implementation of GL. “Many sea shipments allow a cost reduction, so you know that if you get something by air you have to pay 100% then if you go by sea you have to pay only 20%.”

In terms of packing, they advise their suppliers to utilise bio-degradable materials, which are slightly more expensive than standard packing. However, they claim they can recoup this cost because they re-use the packing materials for export purposes.

Green HR

Participants 1 and 4 stated that the only thing that has a financial impact is an employee training programme for environmental practices. However, they are proud of the benefits that they obtain from these practices because some environmental aspects cannot be measured in terms of monetary value.

P3 - “People have now some awareness about the environment than previously. So that is one of the biggest victories I should say”.

P4 - “The entire culture of the organization has shifted a little bit. so that results in better working conditions for the workers and the attitude towards the production and wastage, and how to manage the wastage has been drastically improved”.

Additionally, by incorporating environmentally friendly practices into their supply chain, they strengthened their competitive advantage. P1 stated,

If you talk about some good advantages, due to these compliance practices that we are following especially for the Europe market, we got a high probability of order intake. So, this became a competitive advantage for winning orders in Europe.

5.2.2 Method 2: Secondary Data

These secondary data will show how GSCM contributes to the company EP, OP, and FP respectively. These secondary data were obtained with explicit authorisation from the company via company performance evaluation reports, audit reports, and yearly financial reports. These files were requested online as PDFs, PowerPoint presentations, and Word documents. This data was presented before implementing GSCM (2017-2020) and after implementing GSCM (2021-2023). However, some practices start from the beginning, and some are implemented in later stages. Therefore, the defined period may not be covered by every practice.

Impact of GSCM on environmental performance

Waste reduction

Figure 5.3

Waste reduction distribution from 2018-2023

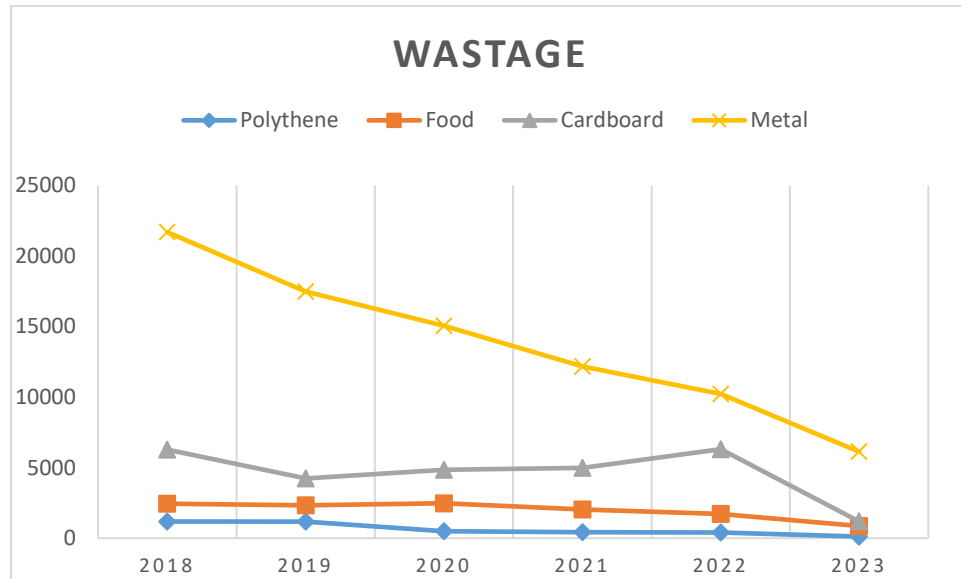


Photo: Company reports, 2023. Reproduced with permission.

The above diagram shows how ABC company managed its waste from its supply chain from 2018-2020. After implementing GP, GL, and GM practices in the company in 2020 all 4 types of waste, polythene, food, cardboard, and metal have been greatly reduced. Most importantly metal and cardboard waste has been reducing drastically.

Noise correction according to standards

Figure 5.4

Noise reduction action -2020

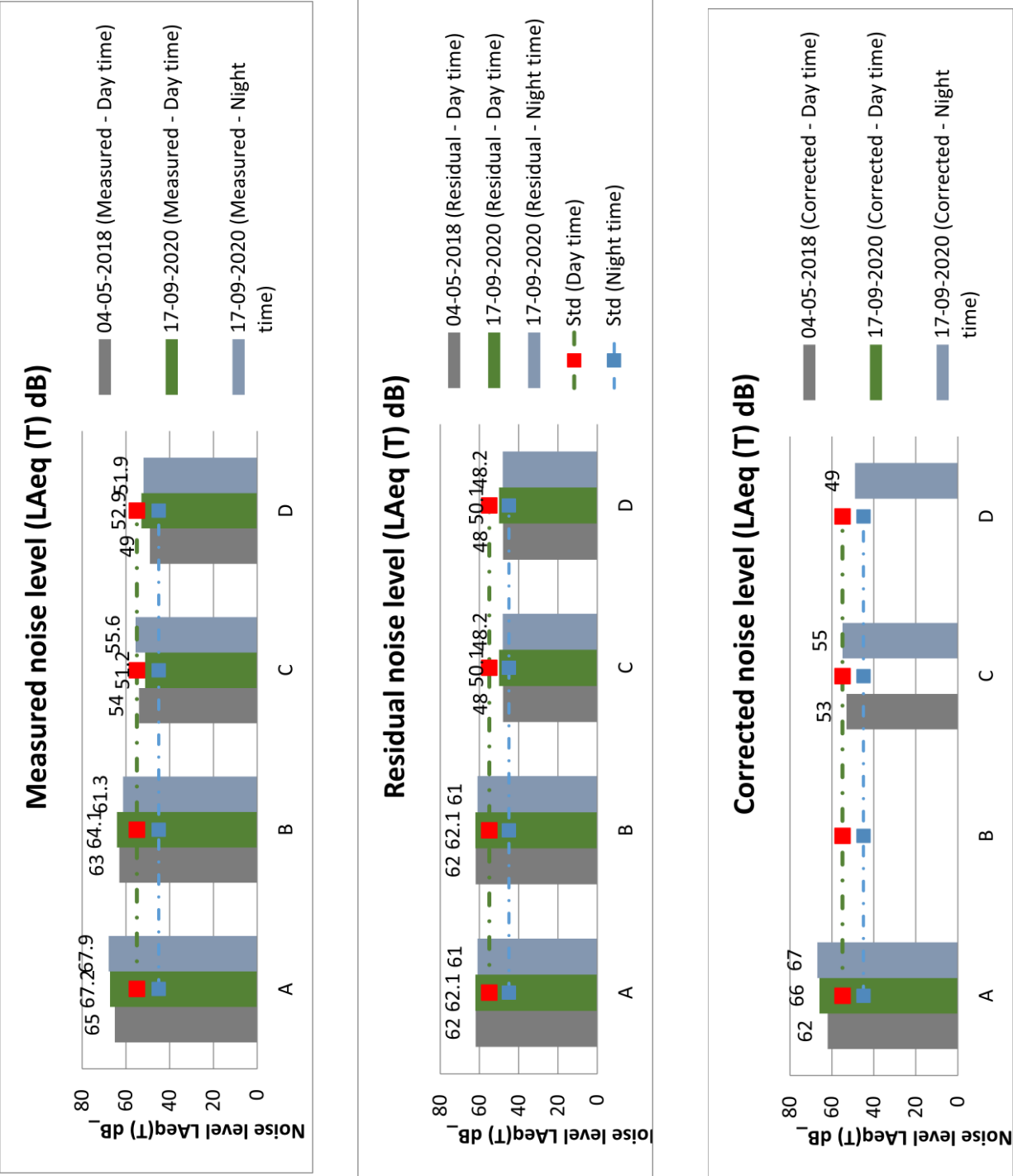


Photo: Company reports, 2023. Reproduced with permission.

The preceding steps demonstrate how the corporation greatly exceeded the standard noise requirement by implementing GSCM practices eco-design and GM. They initially initiated action in 2018 to lower their daytime and nighttime noise, and they successfully reached the standards in 2020. However, there is considerable variation in nighttime noise, which is being addressed. This feat was accomplished by utilising eco-friendly design tools/machines and soundproof cabins.

Frequency of environmental accident

Figure 5.5

Environmental accidents reported from 2017-2023

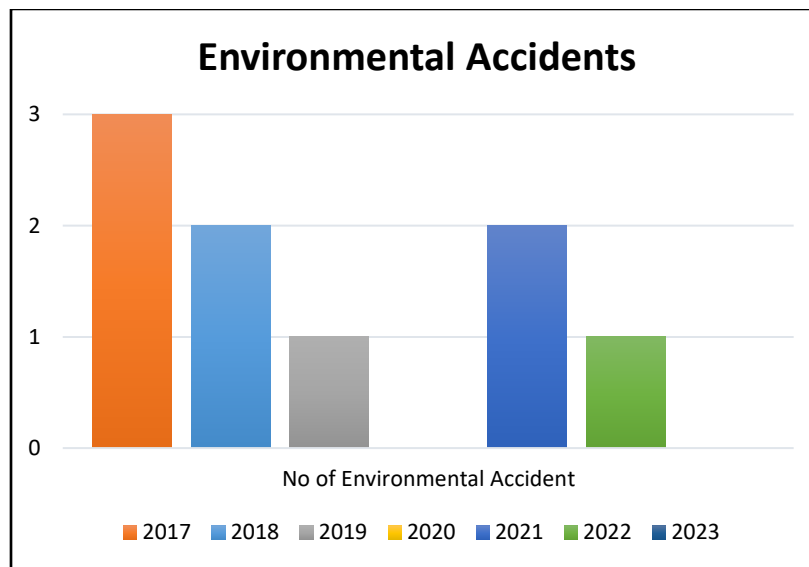


Photo: Company reports, 2023. Reproduced with permission.

