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“The Impact of Sustainable Supply Chain Management on Competitive Advantage:
A Study of Manufacturing Firms in Mekelle City”

By

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partial fulfillment of the requirement for the award of degree of Master's in logistics
and supply chain management.

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DECLARATION

- I. The undersigned, declare that this is my original work and has not been presented to any university other than the MEKELLE University for examination.

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Abstract

In recent years, sustainable supply chain management has become a central focus on global business strategy derived by increasing environmental concerns, resource scarcity, regulatory pressure, and changing consumer preference towards eco-friendly products. For manufacturing firm's sustainability is not only about compliance but also a way of achieving long-term competitive abilities through efficiency, optimal utilization of resources, cost minimization and market differentiation. In emerging economies, like in Ethiopia, particularly in Mekelle city, manufacturing firms face multiple challenges, such as resource constraints, limited reverse logistics infrastructure and limited adoption of sustainability practices. Despite these challenges SSCM offers opportunities for firm strengthen operational performance, enhance customer loyalty and build sustainable competitive advantage through integrating the practices such as SRM, green manufacturing, CRM and reverse logistics. The study was conducted to evaluate "the impact of sustainable supply chain management practice on competitive advantage," a study of manufacturing firms in Mekelle city. Data were collected from 73 respondents across 3 manufacturing firms representing the sectors such as construction materials and soft drink industries. A quantitative research design was employed, using purposive sampling and structured questionnaires. Descriptive and Spearman correlation analyses with SPSS version 21 were used for analysis. The findings revealed that green manufacturing at ($r = 0.373$, $p < 0.01$), customer relationship management at ($r = 0.413$, $p < 0.01$), and reverse logistics at ($r = 0.411$, $p < 0.01$) significantly and positively influenced competitive advantage, though supplier relationship management at ($r = 0.124$, $p > 0.05$) did not. The study concluded that sustainable supply chain management practices, particularly green manufacturing, CRM, and reverse logistics, significantly enhance the competitive advantage of manufacturing firms in Mekelle. Despite the observed challenges, such as underdeveloped reverse logistics and limited use of renewable sources of energy, the firms demonstrate a commendable foundation in sustainability. Enhancing these areas through strategic integration and innovation will support the firms to maintain environmental regulations compliance and enable to gain long-term operational efficiency, customer loyalty, and market differentiation.

Key Words: Sustainability, Sustainable Supply Chain Management, Sustainable Supply Chain Management Practices, SRM, Green Manufacturing, CRM, Reverse Logistics, Competitive Advantage, resource-based view & institutional theory.

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List of abbreviations

SSCMP	:	sustainable supply chain management practice
SSCM	:	sustainable supply chain management
RBV	:	resource based view
IT	:	institutional theory
CRM	:	customer relationship management
SRM	:	supplier relationship management

CHAPTER ONE

AN INTRODUCTION

1.1. Background and justification of the Study

In the field of supply chain management, sustainability as a concept has gained significant attention in recent years. Supply chain management is also related to the wider adoption and growth of the sustainability concept (Linton, et al., 2007). Sustainability stretches the concept of supply chain management to look at optimizing operations from a broader perspective, the entire production system, and post-production stewardship as opposed to just production of a specific product. A focus on supply chain is a step towards broader adoption and development of sustainability (Linton, et al., 2007).

In an era marked by growing environmental concerns and social responsibility, sustainability has become a cornerstone of modern business practices. Supply chain management, which encompasses the entire flow of goods and services from raw materials to the end consumer, plays a pivotal role in a firm's sustainable effort (Reynolds, 2024). The increasing awareness of environmental challenges, climate change, natural resources depletion, pollution, and high competition led to increased concerns about the sustainability of the supply chain (Sharma & Singla, 2021). In addition, the goal set by the UN in 2015 is forcing manufacturing companies at the global level.

The UN SDG encompasses the three dimensions of the sustainability concept, such as environmental, social, and economic aspects. Respecting those policies is one way of building sustainable supply chain management and sustainable competitive advantage, because respecting environmental policies, social policies, without losing economic viability, can improve manufacturing companies' brand reputation and prestige this resulting in a powerful competitive advantage (Filho L. W. et al, 2023).

Sustainable supply chain management includes environmental, social, economic, and ethical considerations as well as legal and regulatory principles and competitiveness (Das, 2020). Green

supply chain management has been engaged and emerged as an important organizational philosophy to achieve targeted profit and market objectives and reduce environmental risk, reducing cost, optimizing resources, and enhancing operations throughout the supply chain (Dina Allam, 2021). Sustainability also considers all the flows and issues extending beyond the key areas in the organization's supply chain management, and it has been recognized as a way of achieving a competitive advantage where the focus is moved away from cost and differentiation strategies (Muller, 2008).

Organizations use a sustainable supply chain as one of their strategic tools in strengthening competitiveness relative to competitors. It is also justified based on a reduction in waste and optimizing resource utilization to gain a competitive edge (Wamalwa, 2014). Leading global firms are front players in integrating sustainability into their supply chain, improving innovative strategies to reduce environmental harm, increase social welfare, and ensure economic viability (Reynolds, 2024).

Theories describing the practical existence of companies adopting efficient supply chain management and competitive advantage include the concept of organizational thinking and adaptive capability (Walker, 2015). The concept of adaptive capabilities takes the view that SSCM is a tool that can provide a competitive advantage to organizations (Sarkis, et al., 2011). This theory suggests that businesses often reconfigure and realign their unique competencies in the event of environmental changes and turbulence in which companies operate. This realignment of the company's capabilities to environmental changes results in the company's competitive advantage. The organizational theory explicitly outlines the effect of structural forces on organizations to follow sustainable supply chain management practices (Ochieng, 2016). According to Assefa. B, in (Japee, 2022). In Ethiopia, the present business environment is becoming more customer-driven and competitive. As a result, it is unquestionable that businesses should develop an integrated and efficient system that allows resources to move seamlessly and instantly across the supply chain.

Competitive advantage is gained when a company can produce goods at a lower cost or with a superior differentiation than its existing and potential rivals. In the context of sustainable supply chain management, companies that apply sustainability practices can differentiate themselves from their competitors in several ways. Currently, Problems related to environmental issues have brought

changes for most people to adopt environmentally friendly lifestyles (Kustiawan M. et al., 2023). This has led to a shift in consumer behavior, with consumers buying products that have a small impact on environmental damage.

The market need for environmentally friendly products has changed the competitive map of the business world. In a green market, companies will compete with green competitors to meet the need for environmentally friendly products for green customers. Greenmarket orientation is an extension of market orientation that companies can adopt to create excellence in sustainable development, where companies that focus on the green market aim to increase competitiveness in an increasingly competitive business environment (Tjahjadi et al., 2020). The meaning of sustainable competitive advantage is a process that meets current needs without sacrificing the organization's ability to meet future competitiveness by developing a dynamic concept that includes an orientation towards conservation because no organization has unlimited resources and is oriented towards the future by placing the organization in long-term resource development to generate strategic advantages (Chaharbaghi & Lynch, 1999). Companies that adopt sustainable practices can differ from their rivals through brand reputation, cost-saving mechanisms, regulatory compliance, and market opportunities.

The manufacturing process encompasses all steps involved in the transformation of raw material into finished products. Such steps in the manufacturing processes are design, production planning, material selection, fabrication, assembly, quality control, and distribution (Groover, 2016). Effective management of each step leads to enhancing the sustainability of the supply chain.

According to Rauer and Kaufmann (2015), the level and degree of trust between the supply chain partners is key for SSCM and therefore, any relationship with no trust would not materialize the SSCM efforts in the firm. In developed countries, pressure from either consumers or the government compels corporations to become sustainable in their approach” (Kottala, 2021).

Manufacturing is a critical part of almost all supply chains. It plays an important role in achieving supply chain goals by optimizing resource utilization, reducing waste, improving operational efficiency, and serving as a center of competitive advantage. Automobiles, electronics, garments, cements, beverages, and mineral waters are some important sectors where their entire supply chain is guided by manufacturing processes.

Manufacturing companies have a big share in natural resources consumption to meet the demand in the market for either consumer or industrial goods. These resources are limited in nature, so they need responsible consumption and an optimal production system, in order to build a secure supply chain management for a long period of time and to ensure sustainable supply chain management. The efficiency of manufacturing companies is more influential than any other part of the supply chain in waste reduction, cost minimization, and resource utilization.

The efficiency of manufacturing can be developed through effective supplier and customer relationship management, the introduction of an eco-friendly processing system, and the development effective reverse logistics handling system. The UN SDG No. 12 defines Responsible consumption and production: this goal forces businesses to apply sustainable consumption of resources by optimizing their usage of resources within the supply chain. This includes minimizing resource wastage through the use of efficient logistics and an inventory management system that can reduce excess production and that can encourage recycling initiatives. However, MEKELLE is revolves around the limited or low understanding and application of SSCM practices within the local manufacturing sectors. Manufacturing firms frequently face challenges that come from the repetitive interruptions in their operations; this is an indicator of the absence of a consistent and strategic supply chain. Customers are becoming aware of the social and environmental problems caused by manufacturing companies using traditional supply chain management, which does not concentrate on social and environmental aspects, so manufacturing companies are finding it difficult to effectively and efficiently respond to customer needs with their traditional supply chain network (Muller, 2008).

Several challenges face the manufacturing firms in their supply chain systems, such as resource constraints (financial crisis, shortage of supplies, and variability of foreign currency exchange, etc) and infrastructure issues (Jalu G. & Japee G., 2021). Those lead to inefficiencies in the city's manufacturing companies. Because of this, the researcher is motivated to study this field of study, and the study area is selected based on convenience, and Mekelle is one of the industrial hubs in Ethiopia.

1.2. Statement of the Problem

Companies that incorporate sustainable practices and principles into their operations can improve their overall supply chain performance, reduce waste, and increase efficiency. Technology Adoption, such as automation, data analytics, and the Internet of Things, can help organizations achieve these goals by providing real-time data, facilitating communication and collaboration, and streamlining processes. Companies can differentiate themselves in the market and attract environmentally conscious customers by employing and leveraging sustainability credentials (Reynolds, 2024). Nowadays, the public is increasingly concerned about the impact of industry on the environment and society as a whole, and many industrial companies are forced to accept the application of sustainability across their supply chain network, which embraces the social, economic, and environmental aspects as opposed to the traditional SC network (Marshall, 2015).

Most research conducted on sustainable supply chain management (SSCM) and competitive advantage is concentrated on industrialized nations, with limited attention given to emerging economies in the sub-Saharan region (Govindan K, 2020). Based on this, it may be difficult to apply directly and to generalize that the same practices and collaboration, as well as problems of SCM, exist in an emerging economy like our country. That means the developed nations are different from the developing nations in level of technology, political, cultural, economic, social, and legal status.

Previous studies conducted focused on sustainable supply chain management in developed countries (Schonebeck, Theresa Pöllinger & Lina, 2020); (Ozlem Ayaz Arda et al., 2023); (E. Siems et al., 2021); (Ali Khalfallah; Carlos Leitão, 2024); (Ehsan Shekarian, Behrang Ijadi, Amirreza Zare and Jukka Majava, 2022); and few studies conducted in developing sub-Saharan countries focusing on sustainable supply chain management; (Gele M., 2019); (Reynolds, 2024); (Ernest M.i, James K., & Marian T., 2024). In Ethiopia, there are few studies conducted focusing on sustainable supply chain management (S.N.Ephrem and D. Sharma, 2024); (H. N.Tilahun & Chalchissa A.K., 2022); (D.G. Shimelis, Nadeem P.S., 2024); and (Assefa Balda, Rajwinder Singh, 2019). The reviewed studies, conducted in developing countries of sub-Saharan including Ethiopia are more focusing on agro-processing sector particularly food and beverage, mineral water production, sugar and not give enough attention to the manufacturing sector of construction materials. (Assefa Balda, Rajwinder Singh, 2019) Studies was limited to the implementation of SSCMP by selected large manufacturing firms and measured four practices (green purchasing practice, sustainable product and production, sustainable packaging

and sustainable logistics) and concluded that, only sustainable packaging was highly concerned and well-practiced by the selected large manufacturing firms. So, in this case, the impact of SSCM on competitive advantage through is not addressed.

The (S.N.Ephrem, and D. Sharma, 2024) studies was focused to four major industry groups of the impact of SSCM on competitive advantage and organizational performance and measured five indicators environmental conservation, supplier collaboration, green product design with green warehouse, logistics optimization and reuse of materials, and the study revealed that successful implementation of SSCM can improve manufacturing firms competitive advantage and organizational performance. But the study didn't measure the other indicators of sustainable supply chain management practices, such as effective SRM, green manufacturing, CRM, and reverse logistics. Those are critical indicators in adoption sustainability in the field of supply chain management, but still remain under-researched.

Furthermore, manufacturing companies in Ethiopia are challenged with constraints such as finance, foreign currency exchange, bureaucracy, and raw materials (UNDP, 2023). While SSCM has been widely studied in developed economies, there is limited empirical evidence on its role in enhancing competitive advantage in emerging economies such as Ethiopia. Specifically, manufacturing firms in Mekelle city exhibit inconsistent adoption of sustainable supply chain management practices, resulting in inefficiencies, underutilized reverse logistics, and limited integration of green manufacturing and customer engagement. In addition, the existing studies in Ethiopia emphasize mostly on agro-processing sectors, resulting in a gap in understanding how sustainable supply chain management practices impact the competitiveness of manufacturing producing construction materials and other industrial goods. This study seeks to investigate how the key SSCM practices, such as supplier relationship management, green manufacturing, customer relationship management, and reverse logistics, affect competitive advantage in Mekelle's manufacturing firms.

1.3. Objective of the study

1.3.1. General Objective

To evaluate the impact of sustainable supply chain management practices on the competitive advantage of manufacturing companies in Mekelle City.

