THE IMPACT OF CLOUD COMPUTING AND ICT SERVICES IN GREEN SUPPLY CHAIN MANAGEMENT PRACTICES: SELECTED COMPANIES IN ETHIOPIA.

BY

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A THESIS SUBMITED TO ADDIS ABABA UNIVERSITY COLLEGE OF BUSINESS AND ECONOMICS SCHOOL OF COMMERCE FOR THE PARTIAL FULFILMENT OF THE DEGREE OF MASTER OF ARTS IN LOGISTICS AND SUPPLY CHAIN MANAGEMENT

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Declaration

I, Henok Tesfaye, hereby declare that this thesis entitled “The Impact of Cloud Computing and ICT Services in Green Supply Chain Management Practices: Selected companies in Ethiopia”, has been carried out by me for the partial fulfillment for the degree of Master of Arts in Logistics and Supply Chain management from the Addis Ababa University. This thesis is an original has not been submitted for any other university for any diploma or fellowship and I have acknowledged all the resources used.

Henok Tesfaye Gedaye

Signature_____

Date _____

Certification

This is to certify that the thesis entitled “The Impact of Cloud Computing and ICT Services in Green Supply Chain Management Practices: Selected companies in Ethiopia.” Submitted to Addis Ababa University School of Commerce for the award of the degree of Master of Arts in Logistics and Supply Chain management has been carried out by Henok Tesfaye under my supervision and Guidance.

Advisor: Shiferaw Mitiku (PhD)

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The Researcher

Abstract

This study looks at how Green Supply Chain Management (GSCM) practices in the target firms are affected by Cloud Computing (CC) and Information Communication Technology (ICT) services. The goal is to investigate the connection between the use of CC and ICT services and the adoption of sustainable supply chain practices. The study uses quantitative & qualitative research techniques to gather and analyze information. The data are analyzed using correlation analysis, to ascertain the connection between CC, ICT services, and GSCM practices. The results show a strong relationship between the use of CC and ICT services and the adoption of GSCM practices. By highlighting the potential of CC and ICT services in supporting environmentally responsible supply chain practices, the study adds to the body of previous work. The research findings highlight the significance of combining CC and ICT services to improve sustainability and efficiency within supply chain management and offer useful insights for practitioners and decision-makers. The adoption of CC and ICT services in the framework of GSCM raises the bar for environmental performance and sustainability in supply chain operations, and further study can address implementation techniques and issues related to these adoptions.

Definition of Terms

GSCM- Green Supply Chain Management

CC- Cloud Computing

LSCM- Logistics and Supply chain management

SAAS – Software as a service

PAAS – Platform as a service

IAAS – Infrastructure as a service

SCM – Supply chain Management

LCI- Life cycle inventory, life cycle impact

LCA- Life cycle Analysis

ICT – Information Communication Technology

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1. Chapter One: Introduction

1.1 Background of the study

Sustainability and eco-friendliness are increasingly becoming crucial aspects of modern life. The concept of sustainability is centered on the principle of meeting the present needs of the society without compromising the ability of future generations to meet their own needs.

To promote sustainability through green supply chain management, it is important to identify and reduce the environmental impact of supply chain activities. Sustainable supply chain management involves integrating environmental, social, and economic considerations into supply chain management practices, while green supply chain management focuses on reducing the environmental impact of supply chain activities.

According to (Li, Zhu, *et al.,* 2021), green supply chain management practices contribute to sustainability by reducing environmental impact, promoting resource efficiency, and creating social and economic benefits. In addition, green supply chain management practices are an essential tool for achieving sustainable development goals (Jing *et al.,* 2020).

Both sustainability and green supply chain management practices seek to promote responsible use of resources, minimize environmental impact, and promote social and economic development (Sarkis *et al.,* 2020).

It is important for businesses to adopt a lifecycle approach to sustainability in the supply chain. This involves considering the environmental impact of a product or service throughout its entire lifecycle, from raw material extraction to end-of-life disposal or recycling. By taking a lifecycle approach, businesses can identify opportunities to reduce environmental impact and promote sustainability throughout the supply chain (Sarkis *et al.,* 2020).

Therefore, businesses that integrate both sustainability and green supply chain management practices into their operations can achieve a more comprehensive and effective approach to responsible business practices.

Green Supply Chain Management (GSCM) has become a critical issue in the global business environment due to the growing concern for environmental sustainability.

African countries are particularly vulnerable to environmental degradation due to their dependence on natural resources for economic growth and their high levels of poverty. This has resulted in various environmental challenges, such as deforestation, soil degradation, and loss of biodiversity (Olanrewaju and Ogundiran, 2021). In Africa, where environmental

sustainability is a key issue, there is a need to explore the role of these technologies, i.e., Cloud Computing and ICT Services in enhancing GSCM practices.

The need for Green Supply Chain Management (GSCM) practices in Africa is driven by regulatory requirements and stakeholder pressure. According to (Zaki and Omar, 2020) , many African countries are adopting policies and regulations that require businesses to adopt Green Supply Chain Management (GSCM) practices. Stakeholders, including customers, investors, and civil society organizations, are also increasingly demanding environmentally responsible business practices from African businesses.