According to the graph, the number of environmental accidents has declined over time. Most importantly, there will be no environmental disasters in 2023. A competent IEM system thoroughly investigates the decrease of environmental accidents by implementing an audit system in their firm. This company established an IEM system in 2020, and they met their aim by 2023 by reporting “0” environmental accidents.

Reduction of CO2

Figure 5.6

Total carbon footprint – import shipments from 2018-2023

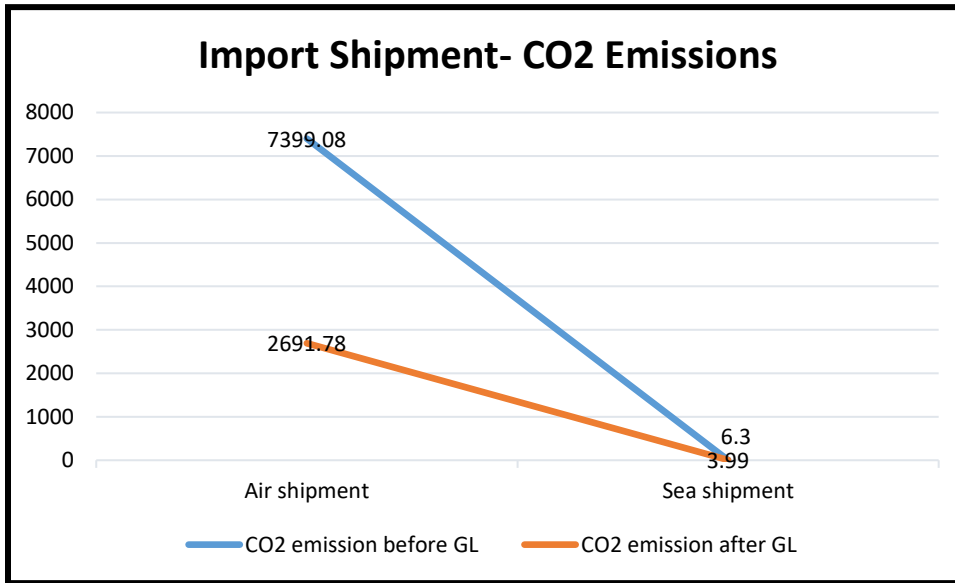


Photo: Company reports, 2023. Reproduced with permission.

The graph displays the carbon footprint of imported goods. According to the data, after implementing GL, the company was able to reduce CO2 emissions by lowering the number of shipments. CO2 reduction from air transportation is 46.6%, and CO2 reduction from sea transportation is 21.4%. This calculation is based on Greenhouse gas reporting: conversion factors 2020 (CO2 Everything, n,d). These practices improve the company's environmental situation by lowering air pollution.

Company environment situation

Reduction of paper usage

Figure 5.7

Paper usage of different departments from 2020-2023



Photo: Company reports, 2023. Reproduced with permission.

According to the company KPIs, one of their major performance indicators for enhancing environmental stance is reducing paper usage. The above figure illustrates that when they introduced this practice in 2020, they consumed roughly 75% paper, which is nearly high. According to the data presented, the production and finance/shipping departments used most of the paper. However, by using an online inspection system, a B2B platform, and e-document systems, the firm was able to eliminate their manual work, resulting in a 55% reduction in paper usage by 2022.

CSR program to improve company environment situation

Figure 5.8

Track records of tree planting CSR project form 2018-2023

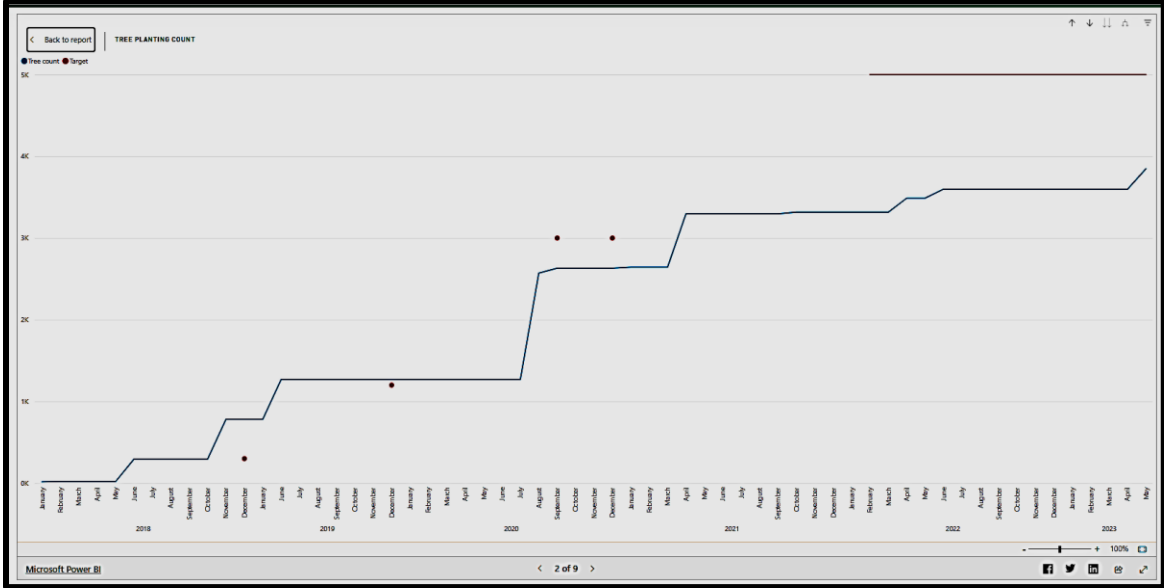


Photo: Company reports, 2023. Reproduced with permission.

To help the environment in which they resided; the company launched a tree-planting campaign in 2018. This diagram indicates that they gradually succeeded, and by 2023, they planted almost 3000 trees.

Impact of GSCM on operational performance

Product quality improvement

Figure 5.9

Customer complaints received from 2018-2023

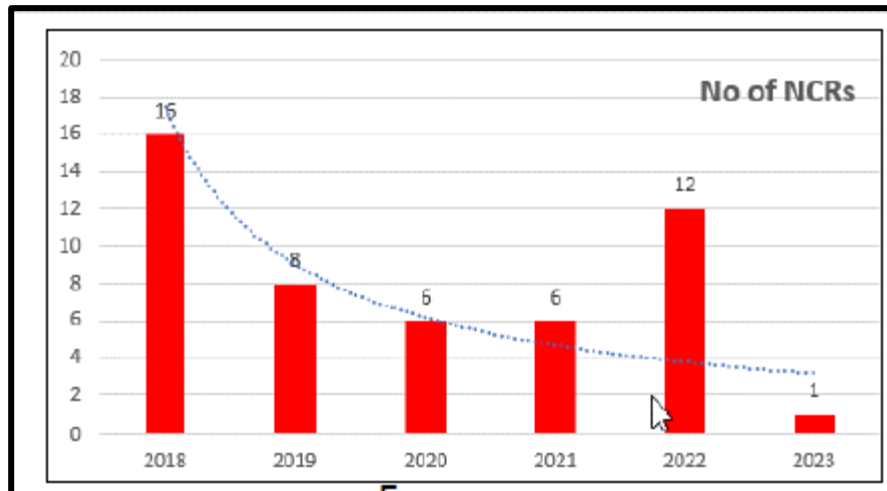


Photo: Company reports, 2023. Reproduced with permission.

Client feedback on their products is represented by the number of NCRs. According to the graph, before the adoption of the GSCM in 2020, the number of NCRs was 16. However, the number of complaints received by the customer decreased from 16 in 2018 to 1 in 2023. This is due to the company establishing an internal quality control system as GM practice to reduce their number of complaints, which results in a lower scrap rate at the client end, an improved brand name, a competitive advantage, and reduce reverse logistics, and waste.