1.3.2. Specific Objectives

1. To evaluate the current state of sustainable supply chain management practices by the manufacturing companies in Mekelle City.
2. To evaluate how these practices, influence operational efficiency and cost-effectiveness.
3. To assess the relationship between SSCM and competitive advantage within the local manufacturing sector.
4. To identify barriers to implementing sustainable supply chain management in Mekelle's manufacturing industry.

1.4. Significance of the Study

This study would contribute valuable insights into how sustainable supply chain management can serve as a strategic tool for enhancing competitive advantage in manufacturing firms within Mekelle City. The findings would be beneficial for business leaders, policymakers, and academic researchers by providing a framework for understanding the implications of sustainability on business performance through enhancing the competitive advantage. Additionally, it may encourage manufacturers to adopt sustainable practices by demonstrating their potential benefits. The findings of this study would provide supportive literature to the existing theories, which serve as a backbone for the sustainability scientific evidence or logic.

1.5. Scope of the Study

The research was focused exclusively on manufacturing companies located in Mekelle City. It was evaluated four aspects of SSCM such as customer relationship management, green manufacturing, supplier relationship management, and reverse logistics practices. The study used only primary data.

1.6. Limitations of the study

The study may encounter several limitations, including potential biases in self-reported data from company representatives regarding their sustainability practices. The information about the impact of the war on manufacturing companies is not accessible yet; as a result, it is difficult to know the specific number of manufacturers in normal operation at the current time. This is a challenge to use probability sampling. Additionally, due to resource limitations, the sample size may not fully represent all manufacturing sectors within Mekelle City. Furthermore, external factors such as economic fluctuations or changes in regulatory policies could also impact the findings.

1.7. Organization of the study

The thesis has five chapters. The first chapter consists, the background of the study, problem statement, objectives of the study (the general and specific objectives), significance of the study, scope of the study, limitations of the study, and research justification. The second chapter consists of the structured literature review, organized with the following parts: theoretical frameworks, extensive definitions of sustainable supply chain management, sustainable supply chain management practices, including SRM, Green manufacturing, CRM, and Reverse logistics, competitive advantage, and empirical literature. The third chapter is about the methodology that will be used in the study. This includes the method of data collection and the type of data that will be used, sample determination techniques, method of data analysis, and the appropriate research design will apply. The fourth chapter is the data analysis, and the fifth chapter consists of discussion, conclusion, and recommendations.

Chapter two

Literature review

This chapter will discuss the theoretical bases that are supportive to strengthening the thesis base. The sustainable supply chain management and its practices and competitive advantage will also be discussed; in addition, the empirical literature that interconnects sustainable supply chain management practices and competitive advantage will be reviewed.

2.1. Theoretical literature

In this section, we will review some theories that support the foundation of the study. These theories will be used as a guideline for the logical flow of the study.

2.1.1. Resource-based view

The theory provides an essential framework to explain and predict the fundamentals of a company's performance and competitive advantage (Alamanos, 2023). Resource-based view suggests that an organization can create a strong competitive advantage by creating a bundle of strategic resources and capabilities (K. T. Shibin, 2020). RBV theory in sustainable supply chain management suggests how competitive advantage can be gained by focusing on sustainability-based operations in the supply chain, Touboulis and Walker in (K. T. Shibin, 2020).

The notion of core competencies is closely related to the resource-based view of strategy. Core competencies are distinctive, rare, valuable firm-level resources that competitors are unable to imitate, substitute, or reproduce (Barney 1991; Prahalad & Hamel 1994). The sources of value for the firm are embedded in the competitive situation characterizing its end-product strategic position. The strategic position is a firm's unique set of activities that are different from its rivals. Prahalad and Hamel (1990) suggested that competitive advantage based on resources and capabilities is more important than just based solely on products and market positioning in terms of contributing to sustainable competitive advantages. Strategic assets are the set of difficult to trade and imitate scarce, appropriable, and specialized resources and capabilities that bestow the firm's competitive advantage (Amit & Shoemaker 1993). Business strategy is viewed as a tool in supply chain management to manipulate such resources to create a competitive advantage. RBV suggests that the Sustainable competitive advantage is attainable when an organization's resources that are

valuable, rare, inimitable, and non-substitutable are linked to specific strategic capabilities like prevention of pollution, product stewardship as well as sustainable development.

2.1.2. Institutional Theory

Institutional theory has been used to examine how businesses react to mounting environmental management demands (Bansal and Clelland, 2014; Jennings and Zandbergen, 2015) in (David A., 2024). Institutional theory comprises societal norms, legal systems, and cultural values that impact businesses (Shabbir, L. R., Ume-Farwa, Khan, A. R., & Hafeez, S., 2024). Nowadays, organizations are not inspired by efficiency; rather, GSCM operations are frequently inspired by a desire for social legitimacy and company sustainability (Zhu, 2007). To ensure the environmental concerns are central to the organization, employees must be involved (Ernest M.I., James K., & Marian T., 2024). Environmental concerns can be of strategic value through the incorporation of sustainable habits into the employee routines and processes in the human resource policies and practices, Dubois & Dubois in (Ernest M.I., James K., & Marian T., 2024). Institutional theory has been used extensively for constructing a green supply chain framework (Sarkis et al., 2011). IT (institutional theory) can employ important programs and technology applications (Heras-Saizarbitoria et al., 2011). The theory has three types of institutional pressures. Those are coercive pressure, mimetic pressure, and normative pressure DiMaggio and Powell, in (K. T. Shibin, 2020). All pressures together act as the force behind the actions of an organization to enhance its social and environmental sustainability initiatives, through which it can attain better legitimacy and brand value (K. T. Shibin, 2020). Such habits and practices can help the organization to achieve Sustainable competitive advantage through institutionalization into the organizational culture, Hart & Sharma, 2004; Michalisin, in (Ernest M.I., James K., & Marian T., 2024).

2.2. Sustainable supply chain management

Sustainability has been a recently included part of the existing concept for a number of decades, which is called supply chain management. The concept appeared in 1960 with the elements of warehousing and transportation, after that it transformed to total cost ownership in the 1970s and to integrated logistics management by the 1980s (McKee & Ross, 2009). In the 1990s, the term supply chain management was recognized as a strategic approach in businesses. After the 2000s, the lean supply chain management emerged as a focus of attention, and through time, it has resulted

in the development of sustainable supply chain management. The concept was approached through different perspectives, one of them being the environmental lens, which derived from the aspiration of minimizing inefficiencies due to cost factors (Corbett & Klassen, 2009). Later, the external circumstances of increasing resource depletion encouraged companies to overthink their resource use (Corbett & Klassen, 2009). Sustainable supply chain management transformed from a single emphasis on material product to an extension to service and included the encouragement of outside actors in order to increase the sustainable development of organizations (Vachon & Klassen, 2009). Thusly, the concept developed from an isolated operation within an organization with a focus on the economic and environmental factors to a concept which includes multiple internal and external stakeholders and considers the environmental and economic as well as the social dimension (Schonebeck, Theresa Pöllinger & Lina, 2020). Because of the increasing contribution of sustainability in the supply chains, various definitions of sustainable supply chain management have been developed. Sustainability has become an ongoing rationale for doing business and can improve a competitive advantage for an organization (Galpin & Whittington, 2012) if it is implemented correctly and embedded across the whole organization (Haugh & Talwar, 2010). The supply chain is a relevant department for the implementation of sustainability due to its aforementioned potentially high negative impact on the environment (Wolf, 2011). According to Stavroulaki and Davis, three main areas are most prominent regarding the supply chain, such as network, management, and process components. Firstly, the network relates to stakeholders involved in the supply chain. Secondly, management encompasses decisions and supply chain strategies mainly executed internally. Thirdly, processes refer to the production mechanisms and logistics, either internal or external to the focal firm, depending on the specific organization. Additionally, the Supply Chain Council developed the supply chain operations reference (SCOR) as a clear visualization of the entire network of a product within the supply chain.

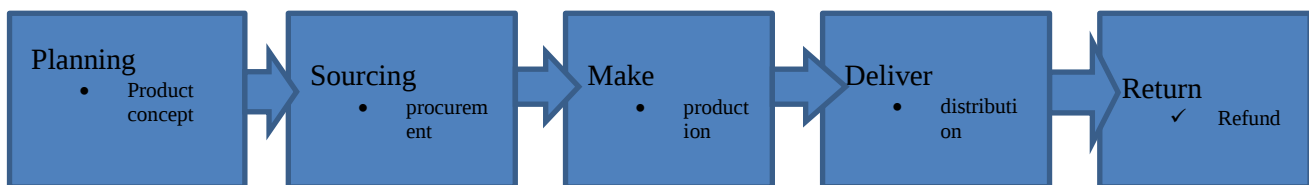


Figure 2.1: SCOR Model

The SCOR model entails the processes plan, source, make, deliver, and return, which represent the main operational processes in the supply chain. These processes entail the areas of product

concepts, procurement, production, distribution, and refunds. Hence, supply chains comprise a vast variety of practices and processes within organizations (Schonebeck, Theresa Pöllinger, & Lina, 2020). Supply Chain involves all activities related to the flow and transformation of goods from the raw materials stage through to the end user, as well as associated information flows (Mibenge M. & Okoye C. N., 2007). Supply Chain Management is the integration of these activities through improved supply chain relationships to achieve sustainable competitive advantage (Presutti Jr., 2003), cited in (Mibenge M. & Okoye C. N., 2007). These flows have to be coordinated both within and among companies. Strategic coordination of these processes, in terms of cost, social and environmental rules and regulations, is important to build a sustainable supply chain within the firms. Developing sustainable linkages among the firms' supply chain networks leads to efficient and effective supply chain management. The linkages support fostering collaboration, improving visibility, and increasing optimal resource utilization. This leads to reduced cost, enhancing the operational efficiency and increasing customer satisfaction.

Carter and Rogers (2008) define SSCM as “the strategic, transparent integration of achievement of an organization's social, environmental, and economic goals in the systemic coordination of key inter organizational business processes for improving the long-term economic performance of the individual company and its supply chain”. Seuring and Müller (2008) on the other hand define SSCM as “the management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements”. Both definitions include the sustainability dimensions and business processes, while the former emphasizes the economic performance and the latter is more elaborate and includes stakeholders. Ahi and Searcy (2013) developed an even more elaborate definition of SSCM and define it as “the creation of coordinated supply chains through the voluntary integration of economic, environmental, and social considerations with key inter-organizational business systems designed to efficiently and effectively manage the material, information and capital flows associated with the procurement, production, and distribution of products or services to meet stakeholder requirements and improve the profitability, competitiveness, and resilience of the organization over the short- and long-term” (Schonebeck, Theresa Pöllinger & Lina, 2020).

A sustainable supply chain focuses on the mitigation of risks that can occur in various areas and in the dimensions of sustainability, environment, social, and economic aspects. For example, for the economic pillar, these are those operational processes that can be interrupted, especially if many actors are involved and if the supply chain is spread globally (Seuring & Müller, 2008). On the environmental aspect, resource depletion and environmental degradation are among the most negatively influential risks (Förstl, Reuter, Hartmann, & Blome, 2010). Hazardous pollutants and the extraction of raw materials can further display a risk to the environment (Vachon & Klassen, 2006). Depending on the product, waste and used products also put the environment at risk (Vachon & Klassen, 2006). Regarding social risks, child labor, safety, and human rights etc, are the most critical factors. Sourcing in the developing world can also display a risk in different ways, mainly socially, regarding working conditions and human rights (Pagell & Wu, 2009). All business organizations confront risks in their supply chain (Roehrich, Grosvold, & Hoejmoose, 2014). However, the level of impact is different from industry to industry. Especially the textile industry and the food industry are exposed to risks (Roehrich, Grosvold, & Hoejmoose, 2014). Sustainable supply chain management is a crucial topic for organizations on the way towards becoming more sustainable. Especially, a close interaction with stakeholders is essential to mitigate risks and achieve synergies. When seen from a holistic perspective, a sustainable supply chain would at a minimum, not harm the environment and could ideally ensure the possibility of doing business eternally (Pagell & Wu, 2009). Because of the numerous stakeholder environments of the companies and intricacies of the supply chain, manufacturing firms face several enablers and challenges in regards to the implementation of sustainable practices within their supply chains (Narimissa, Kangarani-Farahani, & Molla-Alizadeh-Zavardehi, 2020). The different associations of stakeholders share varying interests and priorities and therefore follow diverse objectives, resulting in a multitude of drivers and barriers for SSCM (Rebs, Brandenburg, & Seuring, 2018). As the context of sustainability within the supply chain is complex and linked to multiple actors, various differing drivers and barriers, sometimes even conflicting with one another, arise naturally (Zimon, Tyan, & Sroufe, 2020). The drivers and barriers for sustainable practices within a supply chain can be divided into internal and external factors (Hervani, Helms, & Sarkis, 2005; Freeman, 2010). Hervani, Helms, and Sarkis (2005) have remarked that organizations have a multitude of drivers and barriers when

it comes to SSCM, comprising enablers and constraints from either inside or outside the organization.