Ethiopia is one of the country's most vulnerable to the effects of climate change, including droughts, floods, and desertification (Biru *et al.,* 2021). This vulnerability is compounded by the country's heavy reliance on agriculture, which is highly sensitive to climatic changes. By adopting Green Supply Chain Management (GSCM) practices, Ethiopian businesses can reduce their environmental impact, mitigate climate change effects, and promote sustainable business practices.

According to (Abiy and Upton, 2019) the Ethiopian government has introduced policies and regulations that require businesses to adopt environmentally responsible practices. According to (Biru *et al.,* 2021), Green Supply Chain Management (GSCM) practices can contribute to achieving SDGs such as climate action, sustainable consumption and production, and responsible production and consumption. The adoption of Green Supply Chain Management (GSCM) practices can also create social and economic benefits by promoting responsible business practices, enhancing corporate reputation, and attracting investment.

Cloud computing and information and communication technology (ICT) services provide several benefits that correspond with the goals of green supply chain management. For starters, the usage of cloud-based platforms enables the real-time sharing and exchange of data and information across various stakeholders, facilitating collaboration and coordination throughout the supply chain. This greater connectedness allows for more effective decision-making processes, which leads to less waste, better inventory management, and increased visibility across the supply chain network (Mittal *et al.,* 2018).

Furthermore, the incorporation of ICT services such as Internet of Things (IoT) devices, sensors, and data analytics allows for real-time monitoring and tracking of important environmental metrics across the supply chain. This enables firms to pinpoint areas for improvement, analyze resource use, and correctly assess the environmental impact of their

operations. Organizations can use these technologies to execute proactive waste reduction, transportation route optimization, and energy efficiency measures.(Sharma *et al.,* 2019).
By enabling businesses to optimize their operations, reduce their energy consumption, and collect and analyze data on their environmental performance, Cloud Computing and ICT Services can promote sustainable practices along the supply chain and contribute to a more environmentally sustainable future.

1.2. Background of the organizations

Four organizations are selected for this study. The selection is based on the level on involvement in supply chain operations as well as popularity. Furthermore, the specific inclusion and selection criterion are expressed on the chapter 3.

The Motor and Engineering Company of Ethiopia (MOENCO)

MOENCO is a subsidiary company of Inchcape PLC, a London based company engaged in global distribution & retail leader in the premium and luxury automotive sectors. It mainly represents the Toyota brand. It was founded by Mr. Y. D. Lappine on January 1959 in a small rented house around the area commonly known as Mexico. It now and has over 60 years of experience in the industry.("MOECNO", n.d.)

The Ethiopian Airlines

Ethiopian Airlines (Ethiopian) has had more than 75 years of successful journey which made it the leading Aviation Group in Africa. Of course, Ethiopian is ageing beautifully. Over the decades, the airline has established itself as the leader in all facets of the aviation business: technology leadership, network expansion and aviation mentoring.("Ethiopian Airlines", n.d.)

East Africa Bottling Share (COCA-COLA SABCO)

East Africa Bottling Share Company (EABSC), a subsidiary of CCBA, is the largest bottler of Coca-Cola products in Ethiopia, having served the country for more than 60 years. Having total

production capacity to 352 000 cases per day with over Four facilities in Addis Ababa, Bahir Dar and Dire Dawa, EABSC's greenfield site in Sebeta.("COCA-COLA", n.d.)

United Nations Office for Project Services (UNOPS)

UNOPS supports the Government of Ethiopia, the UN Country Team and other development partners in efforts to achieve the Sustainable Development Goals.it designs projects to reinforce and bolster development priorities in sustainable procurement, project management and infrastructure, and works to strengthen national capacity and capability to deliver quality services. It also provides environmentally friendly solutions and innovative models to modernize Ethiopia's agricultural sector, provide clean energy to off-grid areas and improve health services throughout the country.("UNOPS", n.d.)

1.3. Statement of the Problem

Several studies have investigated the relationship between Information communication technology (ICT) and Green Supply Chain Management (GSCM) practices (Jabbour *et al.,* 2019; Sarkis *et al.,* 2020). ICT can support the implementation of GSCM practices, such as product design, green procurement, transportation management, and waste management. ICT services, such as data analytics, simulation, and optimization, can provide decision support for GSCM practices (Mishra *et al.,* 2018). However, the potential of cloud computing (CC) services in GSCM practices is yet to be explored.

Cloud computing and ICT services have the potential to revolutionize the way organizations operate and deliver services to their customers. However, despite the increasing popularity of these technologies, there is a lack of research that has examined the impact of cloud computing and ICT services on different industries and sectors, and how they can be leveraged to improve efficiency and competitiveness (Botta *et al.,* 2016).

Although there are some studies on the relationship between ICT and GSCM practices, there is a lack of empirical studies that investigate the role of CC services in GSCM practices.