Internal product quality process

Figure 5.10

Non-conformance identification from manufacturing process- 2018-2023

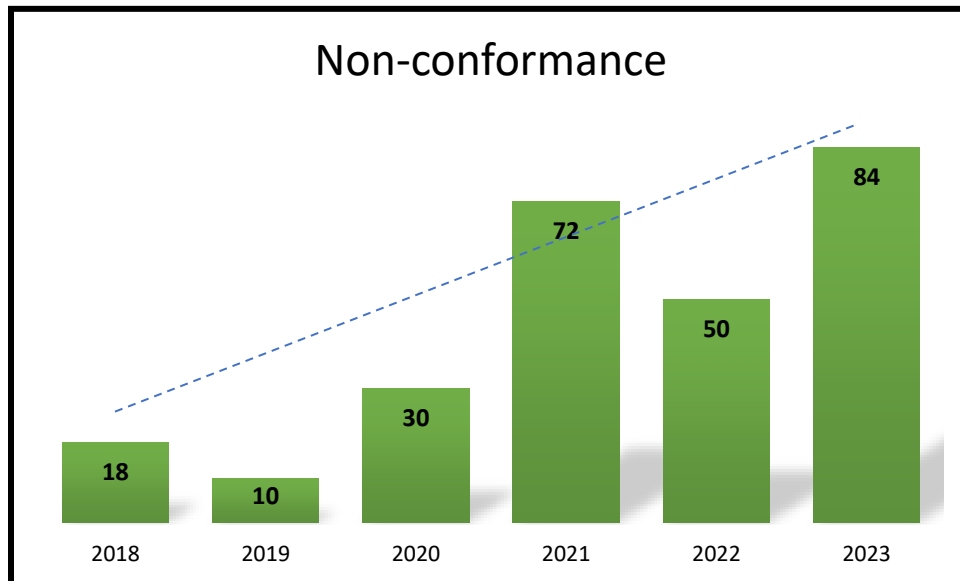


Photo: Company reports, 2023. Reproduced with permission.

The number of non-conformances acquired from manufacturing quality checking is shown in the above chart. To eliminate consumer complaints, the company has established an internal quality control system by 2020 as GM practices. This system enabled them to track the quality of their products before sending them to the end-user. According to the data, the number of rejections increased when the internal quality control system was established starting from 18, they identified 84 rejections in their manufacturing process. Once the rejection cause has been discovered, they are taking the appropriate steps to rework or re-manufacture the product. This resulted in less scrap at the customer's end and reduced reverse logistics activities resulting in lower CO₂ emissions. This also improves the brand name which results in customer satisfaction.

Non-Conformance of Incoming Materials

Figure 5.11

Incoming Materials non-conformance from 2018-2023

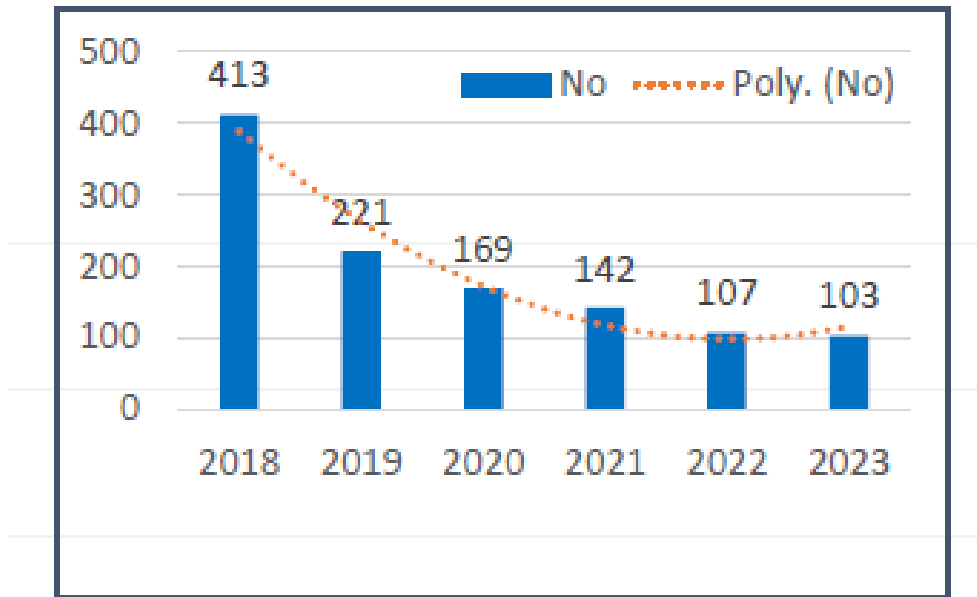


Photo: Company reports, 2023. Reproduced with permission.

This draft indicates the number of rejections discovered while reviewing incoming orders from suppliers. It was over 400 at the start before implementing GP practices. However, after three years (2020), they were able to establish a reliable supplier base as a GP practice. Having dependable sources decreased rejection by 60%. This reduces the scrap rate, solid waste, and logistics costs.

Efficiency improvement

Figure 5.12

Implementation of GIT contribution to company performance- comparison 2022-2023

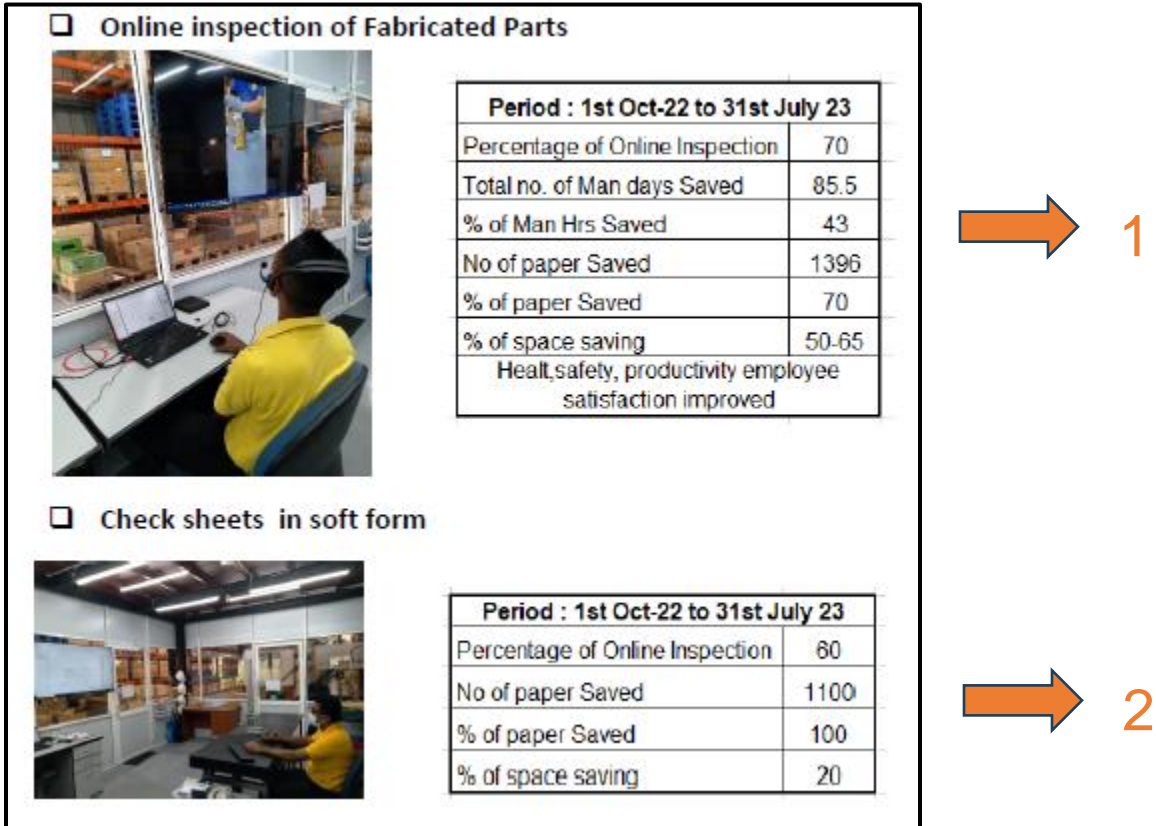


Photo: Company reports, 2023. Reproduced with permission.

The aforementioned details show how the company boosted its productivity by employing an online inspection system (Figure 5.12). They saved 43% of their man-hours and this online practice reduced A4 paper usage by 70%. There is also a 50-65% space savings. The second image demonstrates the usefulness of soft form (e-document). This online practice utilised 100% of the A4 paper with a 20% reduction in space.

Company inventory behaviour

Figure 5.13

Company inventory behavior changes- 2018-2023

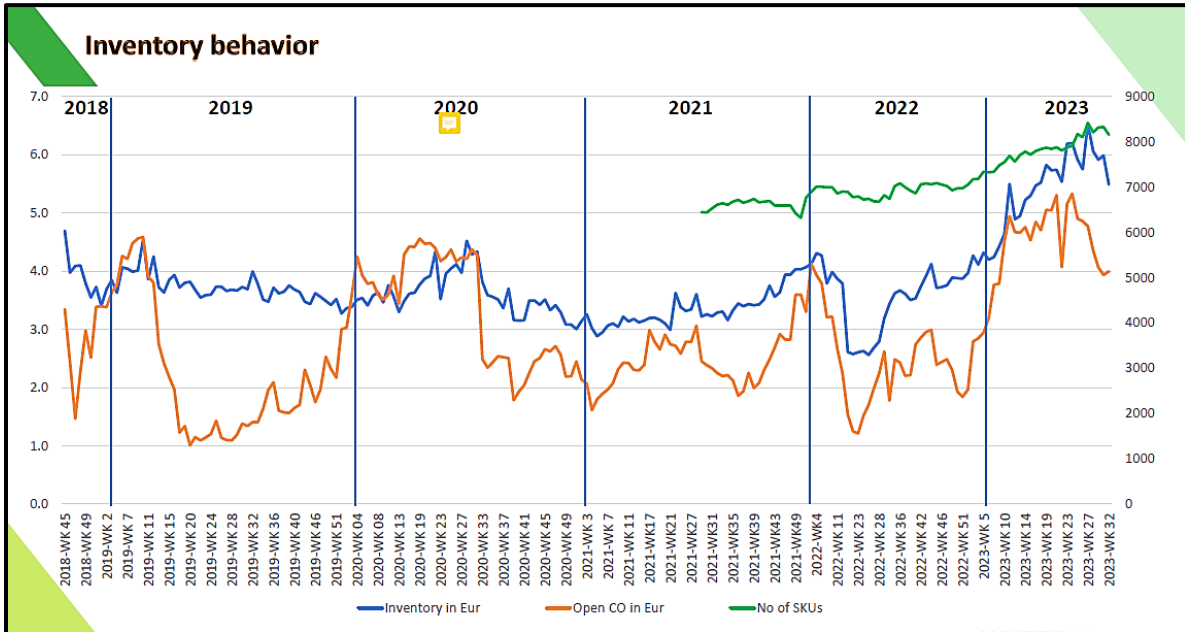


Photo: Company reports, 2023. Reproduced with permission.