The sustainable supply chain management concept entails areas such as sustainable operations and risk management, sustainable supplier management, and corporate social responsibility. A sustainable supply chain considers all three pillars, namely the environmental, the economic, and the social dimension, and in regard to the three dimensions, more sustainable manufacturing practices (Sisco, Chorn, & Pruzan-Jorgensen, 2011). It is furthermore a concept that not only covers the three dimensions, but also it considers moral, technical, legal, and political aspects (Zimon, Tyan, & Sroufe, 2020). Sustainable supply chains fulfill the needs of the present and future generations (Sisco, Chorn, & Pruzan-Jorgensen, 2011). A sustainable supply chain satisfies the needs of the present without harming the chance of future generations to satisfy their needs. Sustainable supply chain management covers different areas in which sustainability and supply chains come together beyond traditional supply chain management, namely in designing products, manufacturing by-products produced during product use, prolonging the product life cycle, and ensuring a recovery processes at the end of the product life cycle (Matsumoto, Masui, Fukushima, & Kondoh, 2017). Further sustainable practices include fair labor conditions for suppliers but also employees to ensure ethical standards (Park-Poaps & Rees, 2010). Diversity within the whole range of stakeholders and the supply chain is also crucial to ensure that different opinions are respected and represented (Worthington, 2009). Concerning operations, several different sustainable practices can be taken by companies (Schonebeck, Theresa Pöllinger, & Lina, 2020). Sustainable processes comprise sourcing, production, and transportation (Ivanov, Tsipoulanidis, & Schönberger, 2017). In specific, green logistics, green inventory management, green facility location, responsible purchasing, green technology choice, and eco design are of importance (Bouchery, Corbett, Fransoo, & Tan, 2016). For the food industry, especially green logistics, eco design in terms of packaging and responsible purchasing play a crucial role. Green logistics is majorly concerned with reducing the negative environmental impact of transportation by reducing emissions, the amount of non-renewable energy, and waste (Bouchery et al., 2016). Eco design is one approach to create products, packaging, and processes to minimize waste and thus the negative impact on the environment (Schonebeck, Theresa Pöllinger, & Lina, 2020). Moreover, responsible purchasing becomes more important for supply chains nowadays as

suppliers can represent a competitive advantage for companies.

Sustainability refers to the integration of the environmental, social, and economic aspects into the organization's operational activities. SSCM is the set of practices that improve a firm's overall performance during the development, production, procurement, and distribution of a product or service to current and potential customers along the supply chain (Garza-Reyes, 2023). Oktem (2014) further decomposed the term sustainability to include consideration for profit, people, and the planet into the firm's culture, strategy, and operations within the perspective of the triple bottom line (TBL) approach, which includes environmental, social, and economic perspectives to achieve supply chain sustainably. Ortas et al (2014) define SSCM as skills and leverage that capacitate firms to structure their business processes to achieve sustainable performance. Sustainable supply chain management plays a critical role in integrating environmental, economic, and social issues into SCM to improve the firm's linkage and bonding with its suppliers and customers without compromising its economic performance. Sustainable practices used to reflect the solution of sustainability issues involve sustainable manufacturing, sustainable procurement, and sustainable distribution (Hazem Ali, 2021). Environmentally based design practices, such as the high usage of recycled materials and those that are designed to reduce carbon dioxide emissions and disassembly, significantly reduce costs and increase firms' market share (Hazem Ali, 2021)

Sustainability is a multi-dimensional combination that enlarges the economic bottom line notion, which focuses on the efficient use of resources and realizing a return on investments, by adding social considerations and promoting greater ecological responsibility. Therefore, business sustainability can be defined as the ability to conduct business with a long-term goal of keeping the well-being of the economy, environment, and society. SSCM refers to a firm's plans and activities that incorporate environmental and social-related issues into SCM to improve the company's environmental and social performance and its suppliers and customers without compromising its economic performance (Assefa Balda, 2019).

According to CSCMP (Council of Supply Chain Management Professionals), 2004, SCM is the planning and organization of all sources and procurement operations, manufacturing techniques,

as well as all logistics monitoring operations, including working with suppliers, intermediaries, outside Service providers, and consumers. SCM is the management component responsible for controlling and coordinating the operations of an organization from the upstream to the downstream (Attia, 2023). Supply chain management (SCM) ensures the appropriate goods are available in the right quantity at the appropriate time, location, price, and quality for the right consumer. The concept of sustainability in supply chain management involves a holistic approach that considers environmental, social, and economic dimensions. Environmental sustainability emphasizes reducing the ecological footprint through practices such as waste reduction, energy efficiency, and the use of renewable resources. Social sustainability, on the other hand, emphasizes ethical labor practices, community engagement, and equitable resource distribution. Economic sustainability ensures that these practices contribute to long-term profitability and competitiveness (Reynolds, 2024). Supplier and customer relationship management as a SSCM practice emphasizes improving collaboration and strengthening partnerships among supply chain stakeholders, such as suppliers, manufacturers, customers, distributors, and other parties participating in the supply chain activities, which are working together towards sustainability goals. The practices also played a vital role in enhancing the transparency in communication and information sharing among the supply chain stakeholders.

Researchers argue that sustainability practices can enhance the firm's competitive advantage through enhancing efficiency, reducing costs, and creating new market opportunities (Reynolds, 2024). The study conducted by Carter and Roger (2008) explained the triple bottom line approach, which integrates the environmental, social, and economic performance. One of the widely adopted approaches by organizations is green supply chain management; it involves the environmental considerations into supply chain operations, including procurement, production, distribution, and disposal (Reynolds, 2024). Digital transformation plays an important role for companies, as the combination of various technologies may lead to the development of significant capabilities, increasing sustainable performance, and enabling the development of sustainable strategies, which can improve companies' position in the market (Kopanaki, 2022). According to Ahmed and Sarkar (2018), Sustainability in commercial organizations is the product of practices with the long-term goal of maintaining the well-being of the community, climate, and economy.

Sustainable supply chain management is considered a tactical, consistent combination and achievement of societal, environmental, and economic aspects of an organization through systemic management of core cross-organizational market processes to enhance the long-term economic success of the particular firm with its supply chain (Busse et al., 2017). Sustainable supply chain management is also defined as green supply chain management or environmental supply chain management. Both of those concepts are defined as green purchasing, green manufacturing, green distribution, and reverse logistics in the organization's operation (Dina Allam, 2021).

2.2.1. Supplier relationship management

Supplier relationship management is a critical aspect of supply chain management, particularly in the current dynamic and interconnected business environment. The contemporary business world is increasingly shaped by complex supply chain dynamics, necessitating an improved framework for supplier relationship management. Nowadays, the supply chain has changed from a local and linear system to global complex networks that are characterized by interdependencies, technological advancements, and strong competition (Reynolds, 2024). This situation forced businesses to understand the strategic importance of supplier relationship management. Strategic management of supplier networks (first, second, and third tiers of suppliers) is important to maintain a consistent operation system.

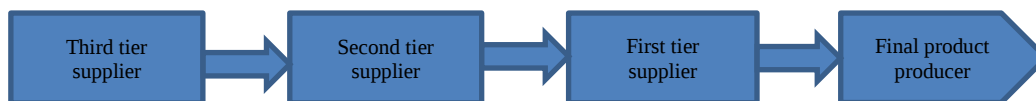


Figure 2.2. Supplier Tiers

Supplier relationship management is the systematic approach for developing and managing partnerships with the suppliers that are critical to the success of the organization. The goal of SRM is to maximize the value derived from suppliers and minimize risks associated with supply chain disruptions. Effective SRM involves regular communication, trust building, and alignment of goals between the buyer and supplier. Previous studies have shown that effective supplier relationship management leads to improved competitive advantage and operational performance for manufacturing companies. Further, studies indicate that companies with strong SRM practices experience higher levels of supplier performance, which translates into better quality

products, reduced costs, and enhanced innovation capabilities. (Daniel R. Krause, 2007) Defined firms that used advanced SRM strategies reported significant improvements in delivery reliability and responsiveness. During the COVID-19 pandemic, organizations with strong supplier relationships were able to pivot more quickly to alternative sources or adapt their supply chain effectively compared to those without such relationships (Choi & Krause, 2020).

Sustainable supply chain management is deeply working on integrating social and environmental aspects into supply chain operations. So, strong SRM can improve sustainability efforts by leveraging collaborations with suppliers who prioritize sustainable practices, such as sourcing raw materials or other inputs responsibly, minimizing waste by employing efficient processes, as well as ensuring fair labor management. Companies that are strongly collaborating with suppliers on sustainability responsible achieve a lower carbon footprint and enhance resource efficient utilization (Carter & Rogers, 2008). Firms working closely with suppliers committed to sustainability can create new products that meet customer demand for environmentally friendly options. Sustainable Supplier Relationship Management practices aim to incorporate environmental and social criteria into supplier selection, evaluation, and development processes (Reynolds, 2024). Govindan et al. (2020) said that sustainable SRM practices can enhance the organization's reputation, reduce environmental impact, and ensure compliance with regulatory standards. Moreover, sustainability considerations in SRM extend beyond environmental factors to include aspects such as labor practices, human rights, and ethical sourcing (Emon & Khan, 2023; Reimann et al., 2021). Firms that emphasize sustainable practices with effective supplier relationship management can differentiate themselves in the marketplace. Clients increase their preference for brands that consider corporate social responsibility, resulting in boosting customer loyalty and market share. Sustainable practices also lead to reducing costs over time by minimizing and eliminating wastes, and increasing efficiency level, by integrating efforts between suppliers and manufacturers, bringing into optimal logistics processes, and resulting in minimizing transportation emissions and lowering costs.

Supplier relationship management focuses on the upstream side of the supply chain activities, such as acquisition and selection of strategic suppliers, which are responsible for green sourcing of required materials for the manufacturing processes. Green sourcing is an important base for sustainable supply chain operations. Green sourcing is a sourcing mechanism that acquires

materials without affecting the surroundings of the source place, as well as the overall ecosystem. Sustainable sourcing is the acquisition of required materials without any influence on the natural environment, human community, and the economic aspect of the firms. Sustainable purchasing practices require the procurement process to be green and sustainable (Shekarian, Ijadi, Zare, & Majava, 2022). The first green practice involves ensuring that the purchased green logo products are recyclable and include environmentally friendly raw materials, for example, meat produced without hormones or antibiotics, certified organic coffee, eco-friendly and lighter-weight packaging, and shopping bags (Duque-Urbe, Sarache, & Gutiérrez, 2019). The second practice is related to socially responsible purchasing activities, such as considering the human rights impact of procured products (Baliga, Raut, & Kamble, 2019), (e.g., not purchasing the products that workers produce under nonstandard conditions). And the most important suggested practice is having a supplier selection strategy based on a code of conduct (Ciccullo, Pero, Gosling, Caridi, & Purvis, 2020). This leads to transparency in purchasing and strengthening procurement centers and local manufacturers (Narimissa, Kangarani-Farahani, & Molla-Alizadeh-Zavardehi, 2020).

Supplier development plays a pivotal role in Supply Chains moving toward sustainability. The primary practices can be categorized into four parts: those are certification matters, technological aspects, location, and training (Shekarian, Ijadi, Zare, & Majava, 2022). Companies prefer suppliers with environmental certifications, as this should help them obtain authentic certifications (Thong & Wong, 2018). Transferring technology to and sharing knowledge with suppliers to develop their capabilities is an effective strategy (Luthra, Garg, & Haleem, 2015). In some cases, choosing local and small suppliers is a preferred solution as they can be trained and developed for the future, and thus some issues, such as local regulatory and legislative requirements and intermediary problems, can be resolved (Mejías, Paz, & Pardo, 2016). Supplier relationship management involves strategies and practices for an organization to apply for managing its interactions with suppliers effectively. Strong SRM can lead to enhanced collaboration, innovation, and efficiency within the supply chain. Its focus is to build long-term relationships that are able to improve sustainable efforts. Strong SRM can lead to enhanced collaboration between the manufacturers and the suppliers who prioritize sustainable practices. The collaboration can lead to cost savings through a bulk purchasing contract or shared resources that can improve the entire supply chain efficiency.

2.2.2. Green manufacturing

Green manufacturing refers to the process of applying practices that able to minimize wastes and environmental impact without losing the economic benefit of companies. According to Zhu et al. (2019), companies that implemented green manufacturing practices reported significant reductions in operational costs due to improved and efficient resource utilization. Firms applying sustainable practices experienced enhanced brand reputation and customer loyalty, leading to increasing market share (Kumar & Singh, 2020). Green manufacturing focuses on reducing costs through applying sustainable practices that can minimize wastes, resulting in reduced operational cost, which also leads to improved efficiency, so, resulting in leveraging companies' competitive advantage.

Green manufacturing employs technologies for cleaner production and process modernization, causing less energy consumption and contamination (Raut, R.D., 2017; Li, J.; Fang, H.; Song, H., 2019; Das, K., 2018). For example, by adopting intelligent factory components, manufacturing machinery renewal, and advanced technology for water-saving and remanufacturing (Shekarian, Ijadi, Zare, & Majava, 2022). Different solutions are developed in industries such as the textile industry via biological production, organic cotton, the replacement of solvent-based polyurethane with water-based alternatives, and natural dyeing processes (Islam, Perry, & Gill, 2020), and in the food industry via returnable and sustainable packaging (Shekarian, Ijadi, Zare, & Majava, 2022). Other practices can be applied to shift toward sustainable production, including digitization, mass customization, lean philosophy, computer-aided design/manufacturing, mobile and remote maintenance, RFID technology, 3D seamless technology, additive manufacturing, and digital printing (Choudhary, Kumar, Luthra, Garza-Reyes, & Nadeem, 2020).

Mass production systems are switched to just-in-time manufacturing in lean production strategies. The lean philosophy introduced by Toyota promotes sustainability (Shekarian, Ijadi, Zare, & Majava, 2022). It is defined as a waste-free system in terms of equipment, materials, parts, and working time, encompassing only what is required for production (Mejías, Paz, & Pardo, 2016). Applying the lean practice, companies can avoid mistakes using the poka-yoke (mistake-proofing) mechanism (Raut, Narkhede, & Gardas, 2017). Sustainable Product and service development

practices have four aspects, including product stewardship, product quality, product safety, and customer-centric products and services (Shekarian, Ijadi, Zare, & Majava, 2022).