Theoretical frameworks that explain the relationship between CC services and GSCM practices are limited. Most of the existing studies have focused on the technical aspects of CC services and their potential benefits, but they have not provided a theoretical basis for understanding

the relationship between CC services and GSCM practices. Therefore, a theoretical framework is needed to explain how CC services can support GSCM practices.

GSCM is an important approach for businesses to manage their environmental impacts and achieve sustainability. ICT and CC services can support GSCM practices by facilitating communication, collaboration, and decision-making across the supply chain. Despite the potential benefits, there is a lack of understanding of the role of CC and ICT services in GSCM practices.

In conclusion, the potential benefits of CC and ICT services in supporting GSCM practices have not been fully explored. This study aims to address the gap by investigating the role of CC and ICT services in GSCM practices by assessing several target organizations.

1.4. Research Question

- To what extent is Green Supply Chain Management practiced on the target organizations?
- What is the role of cloud computing and ICT services on green logistics?
- What is the role of cloud computing and ICT services on green procurement?
- What is the role of cloud computing and ICT services on green production?

1.5. Objectives of the study

1.5.1. General Objectives

The study is intended to examine the Role of Cloud Computing and ICT Services on Green Supply Chain Practices.

1.5.2. Specific Objectives

- To assess the extent of Green Supply Chain Management (GSCM) practices in the target organizations.
- To determine the role of cloud computing and ICT services on green logistics.
- To determine the role of cloud computing and ICT services on green procurement.
- To determine the role of cloud computing and ICT services on green production.

1.6. Significance of the Study

Although several researches have been done on the role of Cloud Computing and ICT Services in green supply chain management practices, there seems to be little or no studies referring to the Ethiopian context. Thus, while taking the sample organizations as a frame of reference, the research assesses the current practices of green supply chain management, the level of involvement in Cloud Computing and ICT Services in the Green Supply Chain Management (GSCM) operations (if any) and future integration options/recommendations.

1.7. Scope of the Study

The Scope of this study is on the components of green supply chain management operations (GSCM) with respect to cloud computing. Which is Green Procurement/Green Sourcing, Green Production & Green Logistics?

1.8. Limitation of the study

The research is limited with the number of target organization samples taken as well as the corresponding representatives chosen. This is mainly due to the time and financial constraints on the researcher.

1.9. Organization of the Study

There are five chapters in the study. The background of the study, the statement of the problem, the research questions, the objective of the study, the significance of the study, and the scope of the study are used to construct Chapter One. A review of related literature is provided in Chapter Two. Chapter Three, which features a study description in bold, the study's methodology, design, population, sample, and data collection instrument. Data gathered using qualitative & quantitative techniques is then evaluated and interpreted appropriately in Chapter Four. The study findings' conclusion and recommendation are included in Chapter Five.

2. Chapter Two: Review of related literature

In this section, a review of relevant literature that has explored the use of cloud computing and ICT services in the context of GSCM practices will be made, focusing specifically on green production, green procurement, and green logistics. The aim of this review is to identify the benefits, challenges, and drivers of implementing cloud computing and ICT services in the context of GSCM practices, as well as to develop a conceptual framework to guide the research methodology and analysis in the subsequent sections of the study.

2.1.Theoretical Literature Review

2.1.1. Green Supply Chain Management

According to a study by (Rathore *et al.,* 2021), Green Supply Chain Management (GSCM) practices can take various forms, such as green purchasing, green manufacturing, and green logistics. Green purchasing involves selecting suppliers based on their environmental performance and sustainability practices. Green manufacturing involves adopting environmentally friendly processes and technologies in production. Green logistics involves adopting environmentally friendly practices in transportation, warehousing, and inventory management.

Recent literature has examined the impact of Green Supply Chain Management (GSCM) on firms' environmental performance and financial performance. For example,(Choudhary and SHankar, 2019) conducted a systematic literature review of Green Supply Chain Management (GSCM) and found that companies that adopt Green Supply Chain Management (GSCM) practices are more likely to reduce their environmental impact, improve their operational efficiency, and enhance their reputation among customers and stakeholders. Similarly, (Hsu, Kuo, & Hu, 2018) found that Green Supply Chain Management (GSCM) practices can lead to lower carbon emissions, reduced waste, and improved resource efficiency.

Several studies have also investigated the barriers to adoption of Green Supply Chain Management (GSCM) practices and the role of government policies in promoting sustainable supply chain practices. For example,(Seuring and Müller, 2018) found that the lack of awareness, the lack of collaboration between supply chain partners, and the high costs of Green Supply Chain Management (GSCM) practices are major barriers to adoption. They also

highlighted the need for government policies that promote sustainability and create incentives for companies to adopt Green Supply Chain Management (GSCM) practices.

2.1.1.1.Green Logistics

According to a study by (Chao, Wang, *et al.*, 2020), the elements of green logistics include sustainable transportation, reverse logistics, green packaging, and green warehousing. Sustainable transportation involves the use of environmentally friendly modes of transport, such as electric vehicles and hybrid trucks. Reverse logistics involves the efficient management of product returns and waste disposal, while green packaging involves the use of sustainable materials and packaging designs. Green warehousing focuses on reducing energy consumption and carbon emissions in warehousing activities.