This figure shows the inventory behaviors of the company and how it fluctuates from 2018 to 2023. Because they moved to GL in 2020, they needed to keep enough stock in their warehouse. As a result, the inventory level gradually climbed which resulted improve in operational performance.

Capacity utilization

Figure 5.14

Efficiency improvement of the company- comparison of year 2022-2023

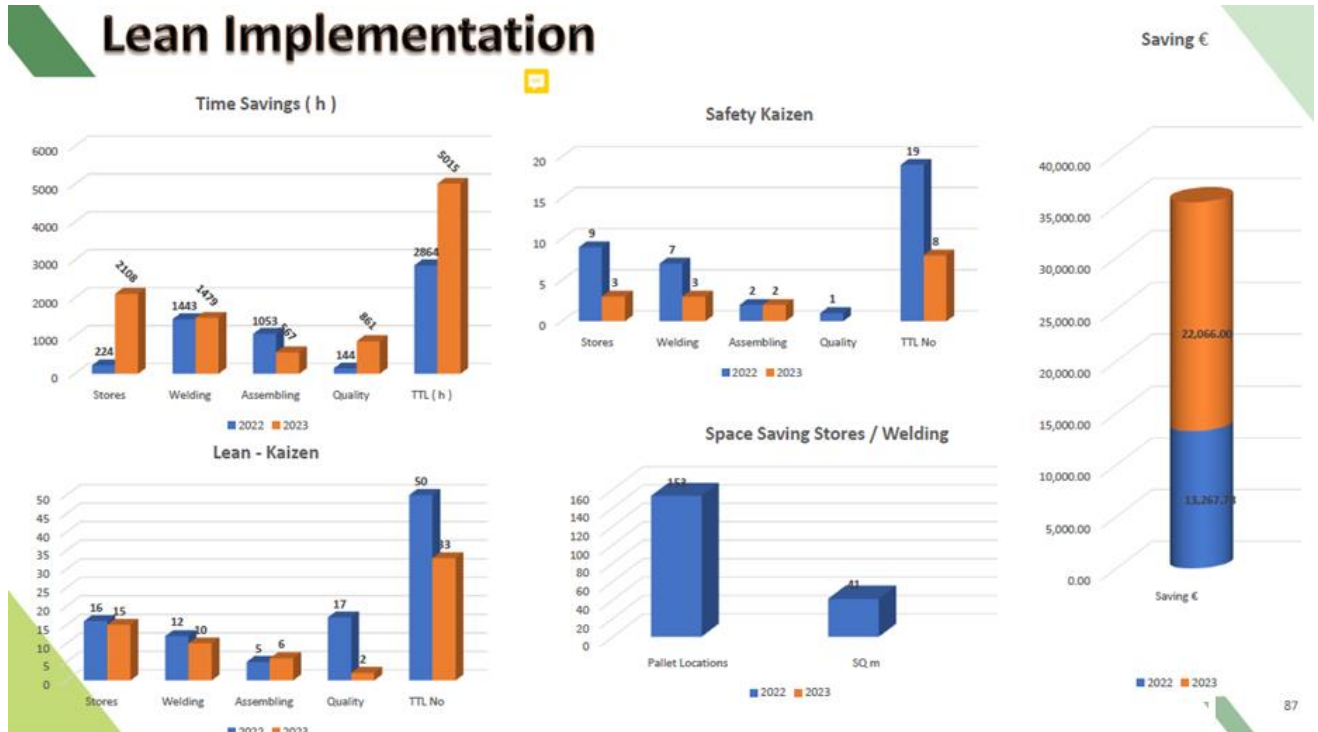


Photo: Company reports, 2023. Reproduced with permission.

This chart explains how GM assisted them in increasing production efficiency, utilising warehouse space, and saving money. When comparing data from 2022 to 2023, there is a 27%-time savings, and 153 warehouse locations that save space. Furthermore, the value savings of 62% in 2023. When compared to data from 2022, it demonstrates a 26% increase in value savings.

GSCM on Financial performance

Transportation cost

Figure 5.15

Import shipment distribution from 2017-2018

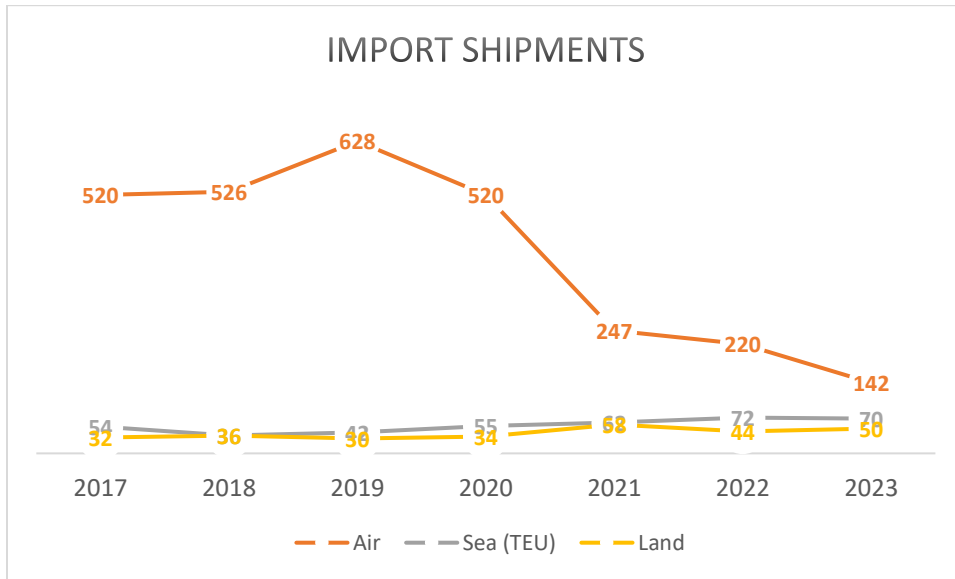


Photo: Company reports, 2023. Reproduced with permission.

This diagram shows the changes in import shipment after implementing GL in 2020. The number of air shipments has declined dramatically from 520 in 2017 to 142 in 2023, while the number of sea shipments has increased significantly from 54 to 74 in 2023. This is a cost-effective feature since it reduces transportation expenses.

Figure 5.16

Export shipment distribution from 2017-2023

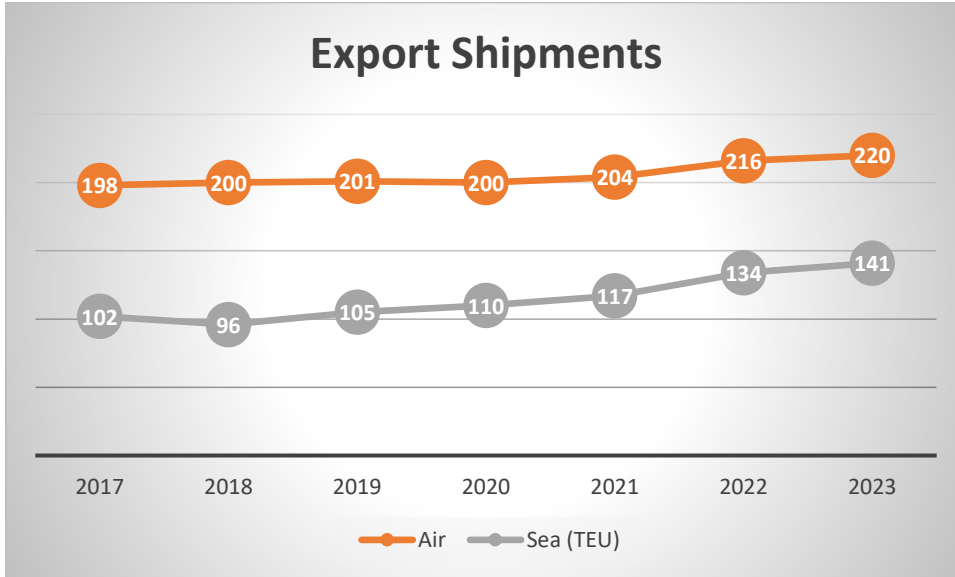


Photo: Company reports, 2023. Reproduced with permission.

This diagram shows the changes in export shipments after implementing GL in 2020. The company has increased the number of sea shipments over the year to reduce the number of air shipments. As a result, the company was able to increase sea shipments from 102 to 141 in 2023. However, there is no significant reduction in air shipment. This is due to the company has decision to arrange direct shipments to end customers to reduce shipment routing.