Sustainable design aims to improve the environmental performance of companies while minimizing environmental impacts (de Sousa Jabbour, de Oliveira Frascareli, & Jabbour, 2015). The design refers to the product and process designs. The product design is defined as the product should be free from any consumer health risk, easily assembled and disassembled, compatible with the ecosystem, and suitable for transportation (in terms of its size and weight). The process design is responsible for the transformation of inputs to the required output (goods or services). It can be defined as a practice of green manufacturing; it reduces the waste of resources, pollution, and energy consumption by employing tools of total quality management, JIT, time-based competition, and sustainable packaging. Green manufacturing is a manufacturing process that can minimize the waste of resources and reduce the environmental impact by using energy efficiency, resource conservation, and sustainable consumption of materials. Further, green manufacturing practice improves operational efficiency and brand reputation of the companies. Companies adopting green manufacturing practices or techniques can reduce production costs over time due to responsible consumption of energy and prevention of waste while appealing to environmentally conscious consumers.

2.2.3. Customer Relationship Management

CRM is a basic business discipline that focuses on managing the company's relationships with its customers. CRM focuses on the creation and maintenance of profitable customer relationships. Customer relationship management is a strategic approach that integrates labor, processes, and technology to understand and manage customer relationships effectively (Ahmed A., 2023). This includes collecting and analyzing customer data to provide goods and services, to satisfy the specific needs, and it leads to assuring long-term relationships. Attia, A. (2023). The implementation of effective CRM enhances the sustainability of supply chain management, resulting in fostering the competitive advantage of manufacturing companies. CRM is one of the most essential factors of modern firms for effective survival, growth, and development of strategies that enhance companies' efficiency, performance, and sustainable competitive advantage (Pilar fidel, 2015). CRM focuses on building, sustaining, and retaining long-term relationships with customers through the utilization of information technology to improve economic efficiency.

Transportation is an essential part of the logistics system within a supply chain. Accordingly, sustainable distribution focuses on minimizing the environmental impact of the raw materials and finished products through the supply chain networks. It should be utilized to achieve economies of scale in inbound and outbound transportation (Mitra & Datta, 2014). The transportation practices can be defined with various categories; consolidation and collaboration actions, for instance, multi-drop, multi-pack, and cross-docking by the integration of demand, the consolidation of internal and external site systems, coordinating lot sizes and collaborative warehousing, and cooperation with vendors to decrease packaging size (Duque-Urbe, Sarache, & Gutiérrez, 2019), the use of alternative and renewable energy, the upgrade, redesign, and automation of freight logistics networks, for example, weight and volume reduction, using full-load capacity and full load truck, applying environmentally friendly storage, reducing container weight, improving refrigeration, and decreasing human intervention (Islam, Perry, & Gill, 2020); tracking emissions caused in product distribution (Esfahbodi, Zhang, & Watson, 2016); the development of services (e.g., the promotion of public transport use and shared-occupancy vehicle use) to minimize or even stop travel (e.g., by telehealth and home healthcare in the healthcare industry, and videoconferencing) and the identification of shorter routes for product transportation to minimize the relevant costs and emissions (Golini, Moretto, Caniato, Caridi, & Kalchschmidt, 2017).

Marketing management is one of the critical functions of customer relationship management. The basic aim of marketing management is to meet high customer satisfaction, resulting in enhancing competitiveness, increasing market share, and sales volume. Sustainable marketing management can be applied with some practices, such as boosting green brand image. This gives a competitive advantage in the global marketing space leading to increases in market share and profitability (Luthra, Garg, & Haleem, 2015); on-time delivery management by increasing supply flexibility and customer relationship management (Li, Fang, & Song, 2019); resolving customer concerns through informing customers of sustainable movements and green initiatives, designing eco-friendly products, distribution systems, and green and sustainable SCs to address the environmental concerns of customers (Hong, Guo, Chen, & Li, 2020) and (Das, 2018); finding markets for recovered products and accessing new markets in comparison to the company's key competitors (Vargas, Mantilla, & de Sousa Jabbour, 2018). Effective customer relationship

management improves the forecasting accuracy of customer demand. The improved forecasting also reduced the raw materials and finished goods inventory levels and leading to smoother operational activities, which reduced the logistics cost and optimized the asset utilization.

CRM involves strategies for managing a company's relationship with current and potential customers. An effective CRM can lead to improved customer satisfaction and loyalty, which are crucial for developing a competitive edge in the market. An improved CRM allows manufacturers to understand their customers' preferences well and produce their products accordingly. This responsiveness can lead to improved customer retention abilities and brand loyalty. According to (Mibenge M. & Okoye C. N., 2007), there are two types of customers that participate in the supply chain system of manufacturing companies. Those are internal and external customers of the firms. The current study will cover the internal customers. Good Internal customer service is directly related to serving the needs of those within the organization, which ultimately affects how the external customers are treated. Great external customer service depends on excellent internal customer service (Earl, 2006). The internal customers include the purchasing/ supply department, inventory department, maintenance, and research and development. The operation/ production department of firms are sending a request by preparing a bill of materials to the inventory department to get the required materials for the production of goods. If the requested material is not available in the warehouse, the inventory department sends a supply request to the procurement department and the procurement is responsible for acquiring the needed materials from the market. The internal customers are focusing on enhancing smooth workflow by improving cross-departmental collaboration. The production department is an internal customer of the inventory department and the procurement department.

2.2.4. Reverse logistics

Reverse logistics is the movement of goods from their delivery location back to the manufacturer's location or to the production place due to recreating value or for safe disposal. Reverse logistics is strongly correlated with the sustainability of the supply chain. SSCM is focusing on minimizing the impact of an organization on the environment and actively working to maximize the organization's economic benefit in the supply chain. Through the alignment of reverse logistics with the operation, companies can improve their sustainable efforts by resource recovery, reduce the need for new raw material (new inputs), improve waste reduction, and

reduce energy consumption; the returned products for reprocessing require used small amount of energy relative to new raw inputs. The objective of green logistics is to give fundamental justifications to convince stakeholders to accept environmentally conscious logistics efforts (Björklund & Forslund, 2019). To ensure environmentally sustainable logistics, companies must establish a performance management system for environmentally sustainable logistics (Persdotter Isaksson, Hulthén, & Forslund, 2019). Companies that ensure a sustainable logistics system it can help them to develop long-term competitive opportunities by differentiating themselves from other rivals through applying impact-free methodologies in their supply chain process. Reverse logistics is crucial because it contributes to the improvement of the organization's objectives, such as increasing customer satisfaction, decreasing resource investment levels, enhancing customer service, recovering assets, comprehending the reasons for hardware returns, reducing inventory, reducing repair costs, and minimizing distribution costs (Mahmoudzadeh, Mansour, & Karimi, 2013). This results in improving the company's sustainable competitive advantage through a cost leadership strategy. Much of the idea of applying reverse logistics in enterprises has good implications for the environment, such as minimizing waste, minimizing product costs, etc. Implementing reverse logistics in supply chains plays a significant role to the organization's performance. Reverse logistics involves the process of moving goods from their final destination back to the manufacturer for repair, remanufacture, or recycling. Efficient reverse logistics management can reduce costs and improve sustainability by minimizing waste. This enables the companies to recover the value of returned goods through recycling or remanufacturing processes. This leads to reduced costs associated with waste of resources and the costs of raw material procurement.

2.3. Competitive advantage

Competitive advantage is developed through the process of competitive strategy and earning above-average gains for companies. Above-average earnings are profits that are superior to alternative investments at the same risk level. Competitive advantage is achieved through the strategic management of supply chain resources, capabilities, and core competencies, as well as the firm's responsiveness to opportunities and threats in the external environment. Resources are the starting point of competitive Strategy within a supply chain and are the inputs required to produce a product or service. Developing strategic management of supply chain resources leads to enhancing the sustainability practices of manufacturing organizations. Tangible resources are raw

materials, premises, machinery, and equipment. Intangible resources are finance, technology, human capital, supplier networks, distribution networks, patents, trademarks, established customer base, brand equity, and firm reputation (John McGee & Tanya Sammut-Bonnici, 2014). Resources can be combined and developed into capabilities, which in turn create core competencies. Capabilities are the firm's capacity to transform resources into competitive products and processes. Capabilities become embedded in a tacit manner into the firm's internal processes. They are difficult to document as procedures and, therefore, difficult to copy. Intangible resources tend to be the main source of inimitable strategic capabilities. Capabilities are a more likely source of unique core competencies that create sustainable competitive advantages (John McGee & Tanya Sammut-Bonnici, 2014).

A number of definitions have been developed for competitive advantage by many scholars. Porter (1980) defined Competitive advantage means having low costs, differentiation advantage, or a successful focus strategy. Ghemawat (1986) provides that the competitive advantage is more sustainable the greater the number of sources of cost or differentiation advantages. According to Barney (1997), the competitive advantage is considered sustainable if those resources are also non-imitable, non-substitutable, and nontransferable. Non-imitable means the activity of the company can't be easily duplicated by competitors, non-substitutable means other companies can't perform the same function, and nontransferable means the company's resources are can't be acquired in the market. Modern business strategy maintains that the strategic imperative of a firm should be sustained, superior financial performance and the belief that this goal can be achieved through a sustainable competitive advantage in the marketplace (Hunt, 2000). Most forms of competitive advantage mean either that a firm can produce a service or product that its customers value than those produced by competitors or that it can produce its service or product at a lower cost than its competitors (Saloner, Shepard, & Podolny, 2001). Competitive advantage is obtained when an organization develops or acquires a set of attributes that allow it to outperform its competitors (Wang, 2014). Competitive advantage is can't be get through simply cutting price or by simply adding quality without reflecting the cost premium in higher price. Competitive advantage requires the firm to be sustainably different from its competitors in such a way that customers are prepared to purchase at a suitably high price. The search for competitive advantage is the search for differences from competitors and for purchase on the basis of value (McGee, 2014).

Competitive advantage refers to the capability of a company to create a defensible position over rivals (Desfitrina et al., 2019). Competitive advantage requires that firms apply value creation strategies that are unique and different from rivals or superior performing of strategies used by competitors (Desfitrina et al., 2019). Competitive advantage is the application of strategic approach not currently being used by other rivals that can be reduce costs, that can be use business opportunities and it can be enabling to balance competitive challenges (szu-yu kuo, 2017). The competitive capability defined by literatures includes cost, innovation, flexibility, time, delivery, and quality (ketchen et al., 2008; marinagi et al., 2014).

The understanding of what is happening in the market, what the customer wants, and an understanding of the changes in the business environment to competing with others. An attempt to understand what and how to manage a variety of resources owned to win the competition and create a competitive advantage must always be made (Kuncoro W., 2018). The introduction of new products in front of the competition from rivals is one way to win the competition through product innovation. Innovation means observing consumers to find and satisfy customers by providing new products, creating innovation in order to have a strategic position in the market, and withstand attacks from competitors with the main objective to meet the market demand (Kuncoro W., et al.). As a result, it enabled businesses to get a competitive advantage.

There are different indicators of competitive advantage, such as product uniqueness, product quality, and competitive price. The product uniqueness refers to the manufacturer combining art and the desire of the customer by deeply understanding the demand of the customer and tailoring its products accordingly. Product quality refers to the quality of the product design from the company's quality, using secure and relevant sources of material, and the product can be fit to the customer's requirements. Competitive price is the ability of the company to adjust the price of the product to the general price of the market. Supply chain management focuses on managing supply chain activities and supports to enhance customer value and to develop sustainable competitive advantage. Competitive advantage can come from various company activities, such as designing, producing, marketing, delivering, and supporting its products. Each of these activities must be directed to support a relatively low-cost position with good quality on the basis of creating differentiation (Desfitrina, 2019). Competitive advantage refers to the attributes that allow an

organization to outperform its competitors. This is influenced by how well the firms implemented the sustainable supply chain management practices. Activities that enable the companies to get a competitive advantage include cost leadership, product focus, and differentiation through sustainability initiatives, enhanced customer loyalty, and improved operational efficiency. Nowadays, most companies commonly use three strategies for improving their competitiveness (Bel, 2018). These three strategies are the cost leadership strategy, the differentiation strategy, and the focus strategy (Cahyadi et al., 2022). A cost leadership strategy can inhibit competitors by reducing the cost of the production process, which offers lower prices to buyers (Parnell & Brady, 2019). Product differentiation helps to enhance a company's competitiveness in the presence of substitutes and the threat of similar companies (Haseeb, M.; Lis, M.; Haouas, I.; Mihardjo, L.W., 2019; & Haddad, H.; Alkhodari, D.; Al-Araj, R.; Aburumman, N.; Fraij, J.).

2.4. Empirical literature

Paul et al. (2024) studied Supplier Relationship Management and sustainability, and the study defines that, SRM facilitates the integration of sustainability principles into supply chain operations by fostering collaboration, enhancing transparency, and ensuring adherence to environmental and social standards. SRM can contribute to sustainability by reducing the environmental impact of supply chain activities, helping to enable firms to identify and manage sustainability risks within their supply chains, such as non-compliance risk related to environmental regulations and reputational damage related to unethical sourcing. Resource efficiency is another mission of sustainability that can be achieved through effective SRM. Beyond that, SRM plays a significant role in addressing the social dimension of sustainability. The extensively reviewed study demonstrates the contribution of SRM in promoting and ensuring sustainability within the supply chain. But not to mention the role of competitive advantage by contributing to the sustainability aspects.

Björkman F. & Green J. (2024) conducted a study on the influence of Buyer-supplier relationship on supply chain sustainability and found that, strong and trust-based buyer-supplier relationship is essential for enhancing sustainable supply chain practices. Further, the smallest interaction can lead to the creation of new ideas and the beginning of a collaborative relationship. These interactions are crucial for firms and can, over time, lead to a competitive advantage. However, the study did not explore how lead to competitive advantage can the buyer-supplier collaborative relationship. The study is conducted on SMEs, using a qualitative research method, using

interviews as a data collection instrument, and the study examines the role of trust, communication, and mutual sustainability goals in strengthening the relationships.