Several recent studies have investigated the impact of green logistics practices on firms' environmental performance and financial performance. For example,(Prajogo and Oke, 2021) found that firms that adopt green logistics practices are more likely to innovate environmentally friendly products and processes, which in turn leads to better financial performance. Similarly, (Khoo and Tan, 2020) identified several green logistics practices in the Asia Pacific region that have contributed to lower emissions, reduced energy consumption, and improved environmental management.

(Wagner *et al.*, 2017) conducted a systematic literature review of green logistics and identified several research gaps and future research directions. They found that there is a need for more empirical studies that measure the environmental and economic impacts of green logistics practices. They also highlighted the need for more studies that investigate the barriers to adoption of green logistics practices, and the role of government policies in promoting sustainable logistics practices.

2.1.1.2.Green Procurement

According to a study by (Kim and Choi, 2021), the elements of green procurement include sustainable sourcing, green product design, green supplier development, and green purchasing policies. Sustainable sourcing involves selecting suppliers who prioritize sustainability in their operations, while green product design involves the development of eco-friendly products that have a reduced environmental impact. Green supplier development involves working with

suppliers to improve their sustainability practices, while green purchasing policies involve developing and implementing policies that prioritize sustainable procurement practices.

Recent literature has examined the impact of green procurement on environmental performance, economic performance, and social performance. For example,(Thakur and Haleem, 2019) conducted a systematic literature review of green procurement and found that green procurement can lead to reduced environmental impact, improved supplier performance, enhanced stakeholder satisfaction, and increased financial performance. Similarly, (Jabbour *et al.,* 2019) found that green procurement practices can lead to improved environmental and economic performance, as well as enhanced social performance through stakeholder engagement and collaboration.

Green procurement practices can take various forms, such as selecting suppliers based on their environmental performance, requesting environmental certifications, promoting environmentally friendly design and production, and encouraging sustainable disposal and recycling. For example,(Haj Mohammad and Hajiaghaei-Keshteli, 2019) found that selecting suppliers based on their environmental performance can lead to reduced environmental impact and improved supplier performance. Similarly,(Chen *et al.,* 2019) found that promoting environmentally friendly design and production can lead to reduced environmental impact and improved product quality.

Several studies have also investigated the barriers to adoption of green procurement practices and the role of government policies in promoting sustainable procurement. For example, (Mishra *et al.,* 2018) found that the lack of awareness, the lack of resources, and the lack of top management support are major barriers to adoption. They also highlighted the need for government policies that promote sustainability and create incentives for organizations to adopt green procurement practices.

2.1.1.3.Green Production

According to (Delgado *et al.,* 2019) , green production can be achieved through the adoption of various strategies, such as lean manufacturing, green design, eco-innovation, and cleaner production. Lean manufacturing is a production approach that aims to eliminate waste and improve efficiency by optimizing the use of resources. Green design involves incorporating environmental considerations into the product design phase to reduce negative impacts on the environment. Eco-innovation entails the development of new products, processes, or services

that have lower environmental impacts than existing ones. Cleaner production involves minimizing waste generation, reducing resource use, and optimizing production processes to achieve sustainable production.

Several recent studies have examined the concept of green production and the impact of green production practices on environmental performance, economic performance, and social performance. For example,(Zeng and Tam, 2021) conducted a systematic literature review of green production and found that green production practices can lead to reduced environmental impact, improved resource efficiency, and enhanced economic and social performance. Similarly, (Sharma *et al.,* 2020) found that green production practices can lead to reduced energy consumption, reduced waste generation, and improved environmental and economic performance.

Green production practices can take various forms, such as implementing energy-efficient technologies, reducing material waste, using renewable resources, and promoting closed-loop production systems. For example,(Han *et al.,* 2018) found that implementing energy-efficient technologies can lead to reduced energy consumption and improved environmental and economic performance. Similarly, (Fargnoli *et al.,* 2019) found that promoting closed-loop production systems can lead to reduced waste and improved resource efficiency.

Several studies have also investigated the barriers to adoption of green production practices and the role of government policies in promoting sustainable production. For example,(Li and Li, 2020) found that the lack of resources, the lack of technical expertise, and the lack of incentives are major barriers to adoption. They also highlighted the need for government policies that promote sustainability and create incentives for organizations to adopt green production practices.

2.1.2. Cloud computing and ICT Services

According to (Zhang *et al.,* 2018), cloud computing is a service delivery model that enables users to access computing resources and services over the internet. Cloud computing services are provided by cloud service providers, who host and manage the computing infrastructure and software applications. Cloud computing services are delivered in three main deployment models, which are public, private, and hybrid clouds. Public clouds are available to the general public and are owned and operated by cloud service providers, while private clouds are dedicated to a single organization and are hosted in the organization's data center. Hybrid

clouds are a combination of public and private clouds, providing organizations with the flexibility to use both types of cloud services.

There are three main types of cloud computing: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) (NIST, 2018).