Cost for energy consumption

Figure 5.17

Company electricity cost distribution from 2018-2023

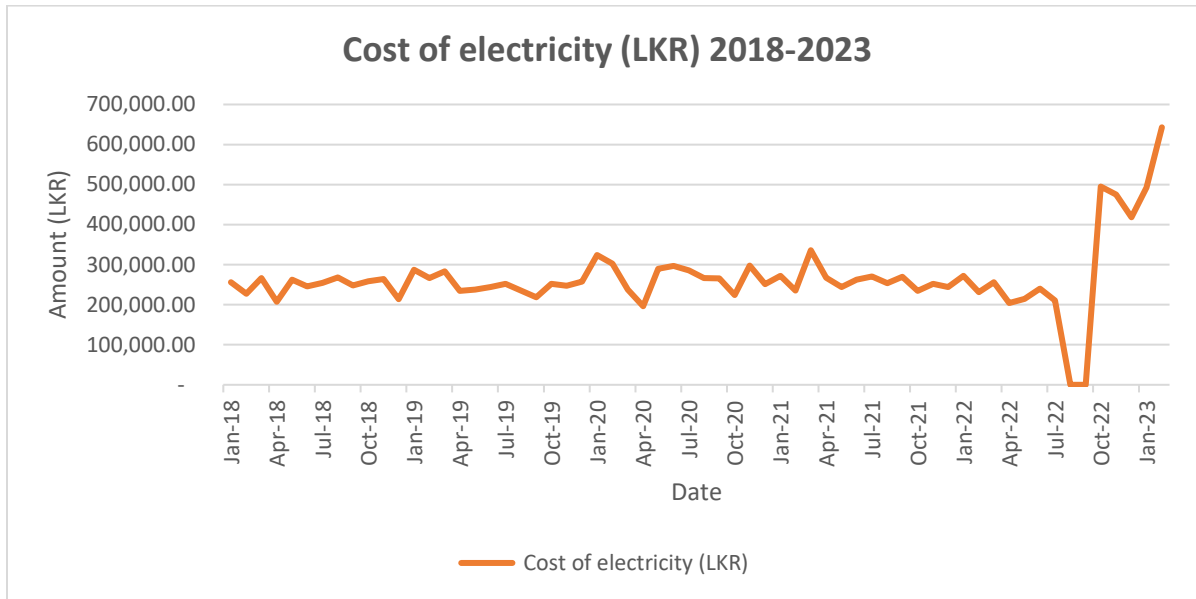


Photo: Company reports, 2023. Reproduced with permission.

This graph depicts how the cost of electricity changed over six years. The cost of electricity has been consistent throughout time. This is due to the company's eco-friendly production facilities, which allow for maximum sunlight during the day, and a natural air ventilation system to reduce electricity consumption. Therefore, even in the peak production time, they maintain their electricity cost in a constant amount. However, there will be a significant hike in 2023 due to the government's social security tax.

Cost for environmental accident

Table 5.1

Environmental accidents

Year	No of environmental accidents
2017	3
2018	2
2019	1
2020	0
2021	2
2022	1
2023	0

Photo: Company reports, 2023. Reproduced with permission.

According to the graph, the number of environmental accidents has declined over time. As a result, the cost of an environmental accident has lowered. The IEM system investigates environmental incidents and develops procedures and methods to prevent them in the future. This results in financial performance.

Inventory cost

Figure 5.18

Company financial, inventory and stock turnover

Finance- Inventory

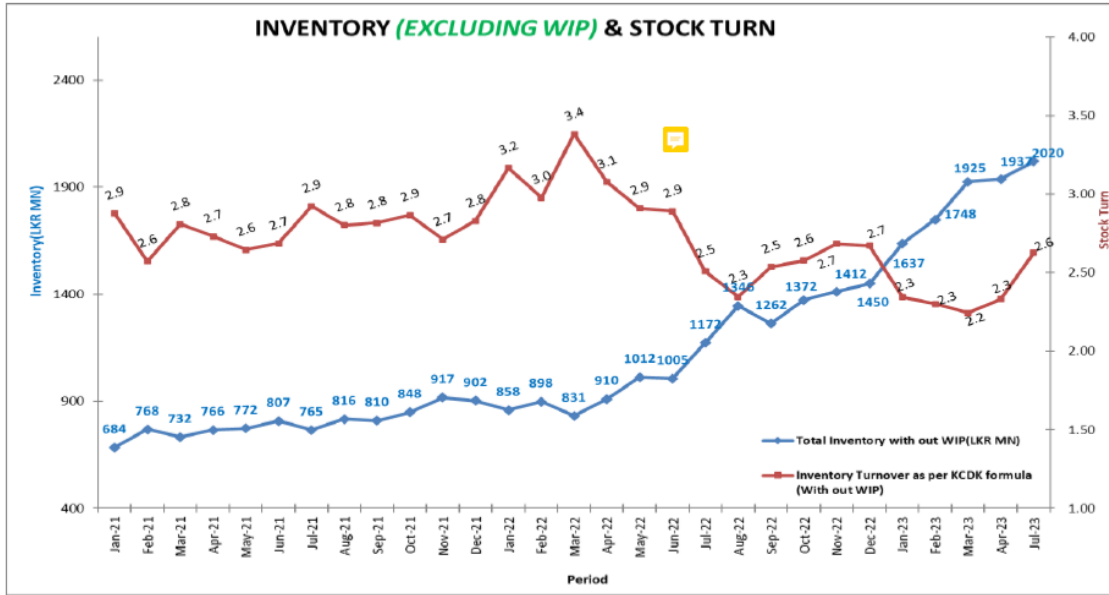


Photo: Company reports, 2023. Reproduced with permission.

This graphic depicts inventory behaviour over three years. Inventory costs increased by 49% after introducing GP and GL practices (all other parameters remaining constant). The reason is that GL and GP may require a longer lead time. Therefore, the company must have safety stock on hand to prevent production delays. These findings are also compatible with figure 5.13 which also showed the high inventory. However, even these practices improve OP, with the higher inventory holding costs impacting poor FP.

Challenges to implement & improve GSCM

Participant	Challenges	Quotes
P1	<ul style="list-style-type: none"> Employee training Hiring human resource who has knowledge about GSCM 	<p>“So, make them train and find a resource for these trainings and find the resource from, you know, that maintain the system. It's difficult. Right. Those are the challenges that we have as of now.”</p>
P2	<ul style="list-style-type: none"> Dealing with company internal parties, suppliers, and freight forwarders for better delivery Employee trainings for e-technology 	<p>“We have to pay extra warehouse charges to our consolidations and another challenge is training employees for the e-technology because most people used to work with papers”</p>
P3	<ul style="list-style-type: none"> Quantify the benefits. Difficult to track environmental improvements. Change employee’s mindset towards environmental benefits. Make budget for the new implementation. 	<p>“Sometimes especially related to environmental area it's a bit difficult to make figures for the accounting”</p> <p>“We have to train people and make them aware of importance of the environment. And then, especially to get out the contribution from each department, it was challenging.”</p>
P4	<ul style="list-style-type: none"> To build reliable supplier base Quantify the benefits for logistic forwarders and internal departments. Dealing with regulatory authorities Dealing with human resource for Technological advancement Human resource who has knowledge about GSCM activities 	<p>“In terms of HR, I think we have to recruit people who have more understanding about these areas and technology”.</p> <p>“Marketing department always looks for low cost. let's say the low cost of the production. So, we have to convince them, okay this will be the future, and these are advantageous”.</p>
P5	<ul style="list-style-type: none"> Supplier monitoring, auditing and collaboration for environmental standards Supplier selection Train employees for e-technology Additional cost for regulatory and compliance 	<p>“We are in a niche market, and we are using customized parts with less bargaining power which is not available in the market. Therefore, we do not have a large suppliers’ base. Therefore, suppliers' selection is challenging when we go for environmental standards.”</p>
P6	Training employees	<p>“So, it is very difficult to, you know, educate employees and point out the importance of this environmental green practices for them because they are not get used for that”</p>

5.3 Discussion

Theoretical relationship to the study

This study investigated how various GSCM practices affect organisational overall performance. As this study shows how GSCM can help organisation to differentiate themselves from the market, drive down cost through efficiency, reduce risks associated with the environment, and create new market opportunities, study findings are well aligned with resource-based theory. Furthermore, by emphasising the interconnectivity of environmental, social, and economic performance in supply chain activities, GSCM corresponds with the TBL concept. As discussed in theories, by incorporating GSCM into a company plan, value can be created across various dimensions.

GSCM on environmental performance

According to the findings, all GSCM practices applied such as eco-design, GP, GM, GL, GHRM & IEM, and GIT have a favorable effect on EP. By incorporating eco-design in their organisation, they could still be able to maintain consistent electricity consumption (figure 5.17) over time even they work extra. The reasons for this include environmentally friendly production facilities, such as plant layouts designed to maximise sunshine and an air ventilation system. Furthermore, the eco-design machines allow low power consumption by delivering environmentally friendly products for customers. Zhu et al. (2008, p. 271) and (Zhu et al., 2012) also showed that eco-design activities like reduction of energy and material usage, design recyclability product reuse of materials, and reduced use of hazardous materials improved EP. The impact of GP & GM also showed a positive impact on EP as it reduces waste from the supply chain (Figure 5.3). These findings also align with the literature findings (Kalyar et al., 2020; Lo & Shiah, 2016; Muma et al., 2014; Vijayvargy & Sahoo, 2021).