2.5. The Research Hypothesis

2.5.1. The relationship between supplier relationship management and competitive advantage:

Firms who build strong relationships with suppliers are able to gain access to critical resources that might otherwise become difficult to come by without those relationships (Amoako-Gyampah, 2019). SRM contributes a big share in improving firm competitive advantage due to its contribution to cost minimization, improvements in quality, and the design of new products. The fostering of partnerships aids firms in enhancing the process of creating competitive advantages at both the supplier and buyer sides that contribute to market share and profitability improvement (Tseng, 2014). From the RBV perspective, SRM can be leveraged to derive some benefits aimed at creating and delivering superior customer value, which can culminate in firm competitiveness (Acquah I. N. et al., 2019).

H1: Supplier relationship management has a positive impact on competitive advantage for manufacturing companies in MEKELLE city.

2.5.2. The relationship between green manufacturing and competitive advantage:

Green manufacturing characteristics consist of using recyclable materials, including flexibility in the product design, production from minimum resources, and the use of cleaner technologies. This leads to a reduction of production costs and leveraging to competitive advantages. Organizational competitiveness can be enhanced by using the GM method as it increases operational competence, reduces costs, and reduces risks related to customer preferences and ecological regulations. Integrating GM practices in business operations, risks related to resource deficiencies, supply chain disruptions, and governing compliance can be reduced. Green manufacturing and firm sustainability are directly interlinked (Shabbir, 2024). Companies can reduce costs and eliminate waste by executing green manufacturing tools, techniques, and processes (Schoenherr, 2012).

Recent literature indicates that a very strong connection between green manufacturing and organizational sustainability. By executing sustainable production practices like waste reduction

and energy efficiency, organizations can expand their environmental performance and support long-term economic viability (Quayson, 2023). According to Li et al. (2024), green manufacturing improves the companies' overall sustainability through better stakeholder collaborations and enhanced brand reputation. These findings indicated the importance of integrating green manufacturing practices into their daily operations to meet sustainability targets and maintain competitive chances in the market.

H2: Green manufacturing has a positive impact on competitive advantage for manufacturing companies in MEKELLE city.

2.5.3. The relationship between customer relationship management and competitive advantage:

The distribution of products and services from manufacturers to consumers involves the deployment of CRM and supplier relationships, and when coordination between both suppliers and customers is appropriately maintained, the highest quality-stock and product range are guaranteed (Soltani, Z. et al., 2018). Companies using strong SCM strategies are more likely to meet customer needs with appropriate goods and services at competitive prices, which logically lead to better business ties and rapid outcomes (Lemon, K.N.; Verhoef, P.C). Customer relationships are influenced by different supply chain factors, including firm characteristics, company size, and position as vendors or customers (Vanichchinchai, 2021). Sustainability concerns in client relationships include the capability to maintain a user base through long-term loyalty and commitment, more environmentally friendly products and services, and a favorable attitude toward, and reputation for promoting environmentally conscious consumer behavior. The beneficial impact of the components of a system on each facet of sustainability may be augmented by CRM-related advantages (Wikhamn, 2019).

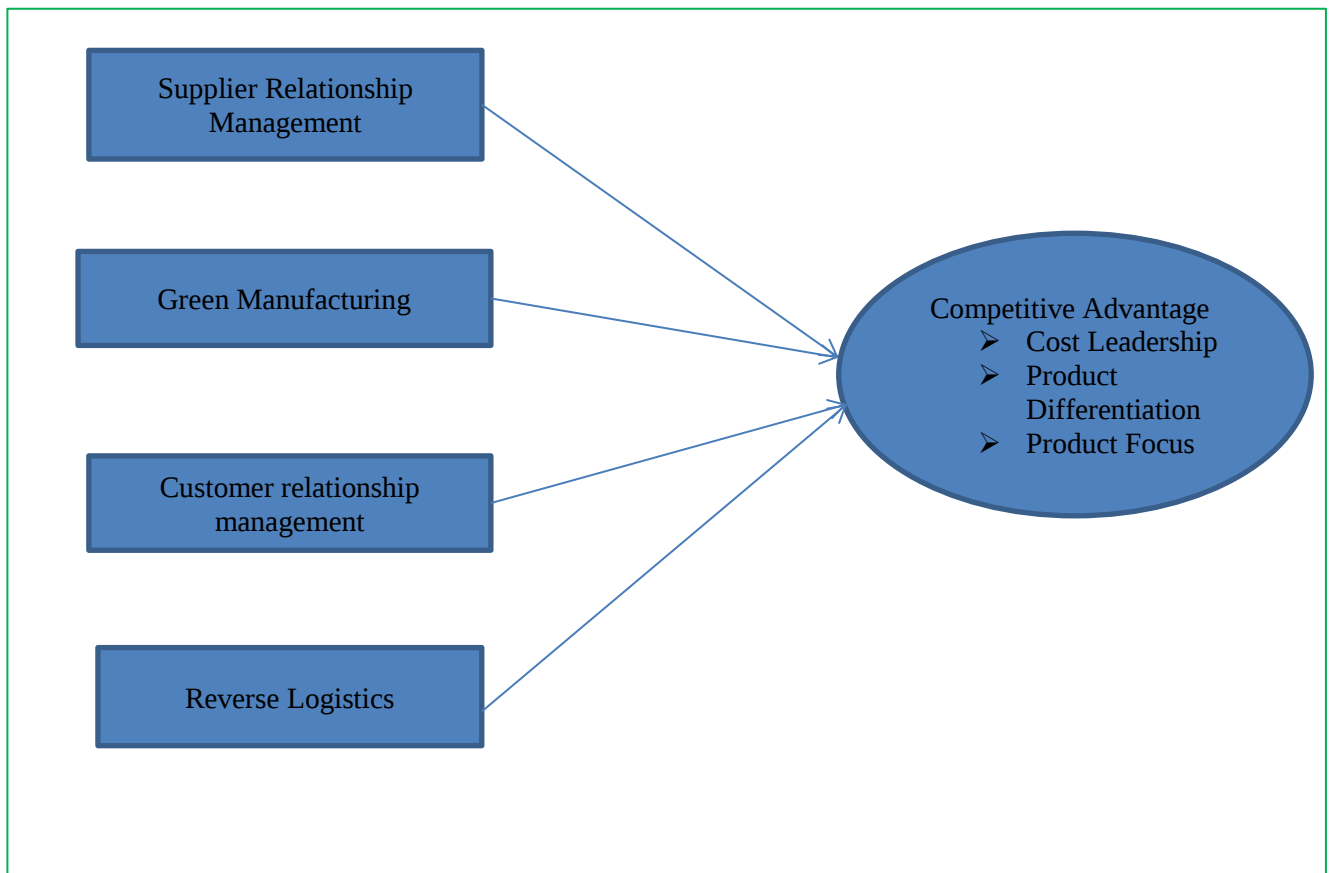
H3: Customer relationship management has positive impact on competitive advantage for manufacturing companies in MEKELLE city.

2.5.4. The relationship between reverse logistics and competitive advantage

According to the resource-based theory, firm resources and capabilities determine firm Performance and sustainable competitive advantage (Penrose, 1959; Peteraf, 1993). Therefore, a firm should develop logistics strategy on its core competencies in order to reduce costs and maximize their value offer (Olavarrieta and Ellinger, 1997). Reverse logistics strategy is a critical

importance in managing the reverse direction in supply chains—from consumer to producer— which counts for 1/5 in some industries (Dowlathshahi, 2005; Autry, 2005). RBV is an economic theory that suggests that a firm's competitive advantage is based on its unique and valuable resources. In the context of reverse logistics, this theory can be applied to the efficient management and utilization of resources involved in the reverse supply chain, such as remanufacturing capabilities and recycling technologies. Firms that are integrating effective reverse logistics system into their operations, they can win differentiation advantage, they can get low cost advantage, and they can minimize risks related to supplier disruptions and raw material depletions.

H4: Reverse logistics has positive impact on competitive advantage for manufacturing companies in MEKELLE city.



Source: Researcher own design based on literature

Figure 2.3. Conceptual Framework

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter discusses the nature of the study, target population, the design that will be used, the method that will be employed in data collection and the technique will be used to analyze the data. This study area was conducted in Mekelle city, the capital city of Tigray regional state, located in northern Ethiopia. Mekelle is one of the industrial hubs of the country, hosting a wide range of manufacturing firms including construction materials, metal works and beverages. The city was selected as the study area due to its strategic importance in Ethiopia's manufacturing firms, where the firms face challenges with inconsistent adoption of sustainable supply chain practices.

3.1. Research Design and approach

This study was applied descriptive and explanatory research designs. The research approach is quantitative research it is a means for testing objectives by examining the relationships between variables. These variables, in turn, can be measured, typically on instruments, so that numbered data can be analyzed using statistical procedures. The descriptive survey method is appropriate when a researcher intends to describe a situation as it is. It also offers a logical structure of the inquiry into the problem of study (Kothari, 2004). Explanatory research is the design allowed the researcher to draw conclusions on the relationship between SSCM Practices and competitive advantage.

3.2. Population of the Study and Sampling Technique

The target population of the study was the three manufacturing companies of Mekelle city, particularly they selected from the large-scale manufacturing companies. These companies were producers of various product, such as beverage product producers and construction materials producers. The study was targeted only the construction material producers and soft drink producers, because lacks of information about the other categories either currently operating or not and still a number of firms were not back to operation.

The standard for classification of the manufacturing firms is based on the following criteria.

Table3.1. classification of manufacturing firms

	criteria for classification	
Company size	Labor force	Capital
small	50-99	601,000-10 million
medium	100-499	10.1 million-90 million
large	>500	>90 million

Source: TIGRAY manufacturing industry (2024)

Sampling is related with the selection of a subset of individuals from the target population to estimate the characteristics of whole population (Singh, 2014). Singh et al., (2014) defined the two advantages of sampling method is faster data collection and lower cost. Three samples were selected, currently available in operation. The samples were MESSEBO cement factory, SELAM terrazzo factory, PEPSI soft drink factory. Purposive sampling was used to select manufacturing firms that are actively engaged in supply chain operations and have at least initiated sustainability practices. Purposive (judgmental) sampling would be used also to select the relevant respondents from the targeted manufacturing firms. This approach ensures that the respondents possess sufficient knowledge and relevance to the study objectives. purposive sampling in a quantitative research can be a powerful tool for advancing theoretical advancement and addressing practical challenges, while it may not aim to represent a large population from the standpoint of sampling generalizability, it is useful to examine and explain a conceptual framework grounded on theories, hence providing more insights for the issues under investigation (Memon et al., 2025). In the purposive sampling technique, the respondents will be selected according to their purpose, where researchers select respondents based on specific characteristics or qualities that related with the study objectives. Due to this reason, the samples selected based on their profession that directly related with the topic. MESSOBO cement factory's 33 employees, lower, middle and top-level managers under the procurement and supply division (local and foreign purchasing departments, store department and inventory and processing control) were participated, from SELAM terrazzo factory 9 workers, lower, middle and top-level managers were participated, and 31 respondents were from PEPSI soft drink factory. As the concept of sustainable supply chain management is new, the researcher is believed that, the sustainable supply chain management is practiced in large scale manufacturing companies by senior level of managements, so, the researcher strongly believes the senior level managers will have enough information on the problem that will be fill

by the study. Because of this, the target sample and respondents will be chosen deliberately by the researcher.

3.3. Data Collection Instrument and Source of Data

Before selecting the data gathering instrument the required type of data for the study should be determined (Kabir, 2016). The study was used primary sources of data. Data that is not published yet and the first-hand information which is not changed by any one (individual) is known as primary data (Taherdoost, 2021). This indicated that, the data is directly collected from the responsible (relevant) respondents by the researcher. The primary data was gathered through questionnaires distribution from the responsible authorities of target companies in MEKELLE city. To collect primary data various methods can be employed, such as, experiment, interviews, surveys and questionnaires (Kabir, 2016; Taherdoost, 2021). The current study was used questionnaire to gather the relevant data from the samples.

According to Taherdoost (2021) questionnaire is one of the common instruments of data collection with a set of questions and secured answers that respondents fill to give the researcher information needed for the study. The data given from a questionnaire can't be achieved from the secondary sources of data (Pandey, 2015). So, the data was collected through structured questionnaire, with five-point LIKERT scale measurements.

3.4. Data Analysis Methods

Finally, the study was applied more of quantitative method of data analysis. The data was analyzed statistically using descriptive statistics which are the current state of SSCMP, the influence of SSCM practices on operational efficiencies and the barriers for implementation SSCM practices, in addition Correlation (spearman correlation) was used to analyze and to find out the relationship of sustainable supply chain management practices with competitive advantage using SPSS version 21. Spearman correlation was preferred due to the ordinal nature of the LIKERT scale data, because ordinal data is missing the assumptions about normal distribution, such as skewness and kurtosis.

3.5. Ethical Consideration

The ethics of studies is deals with the treatment gives for our respondents to involve in our study and how to gives confidentiality for their responses, how to handle the data after collection, and to

respect the response from the respondents. The researcher was communicating transparently with participants regarding of the purpose of the data will be collected, priorities was given for participant interest on the security their names and responses.

3.6. Validity and Reliability Test

3.6.1. Validity

Validity refers to the extent to which an instrument measures what is supposed to measure. Data need not only to be reliable but also true and accurate. If a measurement is valid, it is also reliable (Joppe, 2000). The content of validity of the data collection instrument was determined based on the extensive literature review on the field of study. The valuable comments, corrections and suggestions, given from my advisor was assisted to the validation of the instrument.

3.6.2. Reliability

Reliability analysis used to measure the consistency of a questionnaire. Cronbach's alpha is the most common measure of reliability. For this study the Alpha coefficient for the overall scale calculated as a reliability indicator is 0.806. All the alpha coefficients for the scales were presented on the following table3.2. As described by (Andy, 2006) the values of Cronbach's alpha greater than 0.7 is good. The alpha values in this study are more than 0.7 and Which are good and reliable for the study.