Infrastructure as a Service (IaaS) provides users with access to virtualized computing resources, such as servers, storage, and networking, which they can use to deploy and run their own applications and services. IaaS allows users to have more control over their computing environment, while still outsourcing the maintenance and management of the underlying infrastructure to a third-party provider (Sood and Kaul, 2020).

Platform as a Service (PaaS) provides users with a complete development environment, including programming languages, tools, and libraries, which they can use to develop, test, and deploy their own applications and services without having to worry about the underlying infrastructure. PaaS allows users to focus on application development and innovation, while leaving the management and maintenance of the platform to the provider (Garg *et al.,* 2021) .

Software as a Service (SaaS) provides users with access to a complete application or service, which they can use over the internet on a pay-per-use or subscription basis, without the need to install or maintain any software locally. SaaS allows users to benefit from the latest software updates and features, while leaving the management and maintenance of the software to the provider (Vaquero *et al.,* 2014).

ICT services, on the other hand, encompass a wide range of technologies and services that enable the exchange of information and communication between individuals and organizations. According to(Kuo *et al.,* 2018), ICT services include telecommunication networks, software applications, and data management and storage, and internet services. The use of ICT services enables organizations to communicate and collaborate more effectively, automate business processes, and access and analyze data to make informed decisions.

Several recent studies have examined the concept of cloud computing and ICT services and their impact on business and organizational performance. For example, (Bhardwaj *et al.,* 2019) conducted a comprehensive review of cloud computing technologies and their applications, highlighting their potential benefits for businesses, including cost savings, scalability, and flexibility.

ICT services also play a critical role in enabling businesses to leverage new technologies and improve their operations. For example, data analytics services can help organizations make informed decisions based on data-driven insights, while cyber security services can help protect

businesses against cyber threats.(Goh *et al.*, 2020) examined the impact of data analytics services on business performance and found that data analytics can improve business performance by enabling better decision-making and more efficient operations. Similarly, (Hung *et al.*, 2020) investigated the impact of cyber security services on business performance and found that cyber security services can help businesses mitigate the risks of cyber threats and improve their reputation and customer trust.

Cloud Computing (CC) and ICT services are also transforming the way organizations approach innovation and product development. For example, software development services can help businesses rapidly develop and deploy new software products and services, while cloud-based collaboration tools can enable remote teams to collaborate on projects more effectively.(Chen, Yu, *et al.*, 2018) examined the impact of software development services on innovation performance and found that organizations that used software development services experienced improved innovation performance, such as increased speed to market and better product quality.

The integration of cloud computing and ICT services has been shown to have significant benefits for organizations. According to (Ahuja and Medhi, 2020) , the use of cloud computing and ICT services can improve organizational agility, scalability, and cost-effectiveness. Cloud computing enables organizations to scale their computing resources up or down based on demand, reducing the need for large capital investments in hardware and software. Additionally, the use of ICT services can enable organizations to automate business processes, reducing the need for manual interventions and improving process efficiency.

2.2.Theoretical Framework

2.2.1. Resource-Based View (RBV)

The Resource-Based View theory states that a firm's resources are the key determinants of its competitive advantage. In the context of GSCM, the theory suggests that a firm's internal resources, such as ICT services and cloud computing, can be used to improve its environmental performance by reducing waste, increasing efficiency, and improving sustainability. Therefore, firms can achieve a competitive advantage by leveraging their ICT resources to implement GSCM practices (Barney and Barney, 1991).

According to (Tugrul and Akyuz, 2019), cloud computing and ICT services can offer several resources and capabilities that can contribute to sustainable supply chain management

practices. These resources include improved collaboration, data sharing, and enhanced communication, which can facilitate the integration of sustainability concerns into the supply chain. Furthermore, ICT services such as block chain can provide transparency and traceability, which are critical for ensuring environmental compliance and accountability within the supply chain (Srivastava *et al.,* 2019).

2.2.2. Institutional Theory

Institutional theory suggests that organizations conform to societal norms and expectations to gain legitimacy and support from stakeholders. In the context of GSCM, the theory suggests that firms that adopt environmentally sustainable practices are more likely to be perceived as legitimate by their stakeholders. Therefore, firms that adopt GSCM practices, such as using cloud computing and ICT services to reduce their environmental impact, are more likely to be perceived as legitimate and gain support from stakeholders (DiMaggio and Powell, 1983).

Cloud computing and ICT services can play a critical role in facilitating the adoption and implementation of sustainable practices within the supply chain. Cloud-based platforms can provide opportunities for collaboration and information sharing among supply chain partners, facilitating the adoption of environmentally sustainable practices (Gibson *et al.,* 2019). Similarly, ICT services such as block chain can provide transparency and traceability, which are essential for ensuring environmental compliance and accountability within the supply chain(Srivastava *et al.,* 2019) .

Overall, the emphasis on internal resources, competencies, and sustained competitive advantage is well aligned with the RBV theoretical framework. Moreover, RBV emphasizes the role of the firm's internal resources and capabilities in achieving long-term sustainability goals, which aligns well with the focus on green supply chain practices. And thus, the research is based on it.