According to the findings of this study, GL reduces environmental pollution in two ways respectively, reduce harmful material for packing, and reduce CO2 emission

(Figure 5.6) from its transportation (46.6%-Air shipment, 21.4%-Sea shipment). Muma et al. (2014), Sajjad et al. (2020), and Rogers and Tibben-Lembke (2001) reported similar findings as GL minimise packaging, air, and noise emissions. Similarly, GHRM practices with IEM practices such as internal audits and awareness program improve company EP. This is proved by the company tree planting program achieved its target of more than 3000 trees (Figure 5.8). GHRM-based practices, which is allowing employees to contribute to environmental initiatives and other corporate environmental strategies that help such firms create a strong eco-friendly public image (Afum et al., 2021). Furthermore, this study shows that the implementation of GIT reduced their paper usage (Figure 5.12) by 70- 100% while allowing space saving by 50-65 % (Figure 5.12). Similarly, previous studies e.g. (Khan & Qianli, 2017) showed that GIT capabilities assisted environmental management efforts across the external and internal supply chain, indicating strong business performance.

GSCM on operational performance

Eco-design improves OP by designing less power-consumption machines with high-efficiency machines. GP is improving OP by building reliable suppliers who adhere to delivering quality products in a given period. This has been demonstrated by a reduction of incoming rejections (Figure 5.11) by 60% in 2023. Previous literature also proved that eco-design and GP increase OP (Bahjat et al., 2020; Green et al., 2012; Kalyar et al., 2020; M. T. Khan et al., 2022; Khan & Qianli, 2017; Yu et al., 2014). Similarly, GM improved operational performance by improving production efficiency and illuminating nonvalue activities and waste. GM improve time savings by 27%, space-saving 153 locations in warehouse, value savings 62% in year 2023 (Figure 5.14) and these results have been confirmed by previous studies including (M. Khan et al., 2022; M. T. Khan et al., 2022; Khan & Qianli, 2017; Lee, 2013; Rehman et al., 2016; Rusinko, 2007; Tippayawong et al., 2016).

GL negatively impacts OP since it needs more shipping time; nonetheless, GL has a positive impact in that it lowers waste in its supply chain. Differently, existing literature showed that GL improves OP by enhancing product quality, shorter lead times, and

reducing manufacturing waste (Lai & Wong, 2012). According to the outcomes of this study, GIT and GHRM also increase OP in terms of time savings and process efficiency. GIT operations like online inspection, e-documents, and a B2B system for supplier management, for example, enhanced operational efficiency by saving 43% of their man-hours during seven months. Furthermore, this decreased non-value operations and saved 50-65% of warehouse space (Figure 5.12). According to interview feedback, the impact of GHRM with IEM is considerable because awareness and training programmes for employees increase productivity, which directly improves their OP. This is confirmed by previous literature (Afum et al., 2021; Agyabeng-Mensah & Tang, 2021), GIT improves OP (Kalyar et al., 2020; Santoso et al., 2022).

GSCM on financial performance

Despite the fact that most GSCM practises benefit EP and OP, these individuals are not equally supported to FP. This study's findings suggest that company-related eco-design practices has a favourable impact on FP since it allows companies to keep their electricity costs constant (Figure 5.17). Eco-friendly materials, on the other hand, are more expensive. These results are in line with Green et al. (2012) findings for manufacturing companies in USA.

Similarly, GP is also raising the product's ultimate price because the company lacks bargaining leverage when it comes to environmental regulations. According to the document findings, GP raised inventory costs by about 50% from 2021-2023 (Figure 5.19). The study's findings show that suppliers anticipate environmental certification, and choose biodegradable materials, which raises the product's final cost. These findings were confirmed by (Kalyar et al., 2020; Khan & Qianli, 2017). However, Sahoo and Vijayvargy (2021) argued there is no significant impact of GP on FP.

GM has a favourable influence on FP by saving 62% value in 2023. When compared to data from 2022, this is 26% savings (Figure 5.14). This is due to the implementation of a lean manufacturing system, which reduces non-value operations and utilises man hours, reduces waste in the supply chain, and saves space in the warehouse. However, interview responses revealed that some GM activities, such as waste disposal

methods, are more expensive, and they had to endure higher costs for these practices. These findings is in line with Rehman et al. (2016) and Khan and Qianli (2017).

Moreover, GL practises have an excellent impact on FP. The study findings show that reducing air shipment is one of the most cost-effective activities in GL (Figure 5.15). Most participants answered that the cost of sea shipping is less than the cost of air shipments. As a result, using consolidation shipments, a central shipment collecting system, and the railway for local shipments decreased logistic costs. This finding contradicted with the claims of Agyabeng-Mensah et al. (2020); Agyabeng-Mensah and Tang (2021). Finally, GHRM and GIT do not affect on FP. However, some participants said that various GHRM activities, including training programmes, increase costs, and the cost of GIT implementation is also expensive. Nevertheless, they are long-term investments, and the significance of these practises cannot be quantified financially. This result was supported by the findings of Afum et al. (2021, p. 3092) which investigated the relationship between GHRM and GIT with FP in manufacturing firms in Ghana.

Furthermore, overall GSCM practises boost their competitive edge and increase the likelihood of winning more orders, which has a direct impact on market share growth. Furthermore, increases in profit and sales are indicators of long-term financial performance. These results have been confirmed by previous studies including (Khan & Qianli, 2017; Lee, 2013).

Challenges to implement and improve GSCM practices.

The main challenge reported by many participants is training employees for technological use. Other than that, collaborating with suppliers for environmental requirements, dealing with authorities, quantifying the benefits of GSCM, budgeting for implementation and improvement of GSCM, and track records of environmental improvements are major challenges in ABC company. Some of these findings are well aligned with previous studies, insufficient environmental awareness (Luthra et al., 2011; Mathiyazhagan et al., 2013; Nteta & Mushonga, 2021), lack of an economic justification in terms of performance (Zhu et al., 2005). However, the literature findings varied since previous studies were conducted in different nations, whereas this study focused on Sri Lanka.

5.1 Summary

This chapter intended to assess all the evidence gathered from interviews and secondary data sources from companies to address the research questions posed by this study. A single case study analysis was carried out leveraging information gathered from various secondary sources, such as business audit reports, performance evaluation reports, and annual financial reports. The inquiry comprises a thorough examination of the selected cases' historical evolution of their organisation performance after implement of GSCM and what challenges that company faced when implementing and improving these practices. This has been assessed in terms of environmental, operational, and financial performance. The researcher examined two separate data sets to answer the research's first question: what are the disadvantages and the potential benefits that an organisation may receive from the GSCM? This analysis aided the researcher in identifying new connections between GSCM and organisational success. These findings are comparable to previous findings, and some contradict previous findings. To answer the second study question, a detailed analysis of how these practises can aid in increasing their performance while acquiring a competitive edge was conducted.

Chapter 6. Recommendations and Conclusion

6.1 Introduction

To systematically navigate the winding path of the study, the researcher approaches a key juncture: the synthesis of results to arrive at actionable propositions and a unified conclusion. The purpose of this chapter is to synthesize the ideas obtained in previous chapters and to suggest practical future actions. Therefore, this chapter concludes with the theoretical underpinnings of GSCM as well as practical insights from the field, providing a comprehensive assessment of where GSCM stands today and where it may potentially lead the organisation tomorrow. In addition, a brief set of recommendations for managers and entrepreneurs on how these techniques can implement and gain advantage from it while also providing recommendations for future research.

6.2 Purpose of the research

The ultimate goal of this research was to determine the impact of GSCM on organisational performance in terms of environmental, operational, and financial factors. This study focused on the EI in Sri Lanka and chose a single case study for in-depth analysis. The engineering business was chosen because there was no previous research that focused on this specific area and it the Sri Lanka's second largest economic contributor. However, it also contains a manufacturing technique that uses a lot of natural resources and produces the most glasshouse gases. Therefore, the researcher conducted this study to find out if the company can implement environmentally friendly practices that reduce pollution activity and contribute to environmental sustainability, and how it impacts the company's performance. Thus, research findings contributed to the best example for the manufacturing industry to motivate them to move towards GSCM practices.

This study is founded on two theoretical constructs- RBV theory and TBL theory. The RBV is aided to identify what are the resources and competencies that can initiatives with the concept of GSCM. The TBL theory guides researchers in evaluating how GSCM practises affecting organisations and which areas will be covered by GSCM in the organization's supply chain process. The industry analysis is based on PESTEL and Porter's five forces theory by answering the second question, how can GSCM help businesses grow or sustain their market presence? All PESTEL factors have a favourable impact while the industry structure assessed by Porter's five forces found only three favourable factors competitive rivalry, bargaining power of buyer, and potential of new entrants into the industry.

Chapter four of the thesis comprehensively discussed the details of the research design and the methodology. This research study has been constructed on interpretivism paradigm based on exploring existing research inductively to answer research questions. The research strategy consisted of a single case study analysis that drew on mixed method approach.