Table3.2. Reliability test

indicators	Cronbach's Alpha	N of Items
Supplier relationship management (SRM)	.830	5
Green manufacturing (GM)	.736	6
Customer relationship management (CRM)	.718	6
Reverse logistics (RL)	.858	5
Competitive advantage (CA)	.765	5
Barriers to SSCMP implementation	.835	5
The overall	.806	37

Chapter four

Data analysis and interpretation

This chapter encompasses the data presentation, analysis, and interpretation of the data gathered structured questionnaire. The demographic characteristics of respondents and questionnaires were presented using descriptive statistics, and correlation was used to present the relationship between variables. The study is carried out through distributing 73 questionnaires for three large manufacturing companies (MESSOBO cement factory, PEPSI soft drink factory, and SELAM terrazzo factory) in MEKELLE from the distributed questionnaires, 67(91.8%) were returned, and 6 remain uncollected. The items used to measure the variables were answered on a 5-point LIKERT response scale (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree).

4.1. Descriptive Statistics

4.1.1. Demographic profile of the respondent

Table4.1. Demography of the respondents

Categories		Frequency	Percent
Gender	Male	40	59.7%
	Female	27	40.3%
Level of education	Diploma	6	9.0%
	Degree	45	67.1%
	Masters	16	23.9%
Experience of the respondent in the company	Less than 3 years	17	25.4%
	Four up to six years	9	13.4%
	Seven years and above	41	61.2%

Source: own survey, 2025

The demography of the respondents (gender, level of education, and experience) is presented in the above table; a total respondent participated in this study were 67. In this study, the frequency of males and females was 59.7% and 40.3% respectively. When we come to education level of the respondent, 9% of the respondents have a diploma, 67.1% of the respondents are degree holders, and 23.9% have a master's completed. When we come to how long they have stayed with current working company, 25.4% of the respondents have been stayed less than three years in the current working company, 13.4% of the respondents have been working four up to six years in their current working company and 61.2% of the respondents has working for seven and above years with the current working company. Based on this, most of the respondents are males. When it comes to their education level, most of the respondents are degree holders, followed by master's, and a few have diplomas. The larger portion of the respondents have over seven years of work experience, suggesting that the companies have a mature and experienced workforce. In addition to this, they informed us, which adds reliability to the gathered.

4.1.2. Descriptive Statistics of Supplier Relationship Management

Table4.2. Descriptive statistics of SRM

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
SRM improves cost efficiency	67	4.90	.394	-3.997	.293	15.885	.578
supplier relationship for improved trust	67	4.49	.746	-1.327	.293	.987	.578
supplier integration into short- and long-term planning	67	4.42	.819	-1.432	.293	1.567	.578
Follow sustainability guidelines	67	4.30	.798	-.966	.293	.399	.578
supplier collaboration system in sharing forecasting demand and supply	67	4.30	.817	-.780	.293	-.516	.578
Valid N (listwise)	67						

Source: own survey, 2025

The SRM measurement is used to determine the extent to which an organization has developed a business process that provides the structure for how relationships with its suppliers of that organization will be developed and managed. This measure is assessed using five items. The overall mean of 4.48 and standard deviation of 0.57. This means most of the respondents agreed

on the measurements of SRM with a common understanding. Responses to questions of supplier relationship management are described as follows: Regarding the 1st question, “SRM improves cost efficiency”, the majority of the respondents, 62(92.5%), strongly agree, 3(4.5%) of the respondents agree, and 2(3%) of them were neutral. the mean is 4.9, and the standard deviation is 0.394. The 2nd question is about “developing supplier relationship for improved trust”, the majority of the respondents, 42(62.7%), strongly agree, 17(25.4%) of the respondents agree, and 7 (10.4%) of the respondents are neutral, and 1 (1.5%) disagrees. The mean is 4.49, and the standard deviation is 0.764. The 3rd question is regarding, “the companies’ integration with their suppliers into short and long-term planning”, most of the respondents 39(58.2%) the respondents strongly agree, whereas 20(29.9%) of them agree, and the rest 5(7.5%) of the respondents were neutral and the rest 3(4.5%) respondents were disagree. The mean is 4.42, and the standard deviation is 0.819. Regarding the 4th question, “whether the suppliers follow sustainability guidelines”, the majority of the respondents, 32(47.8%) were strongly agreed. Whereas 25(37.3%) of the respondents agreed, 8(11.9%) of them were neutral, and 2(3%) of the respondents is disagree. The mean is 4.3, and the standard deviation is 0.798. Regarding to the 5th question, “we have supplier collaboration system in sharing forecasting demand and supply”, many of the respondents 34(50.7%) strongly agree, 20(29.9%) of the respondents were agree, 12 (17.9%) of the respondents were neutral whereas 1(1.5%) of the respondents disagree. The mean is 4.3 and standard deviation is 0.817. Strong SRM practices are acknowledged, particularly for cost efficiency and trust.

4.1.3. Descriptive Statistics of Green Manufacturing

Table 4.3. Green manufacturing

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
The production process aligns with government environmental regulations	67	4.48	.587	-.607	.293	-.562	.578
Consider environmental issues during product design	67	4.42	.700	-.793	.293	-.566	.578

minimizes environmental impact in production	67	4.40	.676	-.699	.293	-.582	.578
Green manufacturing increases cost-efficiency and profitability	67	4.39	.602	-.412	.293	-.637	.578
Invest in waste reduction and recycling	67	4.10	.956	-1.073	.293	.881	.578
Use renewable energy sources in production	67	3.82	1.127	-.682	.293	-.171	.578
Valid N (listwise)	67						

Source: own survey, 2025

The green manufacturing application of the firms is measured using six questions. The overall mean of 4.27 and standard deviation of 0.52. This means most of the respondents agreed on the measurements of green manufacturing with a common understanding. Responses to questions of green manufacturing is described as follows; Regarding to the 1st question, “production process aligns with government environmental regulations”, majority of the respondents 35(52.5%) strongly agree, 29(43.3%) of the respondents agree and 3(4.5%) of them were neutral. the mean is 4.48 and standard deviation is 0.587. The 2nd question is about, “green manufacturing increases cost-efficiency and profitability”, majority of the respondents 30(44.8%) strongly agree, 33(49.3%) of the respondents were strongly agree and 4(6%) of the respondents were neutral. The mean is 4.39 and the standard deviation is 0.602. The 3rd question is regarding “minimizes environmental impact in production”, most of the respondents 34, 50.7%) the respondents strongly agree, whereas 26(38.8%) of them agree, and the rest 7(10.4%) of the respondents were neutral. The mean is 4.4 and standard deviation is 0.676. Regarding the 4th question, “consider environmental issues during product design”, the majority of the respondents 36(53.8%) was strongly agreed. Whereas 23(34.2%) of the respondents were strongly agree, 8(12%) of them were neutral. The mean is 4.42 and standard deviation is 0.7. Regarding to the 5th question, “invest in waste reduction and recycling”, half of the respondents 27(40.3%) strongly agree, 26(38.8%) of the respondents were agree, 9(13.4%) of the respondents were neutral whereas 4(6%) of the respondents disagree and 1(1.5%) strongly disagree. The mean is 4.1 and standard deviation is 0.956. The 6th Question is regarding, “use renewable energy sources in production” a number of respondents 19(28.4%) were neutral, 17(25.4%) were agree, 24(35.8%) also strongly agree, the rest were 3(4.5%) were disagree and 3 (4.5%) strongly disagree. The mean is 3.82 and standard deviation is 1.127. The alignment of environmental regulation with production system and cost-efficiency gains are the strong points applied by the companies and the use of renewable energy

source is the weak point. Use of renewable energy is an area for improvement in the manufacturing firms.

In view of green manufacturing, most manufacturing firms in MEKELLE collaborate with their suppliers to find the best solutions in elimination of the negative effects of operations towards the environment. Ogunlela (2018) conducted a study on green supply chain as a tool for competitive advantage and revealed that unlike other sectors, green supply chain management practices in FMCGs producers require close collaboration between stakeholders in the supply chain. Other manufacturing firms consider environmental issues during the design of products. Green manufacturing according to Govindan, Kaliyan, Kannan and Haq (2014), is a framework coordinating the product and their design with their manufacturing, control and arrangement so as to reduce environmental impact.

4.1.4. Descriptive Statistics of Customer Relationship Management

Table4.4. CRM

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Customer satisfaction impacts our competitive position	67	4.55	.681	-2.424	.293	9.926	.578
frequently assess future customer expectations	67	4.30	.551	.026	.293	-.543	.578
frequently gathers customer feedback to improve products	67	4.27	.539	.125	.293	-.385	.578
frequently monitors and evaluates customer satisfaction	67	4.24	.525	.223	.293	-.169	.578
Use customer data analytics to improve responsiveness	67	4.21	.686	-1.455	.293	6.057	.578
loyalty program for long-term customers	67	3.96	.912	-.528	.293	-.506	.578
Valid N (listwise)	67						

Source: own survey, 2025

The CRM measurements were used to evaluate the extent to which an organization developed a business process that provides the structure for how relationships with customers of that

organization will be developed and managed. This measurement was evaluated using six items. The overall mean of 4.25 with standard deviation of 0.43. According to the above table 4.4 shows, responses to questions of customer relationship management is described as follows; the 1st question is about, “whether the company frequently assess future customer expectations”, 41(61.2%) of the respondents which is the majority of the respondents answered agree, 23(34.3%) of the respondent’s answer was strongly agree, 3(4.5%) of the respondent’s answer was neutral. The mean is 4.3 and standard deviation is 0.551. The 2nd question, “customer satisfaction impacts our competitive position”, majority of the respondents which is 41(61.2%) of the respondents replied that they were strongly agree with this question, 24(35.8%) of the respondents agree and 1(1.5%) of the respondents answered that they neutral and 1(1.5%) of them strongly disagree. The mean is 4.55, and standard deviation is 0.681. For the 3rd question, “whether the company frequently monitors and evaluates customer satisfaction”, the largest number of respondents replied that they agree which is 45(67.2%), 19(28.4%) of the respondent’s answer were strongly agree, 3(4.5%) of the respondents answered that they neutral. The mean is 4.24 and standard deviation is 0.525. For the 4th item, “whether the company frequently gathers customer feedback to improve products”, majority of the respondents 43(64.2%) answered that they agree, 21(31.3%) of the respondents were strongly agree, 3(4.5%) of the respondents neutral. The mean is 4.27 and standard deviation is 0.539. Regarding to the 5th question, “whether the company use customer data analytics to improve responsiveness”, for this question 41(61.2%) of the respondents replied that they were agreed, 21(31.3%) of the respondents replied that they were strongly agree, 4(6%) of the respondents replied that they neutral and 1(1.5%) were strongly disagreed. The mean is 4.21 and standard deviation is 0.686. For the 6th question, “whether the company have loyalty program for long term customers”, the majority number of the participants which is 27(40.3%) replied that they agree, 21(31.3%) of the respondents replied that they strongly agreed and 14(20.9%) of the participants were neutral. Whereas 5(7.5%) of them disagreed. The mean is 3.96 and standard deviation is 0.912. CRM practices were viewed positively in enhancing the level of competitive advantage.

4.1.5. Descriptive Statistics of Reverse Logistics

Table4.5. Reverse Logistics

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Lack of infrastructure is a barrier to reverse logistics	67	3.09	1.288	.136	.293	-1.319	.578
Returned products are assessed and reprocessed	67	2.75	1.235	.802	.293	-.774	.578
Uses biodegradable materials for packaging products	67	2.75	1.271	.770	.293	-.675	.578
has an active recycling system	67	2.69	1.157	.949	.293	-.216	.578
Recycling of materials helps our company to create value for returned materials	67	2.63	1.099	1.009	.293	.059	.578
Valid N (listwise)	67						

Source: own survey, 2025

Reverse logistics is used to measure the companies handling system of the used products, faulty products or damaged products, and returned goods, the system of used product disposal (the product that ended its life cycle), and how it manages the impact of these on the environment due to unsafe disposal. The overall mean is 2.78 with standard deviation of 0.97. As shown on the above table 4.5, majority of the respondents 17 (25.4%) agreed on the 1st Question, “lack of infrastructure is a barrier to reverse logistics”, 12(17.9%) were strongly agreed, 8(11.9%) of them were neutral, whereas 5(7.5%) were strongly disagree and 25(37.3%) also disagreed. with the mean of 3.09 and 1.288 of standard deviation. Regarding the 2nd question, “whether the company uses biodegradable materials for packaging products” most of the respondents replied disagree and strongly disagree 34(51%) and 6(9%) respectively. The rest of the respondents 10(15%), 5(7.5%) and 12(18%) were neutral, agreed and strongly agreed respectively on this part. The mean and standard deviation for this statement is 2.75 and 1.271 respectively. The 3rd question is about “whether the company’s returned products are assessed and reprocessed” most of the respondents 39(58%) were disagreed, 4(6%) were strongly disagreed, the rest of them 4(6%), 10(15%) and 10(15%) were neutral, agreed and strongly agree on the statement. The mean and standard deviation of this item is 2.75 and 1.235 respectively. Regarding the 4th question, “whether the company has an active recycling system” most of the respondents 37(55.2%) were disagreed, 4(6%) of the respondents were strongly disagreed whereas 11(16.4%), 6(9%) and 9(13.4%) of the respondents were neutral, agreed and strongly agreed on the statement. The mean and standard

deviation of the statement is 2.69 and 1.157 respectively. The 5th Statement is about, “recycling of materials helping our company to create value for returned materials” for this statement most of the respondents 38(56.7%) were disagree, 4(6%) of the respondents also strongly disagreed, the rest 11(16.4%), 7(10.4%) and 7(10.4%) were neutral, agree and strongly agreed with the statement respectively. The mean and standard deviation of the statement is 2.63 and 1.099. Reverse logistics indicated that, it is underdeveloped in the manufacturing firms