2.3.Empirical Literature Review

2.3.1. The role of cloud Computing and ICT Services on Green Logistics

Several studies have highlighted the potential of cloud computing to reduce the carbon footprint of logistics operations. For instance, one study by (Wu *et al.,* 2020) demonstrated that cloud computing can be used to optimize the routing of delivery vehicles, resulting in reduced fuel

consumption and greenhouse gas emissions. The study used a simulation-based approach to demonstrate that cloud computing can help reduce carbon emissions by up to 28 percent.

Similarly, in a study by (Chauhan and Chauhan, 2018), it was demonstrated that cloud-based logistics systems can reduce the environmental impact of logistics operations by reducing the number of empty miles driven by delivery trucks. The study also highlighted the potential of cloud-based systems to improve the efficiency of logistics operations by providing real-time information to logistics managers and drivers.

Another study by (Zhao *et al.,* 2019) demonstrated the potential of cloud computing and big data analytics to optimize logistics operations and reduce their carbon footprint. The study used data from a Chinese logistics company to develop an optimization model that considers multiple factors, including delivery routes, transportation modes, and inventory levels. The results of the study demonstrated that the optimization model could reduce carbon emissions by up to 15 percent.

Furthermore, the role of ICT services in enabling green logistics has also been highlighted in the literature. For instance, a study by (Ahn *et al.,* 2018) demonstrated that the use of ICT services, such as RFID and GPS, can help reduce the carbon footprint of logistics operations by improving the visibility of goods and reducing the likelihood of lost or damaged goods. The study also highlighted the potential of ICT services to improve the efficiency of logistics operations by enabling real-time tracking and monitoring of goods.

Hypothesis $H1_a$: Adoption of Cloud Computing and ICT Services positively impacts the green logistics management practices.

Hypothesis $H0_a$: Adoption of Cloud Computing and ICT Services has no impact on the green logistics management practices.

2.3.2. The role of cloud Computing and ICT Services on Green Procurement

Several studies have investigated the role of cloud computing and ICT services in enabling green procurement practices. For instance, (Aydin *et al.,* 2019) a study to investigate the impact of cloud computing on sustainable procurement practices in the Turkish construction industry. The study found that cloud computing can facilitate information sharing and collaboration, which are important elements of sustainable procurement practices.

(Tjahjono *et al.,* 2019) conducted a study to develop a cloud-based platform for green supply chain management, which includes green procurement practices. The study found that the

cloud-based platform can improve supply chain visibility and collaboration, leading to more efficient and sustainable procurement practices. Similarly, a study by (Abukhzam and Lee, 2018) found that the use of ICT services in procurement could reduce the amount of paper used in the procurement process, thereby improving the environmental performance of the organization.

Furthermore, cloud computing and ICT services could facilitate communication and collaboration between suppliers and buyers, thus improving supply chain visibility and transparency. According to (Azevedo *et al.,* 2017) ,cloud computing could improve supply chain traceability, which is a critical aspect of green procurement. Through cloud-based systems, procurement managers could easily monitor supplier performance, track environmental metrics, and implement sustainable procurement policies.

Hypothesis $H1_b$: Adoption of Cloud Computing and ICT Services positively impacts the green procurement management practices.

Hypothesis $H0_b$: Adoption of Cloud Computing and ICT Services has no impact on the green procurement management practices.

2.3.3. The role of cloud Computing and ICT Services on Green Production

Several empirical studies have investigated the relationship between cloud computing and green production practices. For example, (Tjahjono *et al.,* 2019) found that cloud-based platforms can facilitate the sharing of resources, such as energy and materials, among different production processes, thereby reducing waste and improving resource efficiency. Similarly, (Wang *et al.,* 2021) found that cloud computing can enable real-time monitoring of energy consumption and production processes, leading to improved energy efficiency and reduced carbon emissions.

The empirical evidence on the role of ICT services in green production practices is also substantial. For instance, (Khalid *et al.,* 2020) found that the implementation of ICT services such as lean manufacturing, total quality management, and Six Sigma can lead to significant improvements in environmental performance. Similarly,(Chao, Zhu, *et al.,* 2020) found that the use of digital technologies, including cloud computing, the internet of things (IoT), and artificial intelligence (AI), can enhance resource efficiency, reduce waste, and improve supply chain collaboration, thereby promoting sustainable production.

According to (Wang and Shu, 2018) , cloud computing and ICT services can also be used to facilitate green design and improve environmental performance by enabling firms to evaluate

the environmental impact of their products and operations, and to identify opportunities for eco-design and eco-innovation. Furthermore, the authors note that the use of cloud computing can enable firms to share information and collaborate with suppliers, customers, and other stakeholders, thereby enhancing the integration of environmental concerns into the production process.