6.3 Linking with the Research Objectives

ABC company has implemented various GSCM practices over the period, which are given below.

Objective one- To identify and understand GSCM practices implemented within the ABC company. The goal is to determine what types of GSCM practises have been applied in this company. As a result, the researcher was able to narrow down their investigation.

Eco-design

- Green purchasing
- Green manufacturing
- Green logistic
- Green human resource management
- Internal environmental management

- Green information technology

Objective two- To investigate the influence of GSCM practices on the environmental performance of the organisation. Here, the researcher objective was to identify how the implementation of GSCM influence EP.

GSCM practices	Interview findings	Document findings
Eco-design	Positive Reduce electricity consumption. Use of natural resource.	Keep electricity consumption in constant (Figure 5.17)
GP	Positive Supplier negotiations to minimise waste and use of biodegradable material	Reduced waste, polythene, food, cardboard, and metal usage (Figure 5.3)
GM	Positive Reduce waste from its supply chain, disposal chemical and other harmful materials in a responsible way	Reduced waste, polythene, food, cardboard, and metal usage (Figure 5.3). Reduce noise (Figure 5.4)
GL	Positive Reduced Air shipment which leads to higher CO2 emission	Reduced CO2 emission from its transportation (Figure 5.6)
GHRM + IEM	Positive Train employees for better environmental practices.	-
GIT	Positive Implement IT practices that can reduced paper usage.	Reduced paper usage (Figure 5.7)

Objective three- To explore the relationship between GSCM practices and the operational performance of the organisation. This objective focused on how GSCM practices impacted on OP.

GSCM practices	Interview findings	Document findings
Eco-design	Positive Produced high efficiency motors.	-
GP	Negative Increase product final cost Increase inventory cost	Reliable supplier base increased quality, flexibility and on time supplies (Figure 5.11). Increase inventory (Figure 5.13)
GM	Positive Remove non-value adding activities	Increase production efficiency (Figure 5.14). Increase product quality (Figure 5.9) Space savings (Figure 5.14)
GL	Negative Increase sea shipment which is take longer delivery time	-
GHRM + IEM	Positive Train employees for environmentally friendly activities. Internal auditing system to evaluate performance	Changed employee's behavior to improve efficiency (Figure 5.14)
GIT	Positive Performance evaluation of GSCM B2B system for supplier negotiation E-document and online inspection	Evaluate performance of GSCM. Increased efficiency by implementing online inspection and e-documents (Figure 5.12).

Objective Four- To examine the impact of GSCM practices on the financial performance of the organisation. This objective shows whether the GSCM impact on FP was positive or negative.

GSCM practices	Interview findings	Document findings
Eco-design	Moderate Allow to use natural resources like sunlight, air ventilation system Eco-friendly materials are costly	Help to constant electricity cost (Figure 5.17).
GP	Positive Build trustworthy and strong relationships	GP raise inventory costs by about 50% from 2021-2023 (Figure 5.19).
GM	Positive Remove non-value addition activities Remove waste. Space saving	Value in 2023 62%. Compared to 2020 it is 26% savings (Figure 5.14).
GL	Positive Increase sea shipment and reduce Air shipment. Sea shipments are cheaper than Air shipments	Increase sea shipment and reduce Air shipment (Figure 5.15 & 5.16).
GHRM + IEM	Slight negative, but longer term positive Train employees for environmentally friendly activities. Internal auditing system to evaluate performance	Reduce cost for environmental accidents (Table 5.1)
GIT	Implementation cost is high, however longer term positive B2B system for supplier negotiation E-document and online inspection	-

Objective five- To identify and analysis the challenges faced by the ABC company in enhancing its GSCM practices with the aim of improving overall supply chain sustainability. The purpose of this objective was to identify what challenges management faced when implementing and improving these practices.

- Training employees
- Find educated candidates who have good knowledge about GSCM.
- Supplier selection according to environmental criteria.
- Quantify benefits from GSCM.
- Make budget plan for GSCM activities.
- Dealing with government authorities.

6.4 Relationship to previous research

Overall, the impact of GSCM on environmental is positive which is compatible with previous findings (Abdallah & Al-Ghwayeen, 2020; Bahjat et al., 2020; Green et al., 2012; Hasan et al., 2022; Kalyar et al., 2020; Khan & Qianli, 2017; Lee & Choi, 2021; Lo & Shiah, 2016; Muma et al., 2014; Pasqualini Blass et al., 2016; Trujillo-Gallego & Sarache, 2019; Vijayvargy & Sahoo, 2021; Zhu et al., 2007, 2012). Eco-design, GM, GHRM & IEM, GIT enhance OP which is also confirmed by the literature (Bahjat et al., 2020; M. T. Khan et al., 2022; Khan & Qianli, 2017; Rusinko, 2007; Sahoo & Vijayvargy, 2021; Sajjad et al., 2020; Santos et al., 2019; Yu et al., 2014; Zhu et al., 2013).

However, this study's findings show, that GL negatively impacts OP which is not aligned with previous findings by Lai and Wong (2012) showed that GL improves OP by enhancing product quality, shorter lead times, and reducing manufacturing waste. Furthermore, the negative impact found from GP on FP is similar to previous studies (Kalyar et al., 2020; Khan & Qianli, 2017) and eco-design on FP is negative and liked to

the previous study (Green et al., 2012). Most importantly, in the Sri Lankan context findings of this research fulfilled the gaps identified in the literature review on the impact of GSCM on the engineering manufacturing industry and the challenges to implement and improve these practices. Furthermore, which was identified as debatable factors such as GP, GL on OP & FP and collaboration with suppliers on OP concluded.

6.5 Significance of the study

The researcher discovered that there are very few papers on the impact of GSCM on organisational performance in Sri Lanka available online and many of them were focused on apparel manufacturing (Priyashani & Gunarathne, 2021; Susitha & Nanayakkara, 2023) and tea manufacturing industry (Jayaratne et al., 2011). Other majority of available research is based on the manufacturing industry and is mostly focused on developing countries like China (Yu et al., 2014; Zhu et al., 2012, 2013), India (Mitra & Datta, 2014; Sahoo & Vijayvargy, 2021; Vijayvargy & Sahoo, 2021), Pakistan (Kalyar et al., 2020; M. T. Khan et al., 2022; Khan & Qianli, 2017), Indonesia (Santoso et al., 2022) and developed countries like NZ (Sajjad et al., 2020), the United States (Green et al., 2012; Rogers & Tibben-Lembke, 2001), and the United Kingdom (Cahyono et al., 2020; M. Khan et al., 2022). Particularly, this study, to the best of the researcher's knowledge, is the only study in Sri Lanka that focused on the engineering manufacturing industry. On the other hand, the literature review indicated that Sri Lankan manufacturing industries are still in initial stage (Jayarathna, 2016). Therefore, the conclusions of this research study may be useful and motivating to other organisations interested in implementing GSCM in their organisation.

6.6 Limitations of the present study

The major limitation of this study is choosing a case study, because case studies concentrate on a single organisation, their conclusions may not apply or generalizable to larger groups or diverse situations. Furthermore, this case study is only based on EI, therefore the findings of this study may not be related to other manufacturing industries. This study only identified six independent variables (Eco-design, GP, GM, GL, GHRM & IEM, GIT) on organisational performance. Another major limitation of this study was the use of secondary sources. Because of the organisational confidentiality researcher could not gather important financial-related data which could shed more light on the research.

6.7 Recommendations for future research and practice

Future research recommendations

This study principally investigated the impact of identified GSCM practices on organisational performance. The paper also explored the challenges to implement and improve GSCM practices in an organisation. Although the aim of the study is achieved, the researcher acknowledges that our study is fraught with a few shortcomings which provide opportunities for future studies. First, as mentioned in 6.3, this study could be able to be identified six GSCM practices and their impact on OP. But future research may include more independent variables including cooperation with the customer, reverse logistics, technical innovation, and investment recovery to test the relationship with OP. Second, this study only focused on the direct impact of GSCM on organisational performance. However, future studies can be conducted to determine whether GSCM has a mediating or indirect effect on OP. Finally, while this study concentrated on the influence of GSCM on the manufacturing business, the impact of GSCM on other industries such as wholesalers and retailers can be studied in the future.

Recommendations for Managers/Practitioners

This study has important managerial implications for Sri Lankan manufacturing enterprises and other developing countries. To begin, organisations must recognise the significance of GSCM practises and become more proactive in applying them. In particular, designing eco-friendly products, select and implement environmentally friendly manufacturing methods, purchasing environmentally friendly materials and green logistics are major components of the green supply chain. Therefore, these practices must be embraced by manufacturing organizations to increase sustainable performance by reducing the harmful effects of their products and processes on the environment.

Secondly, this study gives significant importance of GSCM practices to improve its operational cost by focusing their product quality, cost reduction, and flexibility. Implementing a GSCM will help managers and entrepreneurs build cost-effective and process efficiency strategies to improve their financial performance and retain their competitive edge.

Lastly, for those entrepreneurs and managers striving for imminent GSCM practices, the study facilitates the type of challenges that organisations could be faced when implementing GSCM practices. Furthermore, the study emphasises the significance of a self-diagnostic tool for enterprises to identify and analyse the existing state of improvement in the firm's product and process and improve it by focusing more on GSCM practises.