4.1.6. Descriptive Statistics of Competitive Advantage

Table4.6. Competitive Advantage

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
implementing SSCM strengthen our brand reputation and attracts environmentally conscious customers	67	4.51	.612	-.845	.293	-.244	.578
impact of green manufacturing practices on operational efficiency	67	4.40	.698	-1.022	.293	.905	.578
supplier relationship contribution on competitive advantage	67	4.34	.708	-.871	.293	.543	.578
contribution of effective CRM on competitive advantage	67	4.30	.675	-.747	.293	.781	.578
competes by producing and offering unique, superior quality and innovative products	67	4.04	.843	-.556	.293	-.303	.578
sustainable supply chain practices enhance our financial performance and profitability	67	3.97	.852	-1.002	.293	1.608	.578
operational efficiency and responsiveness have improved due to SSCMP	67	3.67	1.147	-.499	.293	-.973	.578
focus on specific niches of markets	67	3.57	.957	-.304	.293	-.824	.578
compete through cost leadership by reducing production and operational costs	67	3.43	1.076	-.046	.293	-1.272	.578
tailored products in a relatively minimum cost of production within the industry	67	3.39	1.072	-.156	.293	-1.047	.578
impact of reverse logistics on operational cost	67	2.52	.560	-.623	.293	-.656	.578

Valid N (listwise)	67						
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Source: own survey, 2025

Competitive advantage is used to measure the competitive capability of the manufacturing companies on cost, innovation, delivery and flexibility against their competitors. This measure was assessed using 11 items, to assess whether the organizations competitive capability is improved or not due to the item's application. The overall mean is 3.83 with standard deviation of 0.43. This means most of the respondents agreed to items of competitive advantage with common understanding. According to table 4.7, response for the 1st question, "contribution of effective CRM on competitive advantage of the company", majority of the respondents which is 34(50.7%) replied that it has good contribution, 27(40.3%) of the respondents replied that it has significant contribution, the rest 5(7.5%) and 1(1.5%) of the respondents replied that it has somewhat contribution and lower contribution respectively. The mean is 4.3 and standard deviation is 0.675. For the 2nd item, "impact of green manufacturing practices on operational efficiency of the company", the majority of the respondents 34(50.7%) of them answered significantly improved, 27(40.3%) of the respondents replied somewhat improved, 5(7.5%) of the respondents replied no change and 1(1.5%) of the respondent replied somewhat decreased. The mean is 4.4 and standard deviation is 0.698. For the 3rd item, "implementing SSCM strengthen our brand reputation and attracts environmentally conscious customers", majority of the respondents 38(56.7%) of the respondents replied that they strongly agreed, 25(37.3%) of the respondents answered that they were agree and 4(6%) of the respondents neutral. The mean is 4.51 and standard deviation is 0.612. For the 4th item, "the effective supplier relationship contribution on competitive advantage", the majority of the respondents which about 31(46.3%) answered significant contribution, 29(43.3%) of the respondents replied that have a good contribution and the rest 6(9%) of them were replied on moderate contribution and 1(1.5%) the respondent answered on low contribution. The mean is 4.34 and standard deviation is 0.708. For the 5th question, "our company competes by producing and offering unique, superior quality and innovative products", the majority of the respondents 29(43.3%) of the respondents answered that they agree, 22(32.8%) of the respondents replied that they were strongly agree, 13(19.4%) of the respondents answered that they neutral and 3(4.5%) of the respondents were disagreed. The mean is 4.04 and standard deviation is 0.843. For the 6th item, "sustainable supply chain practices enhance our financial performance and profitability", the majority

36(53.7%) the participants answered that they agreed, 17(25.4%) of the respondents were strongly agreed to this question, 10(15%) of the respondents answered that they neutral to this question and 3(4.5%) respondents were disagreed the rest 1(1.5%) was strongly disagreed. The mean is 3.97 and standard deviation is 0.852. For the 7th item, “our company compete through cost leadership by reducing production and operational costs”, the majority of the respondents which are 23(34.3%) and 12(17.9%) of the respondents answered that they agreed and strongly agree respectively, the rest 14(20.9%) and 18(26.9%) of the respondents were respectively neutral and disagreed to this question. The mean and standard deviation of the statement is respectively 3.43 and 1.076. The 8th Question is about, “whether the company focus on specific niches of markets” a number of respondents 30(44.8%) were answered agree, 15(22.4%) respondents were neutral, 10(15%) also strongly agreed and the rest 12(17.9%) were disagreed. The mean of the statement is 3.57 and standard deviation is 0.957. The 9th Case is about “whether the company operational efficiency and responsiveness have improved due to SSCMP” the number of respondents 26(38.8%) replied agree, 18(26.9%) respondents replied strongly agree, the reply from 10(19.2%) respondents were disagree, 7 (13.5%) were also neutral on this statement and the rest 15(22.4%) and 1(1.5%) was replied agree and strongly disagree respectively. The mean and standard deviation of this statement is 3.67 and 1.147 respectively. The 10th Case is regarding “our company can tailor products in a relatively minimum cost of production within the industry” in this case 17(25.4%) respondents were disagreed and 1(1.5%) respondents also strongly disagreed, 14(20.9%) of the respondents were neutral on this case, the rest of 25(37.3%) and 10(14.9%) respondents were agreed and strongly agreed on the case. The mean and standard deviation of the statement are 3.39 and 1.072 respectively. The 11th Item is about “impact of reverse logistics on operational costs of manufacturing companies” 37(55.2%) of the respondents said, significantly decreased the operational cost if apply effective reverse logistics system, 28(41.8%) of the respondents also said, somewhat decreased the operational costs if apply reverse logistics system and 2(3%) respondents said, no change. The mean and standard deviation of this case is 2.52 and 0.56 respectively. Cost leadership and market niche targeting are less emphasized this reflecting that, there is lack of differentiation or strategic focus in these areas.

4.1.7. Descriptive Statistics of The Barriers for Implementation of SSCMP In MEKELLE City Manufacturing Firms

Table4.7. The Barriers for Implementation of SSCMP In MEKELLE City Manufacturing

Firms

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
SSCMP implementation demands high investment on sophisticated technologies and specific skills	67	4.45	.764	-1.392	.293	1.632	.578
SCM structure affect the implementation of SSCMP	67	4.34	1.023	-1.616	.293	1.755	.578
The absence of enough support from senior experts influence the implementation of SSCMP	67	4.24	1.031	-1.356	.293	1.037	.578
Budget limitation is challenging the implementation SSCMP	67	4.15	1.132	-1.208	.293	.235	.578
Low effort to effectively coordinate all activities within the SCM affects the implementation of SSCMP	67	4.01	1.121	-1.226	.293	.821	.578
Valid N (listwise)	67						

Source: own survey, 2025

The table shows the measurements used to assess the barriers to the implementation of sustainable supply chain management in manufacturing companies of MEKELLE city. It was measured using five cases. The overall mean is 4.24 with standard deviation of 0.79. The 1st Case is regarding the “SCM structure affect the implementation of SSCMP” majority of the respondents 41(61.2%) were strongly agree, 16(23.9%) were agreed, the rest 3(4.5%), 6(9%) and 1(1.5%) respondents were replied neutral, disagree and strongly disagree respectively. The mean and standard deviation of the case is 4.34 and 1.023. The 2nd Case is about “SSCMP implementation demands high investment on sophisticated technologies and specific skills.” most of the respondents 39(58.2%) were strongly agreed, 21 (31.3%) respondents agreed, the rest 5(7.5%) and 2(3%) respondents were neutral and disagreed on this statement. The mean for this case is 4.45 and standard deviation of 0.764. Regarding the 3rd Case is about “whether the absence of enough support from senior

experts influence the implementation of SSCMP” most of the respondents 36(53.7%) answered on strongly agree, 19(28.4%) also agreed and the rest 5(7.5%), 6(9%) and 1 (1.5%) respondents neutral, disagree and strongly disagree respectively. The mean and standard deviation of this case were 4.24 and 1.031. For the 4th case, “budget limitation is challenging the implementation SSCMP” 35(52.2%) of the respondents strongly agreed on this case, 19(28.4%) of the respondents were agreed, the rest 2 (3%), 10(15%) and 1(1.5%) respondents were neutral, disagreed and strongly disagreed with this case. The mean and standard deviation of this case were 4.15 and 1.132. The 5th Case is associated with the level of effort towards sustainability implementation “low effort to effectively coordinate all activities within the SCM affects the implementation of SSCMP” about 27(40.3%) respondents strongly agree, the same to that 26(38.8%) also replied agree, the rest 5(7.5%), 6(9%) and 3(4.5%) of the respondents were neutral, disagree and strongly disagree on this case. The mean and standard deviation for this statement were 4.01 and 1.121 respectively. Finally, structural and resources related challenges are hindering for implementation of sustainable supply chain management practices. The challenges related to resources are high requirement of investment cost and lacks of senior experts are some examples.

4.2. Correlation Analysis

Table4.8. Spearman Correlation Test

			Correlations				
Spearman's	SRM	Correlation Coefficient	1.000	GM		RL	
		Sig. (2-tailed)	.				
	GM	Correlation Coefficient	.694**	1.000			
		Sig. (2-tailed)	.000	.			
	CRM	Correlation Coefficient	.315**	.486**	1.000		
		Sig. (2-tailed)	.009	.000	.		
	RL	Correlation Coefficient	-.328**	.048	.208	1.000	
		Sig. (2-tailed)	.007	.701	.092	.	
	CA	Correlation Coefficient	.124	.373**	.413**	.411**	1.000
		Sig. (2-tailed)	.318	.002	.001	.001	.
**. Correlation is significant at the 0.01 level (2-tailed).							

Table 4.8 shows the relationship between the variables (the independent and dependent variables) SRM, green manufacturing, CRM and reverse logistics with the dependent variable competitive advantage. Spearman correlation coefficient was used to test the strengths of the relationships between the independent variables and the dependent variable. Because, the data is meeting the assumptions of the spearman correlation test. Supplier relationship management has no significant and direct impact on competitive advantage. Green manufacturing has positive and significant impact on competitive advantage. Customer relationship management has positive and significant impact on competitive advantage and the reverse logistics have positive and significant impact on competitive advantage. The result of correlation analysis indicated that three of the independent variables (green manufacturing, customer relationship management and reverse logistics) has positive and significant impact on competitive advantage while the rest one independent variable SRM remain has not significant and direct relationship with competitive advantage. Green manufacturing is significantly correlated with competitive advantage at ($r = 0.373, p < 0.01$), CRM is significantly correlated with competitive advantage at ($r = 0.413, p < 0.01$) and reverse logistics is highly correlated with competitive advantage at ($r = 0.411, p < 0.01$), the rest one SRM is not significantly correlated at ($r = 0.124, p > 0.05$).

Table 4.9. The summary of correlation test

Hypothesis	Coefficient and P values	Remark
<i>H₁: SRM has positive impact on CA for manufacturing companies in Mekelle city.</i>	<i>$r = 0.124, p > 0.05$</i>	<i>reject the alternative hypothesis</i>
<i>H₂: GM has positive impact on CA for manufacturing companies in Mekelle city.</i>	<i>$r = 0.373, p < 0.01$</i>	<i>accept the alternative hypothesis</i>
<i>H₃: CRM has positive impact on CA for manufacturing companies in Mekelle city.</i>	<i>$r = 0.413, p < 0.01$</i>	<i>accept the alternative hypothesis</i>
<i>H₄: RL has positive impact on CA for manufacturing companies in Mekelle city.</i>	<i>$r = 0.411, p < 0.01$</i>	<i>accept the alternative hypothesis</i>

The result of correlation analysis of this study supports that green manufacturing, customer relationship management and reverse logistics has positive and significant correlation with competitive advantage and the rest of one (supplier relationship management) has positive but not

significant correlation with competitive advantage when calculated using spearman correlation coefficients. As a result, the entire hypotheses are accepted in terms of the positive relationship of the factors with competitive advantage, even if the one is insignificantly correlated. The relationship of those factors with competitive advantage is supported by previous studies. (Ahmed A. , 2023) Was conducted a study on the effect of SSCM on CRM and competitive advantage and revealed that, CRM has a positive and significant impact on competitive advantage. (Mesjasz-L.A., 2017) Study was revealed that reverse logistics allow sustainable use of existing resources. The insignificance of supplier relationship management is indicating weak supplier development strategy, poor collaboration, and misalignment with sustainability goals. It will be resulting into missed opportunity for building strong upstream partnerships for strategic advantage. Green manufacturing improves efficiency and brand reputation, through reduction of production costs and attracting to environmentally conscious consumers. Customer relationship management enhances the customer loyalty and responsiveness in order to increase the firms market differentiation. Reverse logistics helps in resource recovery and waste reduction, minimizing operational costs and improving sustainability images of the firms.