A study by (Tsai *et al.,* 2018) found that the use of cloud computing and ICT services can also facilitate the adoption of green manufacturing practices, such as cleaner production, waste reduction, and energy efficiency. The authors note that cloud computing can enable firms to track and monitor their resource consumption, identify inefficiencies, and implement measures to reduce their environmental impact. Furthermore, the use of ICT services can enable firms to integrate sustainability considerations into their decision-making processes and to engage with stakeholders on environmental issues.

Hypothesis $H1_c$: Adoption of Cloud Computing and ICT Services positively impacts the green manufacturing management practices.

Hypothesis $H0_c$: Adoption of Cloud Computing and ICT Services has no impact on the green manufacturing management practices.

2.4.Conceptual Framework

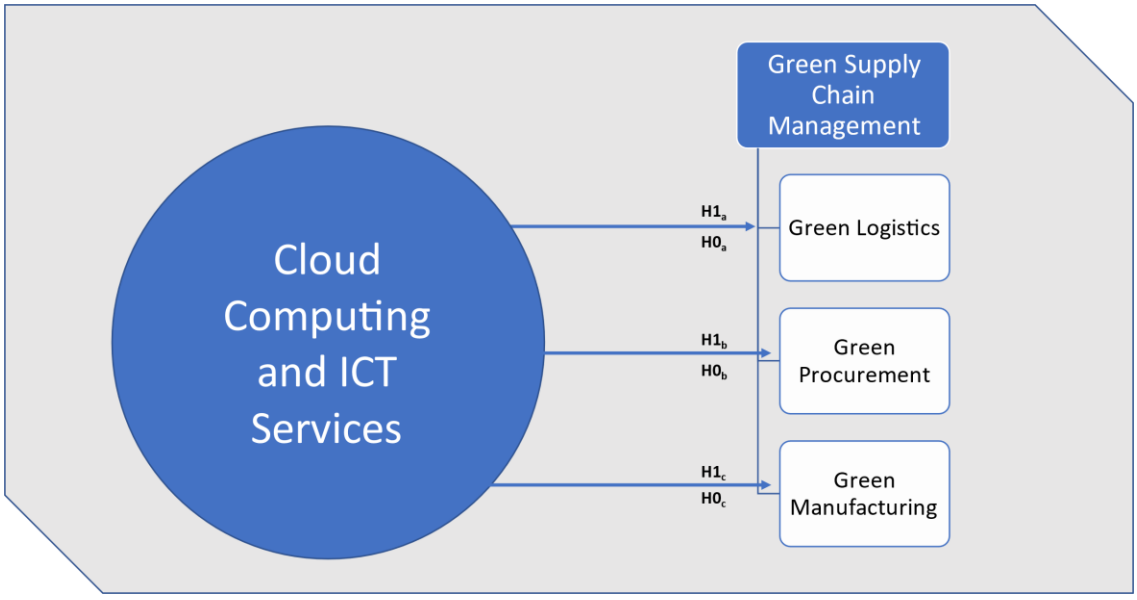

Figure 1 Conceptual Framework

2.5.Summary of Hypothesis

- Hypothesis $H1_a$: Adoption of Cloud Computing and ICT Services positively impacts the green logistics management practices.
- Hypothesis $H0_a$: Adoption of Cloud Computing and ICT Services has no impact on the green logistics management practices.
- Hypothesis $H1_b$: Adoption of Cloud Computing and ICT Services positively impacts the green procurement management practices.
- Hypothesis $H0_b$: Adoption of Cloud Computing and ICT Services has no impact on the green procurement management practices.
- Hypothesis $H1_c$: Adoption of Cloud Computing and ICT Services positively impacts the green manufacturing management practices.
- Hypothesis $H0_c$: Adoption of Cloud Computing and ICT Services has no impact on the green manufacturing management practices.

2.6.Identified Literature Gap

The existing literature shows that cloud computing and ICT services have the potential to significantly impact green logistics, green procurement, and green manufacturing practices. However, there is a gap in the literature regarding the specific impacts of these technologies on these areas of sustainable operations.

Regarding the impact of cloud computing and ICT services on green logistics, previous studies have focused on the benefits of these technologies in improving supply chain efficiency, reducing transportation costs, and enhancing visibility and transparency in logistics operations (Zhao *et al.,* 2018). However, there is a lack of research on how cloud computing and ICT services can be used to improve the sustainability of logistics operations, such as reducing carbon emissions, minimizing waste, and optimizing resource utilization.

Similarly, studies on the impact of cloud computing and ICT services on green procurement have primarily focused on the benefits of these technologies in streamlining procurement processes, improving supplier collaboration, and enhancing data management (Duan *et al.,* 2018; Kuo *et al.,* 2020), However, there is a gap in the literature regarding how cloud computing and ICT services can be used to support sustainable procurement practices, such as green supplier selection, ethical sourcing, and circular procurement.

Finally, research on the impact of cloud computing and ICT services on green manufacturing has primarily focused on the benefits of these technologies in improving production efficiency, reducing energy consumption, and enhancing quality control (Chen, Wang, *et al.*, 2018; Li, Sun, *et al.*, 2021) , However, there is a gap in the literature regarding how cloud computing and ICT services can be used to support sustainable manufacturing practices, such as reducing waste and emissions, promoting circular economy principles, and integrating sustainability considerations into product design.