6.8 Conclusion

The purpose of this study was to identify and investigate how GSCM practises can have an impact on organisational environmental, operational, and financial performance in ABC company in Sri Lankan context. To answer the main study question, five research objectives were developed, as detailed in Chapter One. The study then

explored the essential theoretical ideas as well as current engineering industry-related elements. The RBV and TBL theory presented the theoretical concepts relevant to the major study challenge, whilst PESTEL analysis and Porter's five forces analysis explored the EI's industry-related elements in detail. The literature review was organised around three research objectives and primarily focused on the manufacturing industry. Given the nature of the research problem, the study used a mixed-method approach, with data gathered through semi-structured interviews and secondary data analysis. Furthermore, thematic analysis was employed to assess qualitative data, while bar charts and tables were used to depict numeric data.

The findings of this study indicated that most of the GSCM practices positively impact organisational environmental and operational performance while eco-design and GP negatively impact FP. Furthermore, GIT and GHR also increase costs in the short term. All the implemented GSCM practices eco-design, GP, GM, GL, GHRM & IEM, and GIT positively impact EP. However, only GL negatively impacts OP while other practices have a positive relationship. Furthermore, the study discovered that the most frequent challenge that ABC organisation experienced was training employees for GSCM practises, while other departments indicated distinct challenges such as supplier negotiation, supplier selection, dealing with authorities, quantifying benefits, and budgeting. However, the overall outcomes of this study revealed that GSCM practises providing a competitive advantage to the organisation, resulting in long-term benefits.

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Appendix A. Ethics Approval

[Removed]

Appendix B. Participant Information Sheet



Impact of Green supply chain management on organizational performance; A Case study of engineering company in Sri Lanka

Information Sheet for Participants

Thank you for showing an interest in this project. Please read this information sheet carefully before deciding whether or not to participate. If you decide to participate, I thank you. If you decide not to take part, there will be no disadvantage to you of any kind and I thank you for considering my request.

Introduction

I am Beshani Ekanayake, a master's student at the Southern Institute of Technology. I am conducting a research project on “Green supply chain management on organisational performance” to full fill the MGT910 subject requirements of the Master of Applied Management.

What is the aim of the project?

This project aims to examine GSCM practices in the “ABC” company to find out their contribution to organisational performance. This will mainly focus on current GSCM practices in organisation and their impact on organisational performance in terms of operational, environmental, and financial. Furthermore, to identify the obstacles that organisations experience while attempting to improve these practices.

What type of participants are being sought?

I am looking for six functional managers or executives (one from each) from the supply chain, human resource, compliance, and finance departments who has at least five years of experience in the “ABC” company. I am going to collect different experiences in GSCM, challenges to

improve them, and organisational performance variations in six years period (2017-2023). Therefore, employees who have at least five years of experience will be considered.

What will participants be asked to do?

If you are agreeing to participate in this project, you will be asked to attend a video or audio-conferencing interview for a minimum of 40 minutes no more than one hour. Your level of participation is entirely voluntary. You will not be asked to give any personal information which is not related to the research topic. This will include questions about your job role related to GSCM and your personal experience with the implementation of GSCM. Furthermore, you will be asked challenges to improve these practices in your organisation. Please be aware that you may decide not to take part in the project at any time without any disadvantage to yourself of any kind.

Can participants change their minds and withdraw from the project?

You may withdraw from participation in the project at any time up until the point at which the data is anonymised and amalgamated into the report, without any disadvantage to yourself of any kind.

What data or information will be collected and what use will be made of it?

All the interviews will be recorded via Microsoft Teams and will be transcribed by the researcher. The outcome of the data and recordings will have access only to the researcher, supervisor, and examiner. Your name will not be used in the final report, and you will not be able to be identified in any way. All information will be kept confidential, and the data will be used by the researcher only for the purposes of this study.

What will happen to the results?

The results of the project may be made available at the Southern Institute of Technology library (Invercargill, New Zealand). You are most welcome to request a copy of the results of the project should you wish.

How will the data be stored?

The data collected will be securely stored in such a way that only the researchers will be able to gain access to it. At the end of the project, any personal information will be destroyed

immediately except that, as required by SIT's research policy, any raw data on which the result of the project depends will be retained in secure storage for five years, after which it will be destroyed.

What if you have any questions about the project?

If you have any questions about the project, either now or in the future, please feel free to contact:

Researcher: Beshani Ekanayake

Southern Institute of Technology

Email: 2021001638@student.sit.ac.nz

Supervisor: Dr. Sanjeev Acharya

Email: Sanjeev.Acharya@sit.ac.nz

This research has been approved by the Human Research Ethics Committee at SIT.

If you have concerns about the **ethical conduct** of this research or the researchers, the following procedure should occur.

Write to the following:

The Secretary of the Human Research Ethics Committee

Southern Institute of Technology

133 Tay St

INVERCARGILL 9840 NZ

Tel: 03 211 2699

All information is confidential and will be handled as soon as possible.

Appendix C Consent For



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Te Pūkenga

Declaration of consent to be interviewed.

Research Title: Impact of Green supply chain management on organizational performance; A Case study of engineering company in Sri Lanka

I have had the scope and nature of the research fully explained to me. Any questions about the research have been satisfactorily answered, and I understand that I may request further information at any stage.

I accept and note that:

1. My participation in this research is entirely voluntary.
2. I may withdraw from participation in the research at any time up to the point at which the data is anonymised and amalgamated, without explanation, disadvantage or disincentive.
3. Any information given during the interview is being utilised solely for the purpose of the specific research project and will not be disclosed to any other person or agency without my express consent.
4. The interview will be recorded for later transcription.
5. This information may be incorporated into the research report, but actual names or other characteristics that may lead to identification of individuals or organisations will not be disclosed.
6. I may request to view any completed drafts or sections of the research report to which I have contributed, at any time.
7. A copy of the completed research report will be made available to me, on request, at the conclusion of the research.

DECLARATION

I have read and understood the information set out on this form and give my informed consent to be interviewed in accordance with the stated terms and conditions.

Name of Research Participant

.....

Name of Researcher

Beshani Ekanayake

Signature.....

Signature.....

Date.....

Date

Appendix D. Interview Questions

1. What specific GSCM practices are currently implemented in the ABC company?
2. What particular differences have you observed in your department after the implementation of GSCM practices?
3. How is environmental sustainability incorporated into the company's supply chain management processes?
4. Are there any specific policies or guidelines related to GSCM that the company follows?
5. How does company integrate sustainability considerations into its procurement and sourcing processes? Are there any monitoring mechanisms or audits in place to assess supplier compliance?
6. Are there initiatives to promote energy efficiency or utilize renewable energy sources?
7. What initiatives has company undertaken to reduce the environmental impact of its transportation and logistics activities?
8. How does ABC company manage and reduce waste throughout its supply chain? Are there specific practices in place to promote recycling, reuse, or waste reduction?
9. How have GSCM practices influenced the selection and sourcing of raw materials or components to promote environmental sustainability?
10. Have GSCM practices led to changes in product design or packaging materials to minimize environmental impacts throughout the product lifecycle?
11. How have GSCM practices influenced your organization's profitability? Can you provide specific examples of cost savings or revenue generation resulting from these practices?
12. How have GSCM practices contributed to reducing waste, improving resource utilization, or optimizing production processes within your organization?
13. Have you observed any improvements in product quality, reliability, or consistency as a result of implementing GSCM practices? How has this impacted your operational performance?

14. What challenges have you faced in understanding and meeting the evolving regulatory requirements related to GSCM practices?
15. What challenges have you faced in aligning stakeholder interests, expectations, and priorities regarding GSCM practices?
16. What challenges has ABC Company faced in allocating sufficient resources, including financial, technological, and human resources, to support the implementation and advancement of GSCM practices?

Appendix E. Internal and External GSCM practices

Internal GSCM	External GSCM
<p>Internal Management</p> <ul style="list-style-type: none"> • Commitment of GSCM from senior managers • Support for GSCM from mid-level managers • Cross-functional cooperation for environmental improvements • Total quality environmental management • Environmental compliance and auditing programmes • ISO 14000 certificate • Environmental Management Systems exist. • Eco-labelling of products <p>Eco-design</p> <ul style="list-style-type: none"> • Design of products for reduced consumption of material/ energy • Design of products for reuse, recycle, recovery of material, component parts. • Design of products to avoid or reduce use of hazardous of products and/or their manufacturing process. 	<p>Green purchasing</p> <ul style="list-style-type: none"> • Providing design specification to suppliers that include environmental requirements for purchased items. • Cooperation with suppliers for environmental objectives • Environmental audit for suppliers' inner management • Suppliers' ISO14000 certification • Second-tier supplier environmentally friendly practice evaluation <p>Cooperation with customers including environmental requirements.</p> <ul style="list-style-type: none"> • Cooperation with customer for eco-design • Cooperation with customers for cleaner production • Cooperation with customers for green packaging • Cooperation with customers for using less energy during product transportation. <p>Investment recovery</p> <ul style="list-style-type: none"> • Investment recovery (sale) of excess inventories/ materials • Sale of scrap and used materials. • Sale of excess capital equipment

Figure A1. Internal and External GSCM practices

Source: Q. Zhu, J. Sarkis, & K-h Lai, 2007. Retrieved from <https://doi.org/10.1016/j.jclepro.2006.05.021>