CHAPTER FIVE

Discussion, Conclusion and Recommendation

5.1. Discussion of the findings

This study assessed the impact of SSCM practices such as (supplier relationship management, green manufacturing, customer relationship management and reverse logistics) on competitive advantage of manufacturing firms. The data collection instrument tool (questionnaire) was prepared and distributed to workers of the factories (MESOBBO cement factory, SELAM terrazzo factory and PEPSI soft drink factory). The respondents participated in study were supply chain managers, purchasing (managers, senior and junior officers), store (managers, senior and junior officers), inventory (managers, senior and junior officers), as well as production and quality managers and officers. Currently, the manufacturing firms of MEKELLE city has good practicing of the sustainable supply chain practices such as SRM, green manufacturing and CRM but the reverse logistics is weak in their current practice. The result of descriptive analysis indicating that, there is a good implementation of sustainable supply chain management practices (supplier

relationship management, green manufacturing, and customer relationship management). The overall mean of supplier relationship management, green manufacturing, and customer relationship management and reverse logistics is 4.48, 4.27, 4.25 and 2.78 with the σ of 0.57, 0.52, 0.43 and 0.97, indicating high agreement on the measurement with the low variance between the respondent's answers except the reverse logistics. Moreover, majority of the respondents gave higher ratings on the three variables (SRM, Green manufacturing and CRM). Based on this information most of the respondents agreed with the measurements of green manufacturing with common understanding. The general mean implies high agreement with slight variation between the participant responses. Therefore, the current state of SRM, Green manufacturing and CRM is at a good level and the reverse logistics is not well practiced currently by the firms but has a highly significant positive correlation with competitive advantage. So, this implication leads to understand that, the area is a potential area for strategic improvement. The companies could highly benefit by strongly working in this area. The companies working closely with their suppliers in number of activities, such as sharing information on inventory level, sales forecast, annual supply requirement and other essential information's required for facility. Due to closely working with their suppliers enabled them to improve their cost efficiency and to build trust-based integration. Regarding the ethical practices, their production process is considering environmental issues workers safety, wastage and responsible sourcing and other sustainability guidelines. They are working on treating and recycling of the used water before disposing to the environment and carefully working in waste minimization techniques. They are closely working with the government environmental regulations and protections. Based on this building strong supplier relationship management resulting into improved green manufacturing practices as a result it leads to better competitive advantage. Base on the result, the firms also well integrated with their customers as it is an important approach to address relationship complexities, intricate supply chains, leveraging data analytics and predictive modeling to anticipate customer needs, optimize service delivery, and enhance long-term partnerships. The use of data analytics and customer feedback is high. This indicated that, the companies using data driven customer strategies. The firms are weak in preparing loyalty programs any initiatives for their reliable and long-term customers. The use of data analytics and feedback supportive customer relationship system is important for manufacturing firms. The system of reverse logistics in the firms was underdeveloped not given an attention yet. However, the approach is very important for securing

the supply chain sustainability and improving competitive advantage. According to Lai, et al in (Vlachos, 2014) RL can be seen a capability that allows manufacturers to use existing resources in alternative yet cost-effectively and ecologically friendly way by extending the product's normal life beyond its traditional usage. There are a number of barriers to the implementation of SSCMPs by manufacturing firms in Mekele city. The major bottlenecks are structural and resource-related challenges for the implementation of sustainable supply chain management practices. The challenges related to resources are high requirement of investment costs and a lack of senior experts are some examples and the structural challenges are related to the current integration of departments within the companies. That means the purchasing system of some of the companies was centralized, because of which sometimes results in interruptions and delays of delivery.

5.2. CONCLUSION

Sustainable supply chain management practices, specifically green manufacturing, customer relationship management, and reverse logistics, are critical drivers of competitive advantage among manufacturing firms in MEKELLE city. The practices contribute to operational efficiency, cost reduction, regulatory compliance, and market responsiveness. The insignificant role of supplier relationship management highlights a weak connection of upstream collaboration, which undermines supply chain resilience and resource optimization. Strengthening SSCM holistically will be key to fostering long-term competitiveness in the manufacturing firms. Regarding the implementation of the sustainability practices by the firms found that, there are a lot of barriers facing the manufacturing firms. The expensiveness of the initial investment, the structure of the current supply chain, and the lack enough sufficient support from senior experts are the major bottlenecks of the firms. So, the problem is related to the structure and a lack of enough resources for developing sustainable supply chain management.

5.3. RECOMMENDATION

Work for supplier relationship development through establishing sustainability criteria for supplier selection and training, and incentives for suppliers to align with green and ethical standards. Introduce clean technologies and energy-efficient processes, and develop partnerships with institutions for technical support and innovation for enhancing green manufacturing. Encourage gradual integration of renewable sources of energy in the production process. Use customer feedback to increase eco-product offerings and build green branding strategies to tap into

conscious consumer segments in order to leverage customer relationship management for market growth. The firms should create collection systems for returns and recycling, and encourage customers to participate in circular supply chain programs. The firms should strengthen their reverse logistics system by developing an organized structure and investing in product return, recycling, and refurbishment processes. Reverse logistics is important for environmental sustainability due to the reduction in pollution by using products again after the end of their life cycle. Reverse logistics allows for the recovery of value from used products. End-of-life products contain materials of full value that should be recovered, which undoubtedly fosters sustainable use of resources (M.L., 2017). This is important for minimizing environmental impacts as well as for recovering values from products that have ended their life cycle. This will result in enhancing the environmental sustainability and profitability. Develop public-private partnerships to improve access to finance for SSCM technologies. Advocate for government policies that support sustainable manufacturing and local suppliers' development.

5.4. THE STUDY LIMITATION AND DIRECTIONS FOR FURTHER RESEARCH

Post-conflict and crisis effects on the manufacturing firms of SSCM practices is not covered. How conflicts, political instability, and pandemics affect the SSCM practices and supply chain resiliency in the manufacturing firms could be investigated in the future. Future studies could combine quantitative surveys with qualitative interviews and focus group discussions. The current study is conducted using a cross-sectional quantitative method that measures relationships at one point in time; future studies should apply a longitudinal design to assess how SSCM practices affect competitive advantage over several years with trends. Regarding the sampling method, future researchers should use probability sampling and expand the sampling size. Advanced statistical models, such as structural equation modeling, should be applied to explore how SSCM practices affect each other in influencing competitive advantage. Geographic expansion to other industrial hubs in Ethiopia is also important to compare the findings with Mekelle.

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MEKELLE UNIVERSITY
COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF LOGISTICS AND SUPPLY CHAIN MANAGEMENT

Greeting! I would appreciate your feedback on my questionnaire. This questionnaire is needed for the completion of my post graduate study in **Logistics and Supply Chain Management** on the Topic “**The impact of sustainable supply chain management practice on competitive advantage: A study on manufacturing firms in MEKELLE city**”. All responses will be remains confidential and secure.

Confidentiality: the information you provide will not be accessible to anyone. It will only be used for academic research purpose.

Your participation is voluntary and you can withdraw even if after having you agreed to participate. In addition, you are free to refuse to answer any question asked in the questionnaire.

Section one

The demography of the respondents

Instruction: Please, indicate your response by putting a (✓) mark in the appropriate box provided.

1. Sex: Male ☐ Female ☐
2. Education level: diploma ☐ degree ☐ masters ☐ PHD ☐
3. Your position in the company:
CEO/ chief executive officer ☐ Supply chain manager ☐
Production manager ☐ Inventory manager ☐
Purchasing manager ☐ logistics manager ☐
Other department _____
4. Years of experience in the company: below 1 year ☐ 1-2 years ☐ 3-4 years ☐
5-6 years ☐ 7 years and above ☐

Section two

Please indicate the extent to which you agree with the following statements on the sustainable supply chain management practices applied by manufacturing companies operating in MEKELLE city.

The scales below will be applicable; **1= represents for strongly disagree, 2= represents for disagree, 3= represents for Neutral, 4= represents for agree and 5= represents for strongly agree.**

1. Supplier Relationship Management:

Please indicate your degree of agreement with the following statements.

Statement	The degree of agreement (scale)				
	1	2	3	4	5
Supplier relationship management improves cost-efficiency	☐	☐	☐	☐	☐
Our company integrates suppliers into short and long-term planning	☐	☐	☐	☐	☐
We have a supplier collaboration system for sharing forecasting demand and supply	☐	☐	☐	☐	☐
The company develops a supplier relationship for improved trust	☐	☐	☐	☐	☐
Our suppliers follow sustainability guidelines.					
Example: ethical sourcing and waste reduction	☐	☐	☐	☐	☐

2. Green Manufacturing:

Please express your degree of agreement regarding the green manufacturing practice through the following statements.

Statement	the degree of agreement (scales)				
	1	2	3	4	5
We consider the environmental issues during product design.	☐	☐	☐	☐	☐
Our factory minimizes the environmental impact in production.	☐	☐	☐	☐	☐
We use renewable energy sources in production.	☐	☐	☐	☐	☐
We invest in waste reduction and recycling.	☐	☐	☐	☐	☐
Our production process aligns with government environmental regulations.	☐	☐	☐	☐	☐
Green manufacturing increases cost-efficiency and profitability.	☐	☐	☐	☐	☐

3. Customer Relationship Management:

Please indicate your degree of agreement regarding the customer relationship management (CRM) through the following statements.

Statement	The degree of agreement (scale)				
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	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
Our factory frequently monitors and evaluates customer satisfaction.	☐	☐	☐	☐	☐
Our factory frequently gathers customer feedback to improve products.	☐	☐	☐	☐	☐
We use customer data analytics to improve responsiveness.	☐	☐	☐	☐	☐
Our factory frequently assesses future customer expectations.	☐	☐	☐	☐	☐
Customer satisfaction impacts our competitive position.	☐	☐	☐	☐	☐
We have loyalty programs or initiatives for long-term customer's	☐	☐	☐	☐	☐
Our firm is able to maintain the optimal level of demand to achieve the desired level of customer service	☐	☐	☐	☐	☐

4. Reverse Logistics:

Please express your degree of agreement regarding of the reverse logistics system through the following statements.

Statement	The degree of agreements (scales)				
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
Our company uses biodegradable materials for packaging products	☐	☐	☐	☐	☐
Our company has an active recycling system.	☐	☐	☐	☐	☐
Returned products are assessed and repurposed	☐	☐	☐	☐	☐
Recycling of materials helping our company to create value for returned materials	☐	☐	☐	☐	☐
Lack of infrastructure is a barrier to reverse logistics	☐	☐	☐	☐	☐

5. Competitive advantage:

Please express your degree of agreement regarding of the competitive advantage your company through the following statements.

Statement	The degree of agreements (scales)				
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>

Our company competes through cost leadership by reducing

production and operational costs	☐ ☐ ☐ ☐ ☐
Our firm focuses on specific niches of markets	☐ ☐ ☐ ☐ ☐
Our firm competes by producing and offering unique, superior quality and innovative products.	☐ ☐ ☐ ☐ ☐
Our firm tailored products in a relatively minimum cost of production within the industry.	☐ ☐ ☐ ☐ ☐
Sustainable supply chain practices enhance our financial performance and profitability.	☐ ☐ ☐ ☐ ☐
Our company operational efficiency and responsiveness have improved due to sustainable supply chain management practices.	☐ ☐ ☐ ☐ ☐
Implementing sustainable supply chain management strengthen our brand reputation and attracts environmentally conscious customers.	☐ ☐ ☐ ☐ ☐

6. The bottlenecks for implementing SSCMP by manufacturing companies of MEKELLE city.

Please express your degree of agreement regarding of the challenges for implementing sustainable supply chain management practices through the following statements.

Statement	The degree of agreements				
	1	2	3	4	5
Sustainable supply chain management practices implementation demands high investment on sophisticated technologies and specific skills	☐	☐	☐	☐	☐
Low effort to effectively coordinate all activities within the supply chain management affects the implementation of sustainable supply chain management practices in our firm	☐	☐	☐	☐	☐
Supply chain management affects the implementation of sustainable supply chain management practices in our company	☐	☐	☐	☐	☐
The absence of enough support from senior experts influence the implementation of sustainable supply chain management practices in our company	☐	☐	☐	☐	☐
Budget limitation is challenging the implementation of sustainable supply chain management practices in our company	☐	☐	☐	☐	☐

Section three

Supplier Relationship Management

Current practices

5. What practices does your company employ to manage supplier relationships sustainably? If all are practiced, please mark (✓) all boxes.
- Regular sustainability assessments ☐
- Collaborative product development ☐
- Long-term partnerships ☐

Impact on competitive advantage

6. How do you believe your supplier relationships contribute to your competitive advantage?
- No Contribution ☐ moderate contribution ☐
- Low contribution ☐ good contribution ☐
- Significant contribution ☐

Barriers for sustainable SRM

7. What challenges do you face in managing supplier relationships sustainably? If both the challenges existed, please select all boxes.
- Lack of supplier commitment ☐
- Limited communication channels ☐

Green manufacturing

Current practices

1. Which green manufacturing practices are currently implemented in your operations? If all are employed in your company, please mark all.
- Use of renewable energy sources ☐
- Use Waste minimization techniques ☐
- Use Eco-friendly materials ☐

Operational efficiency impact

2. How have green manufacturing practices affected your operational efficiency?
- Significantly improved ☐ no change ☐
- Somewhat improved ☐ somewhat decreased ☐
- Significantly decreased ☐

Cost effectiveness evaluation

3. Have green manufacturing initiatives led to cost savings? Please elaborate.

Customer Relationship Management

Customer perception of sustainability

1. Do you think customers prefer suppliers who implement sustainable practices?
- Yes ☐ No ☐

Impact on competitive advantage

2. To what extent do you believe that effective customer relationship management contributes to your competitive advantage through sustainability efforts?

- | | | | |
|-----------------------|--------------------------|--------------------|--------------------------|
| No advantage | ☐ | moderate advantage | ☐ |
| Lower advantage | ☐ | Good advantage | ☐ |
| Significant advantage | ☐ | | |

Reverse logistics

Current practice

1. Does your company have a reverse logistics process in place for handling returns or recycling products? Yes ☐ No ☐

Operational efficiency impact

2. How has implementing reverse logistics impacted your operational costs?
- | | |
|----------------------|--------------------------|
| Significant Decrease | ☐ |
| Somewhat Decreased | ☐ |
| No Change | ☐ |

Barriers for implementation of reverse logistics

3. What challenges do you face in establishing effective reverse logistics systems?
- | | |
|------------------------|--------------------------|
| High costs | ☐ |
| Lack of infrastructure | ☐ |

Thank you for your dedication!
BRHANE KINFE