In summary, while the existing literature has highlighted the potential of cloud computing and ICT services in supporting sustainable operations in logistics, procurement, and manufacturing, there is a gap in the research on the specific impacts of these technologies on the sustainability of these areas of operations. Future research is needed to fill this gap and provide more insights into the ways in which cloud computing and ICT services can be leveraged to support sustainable operations.

3. Chapter 3: Methods of the study

3.1.Description of the study area

Ethiopia is experiencing rapid economic growth and is becoming an important player in global trade. However, like many developing countries, Ethiopia faces environmental challenges due to the impact of its industrial activities on the environment.

The study focused on the green supply chain management practices of the target organizations and how the integration of Cloud computing and ICT services can support these practices. Overall, the study area for this research focuses on specific organizations in Ethiopia, with the aim of providing insights into the role of cloud computing and ICT services in supporting green supply chain management practices in the country.

3.2.Research Design

For the research question 1, this study aimed to investigate to what extent Green Supply Chain Management (GSCM) practices were implemented in the target organizations Through Descriptive research design as it allows for the collection of data to describe the current situation or phenomenon (Babbie and Mouton, 2015).

For research questions 2-4, this study illustrated the role of cloud computing and ICT services in green supply chain management practices Through an Exploratory research design. Exploratory research aims to explain the relationship between variables and seeks to identify the cause-and-effect relationships between them. In this case, the study seeks to determine the impact of cloud computing and ICT services on green supply chain management practices. Therefore, explanatory research methodology enabled the researcher to identify and explain the underlying factors that contribute to the relationship between these variables (Bryman, 2017).

3.3.Research Approach

For the research question 1, a qualitative research approach was appropriate as it allowed for the collection of rich and detailed data on the experiences and perceptions of the participants (Creswell and Creswell, 2017). The use of a qualitative research approach is also justified by the need to explore the experiences and perceptions of the participants regarding GSCM

practices. According to (Jha *et al.,* 2020) qualitative research is useful in exploring the experiences and perceptions of participants regarding complex phenomena. The implementation of GSCM practices in organizations can be complex, and a qualitative research approach provided insights into the experiences and perceptions of the participants regarding these practices.

For research questions 2-4, A mixed research design was the ideal strategy for this topic. The study was conducted through a combination of qualitative and quantitative research methods, including surveys of employees and suppliers, and a review of relevant documentation and data. This design could help in providing a more comprehensive and holistic understanding of the phenomenon under investigation by allowing the researcher to collect and analyze both numerical and textual data, and to triangulate findings from multiple sources (Creswell and Creswell, 2017; Greene *et al.*, 2020; Johnson *et al.*, 2021) .

3.4.Population

The target population included individuals and organizations involved in supply chain management practices. This could include supply chain managers, logistics and transportation professionals, IT professionals, and sustainability or environmental managers.
Overall, the target population for this study was individuals and organizations that are involved in or have knowledge about the adoption and implementation of cloud computing and ICT services in green supply chain management practices.
The selection criterion for the target organizations is per the below listings.

- Industry Sector: organizations from industries that are known to have an impact on the environment, such as manufacturing, transportation, and logistics.
- Size: organizations of varying sizes, from small businesses to large corporations, to ensure that the study is representative of different types of organizations.
- Adoption of cloud computing and ICT services: organizations that have already implemented cloud computing and ICT services in their supply chain management practices to understand the benefits and challenges of adopting these technologies.
- Sustainability initiatives: organizations that have a track record of implementing sustainability initiatives and have made commitments to reducing their carbon footprint.

- Availability of data: organizations that are willing to share data on their supply chain management practices, including their use of cloud computing and ICT services.
- Years in operation: organizations that have been in operation for several years to ensure that they have a well-established supply chain management system that can provide reliable data for the study.

Based on the Above Criterion, 4 Organizations are identified. Namely

- The Ethiopian Airlines
- The Motor and Engineering Company of Ethiopia (MOENCO),
- East Africa Bottling Share Company (COCA-COLA Sabco EABSC)
- United Nations Office for Project Services (UNOPS)

Company Name	**Number of Supply Chain Related Employees**
The Ethiopian Airlines	**100**
The Motor and Engineering Company of Ethiopia (MOENCO)	**35**
East Africa Bottling Share Company (COCA-COLA Sabco)	**100**
United Nations Office for Project Services (UNOPS)	**14**

Table 1 Target Population

Source: Researcher's Survey, 2023

The total Population was **249** personnel.

3.5.Sample

Since the population was defined, we expected that we could be 95% confident that our interval contains the population mean. If we ran our study again, we would be confident our new sample mean would fall somewhere in this interval. To account for the un-certainties a ± 5 % confidence interval was applied.

And thus,

$$\text{Sample Size} = \frac{\frac{z^2 \times p(1-p)}{e^2}}{1+(\frac{z^2 \times p(1-p)}{e^2 \times N}}$$

Where:

N = Population Size

Z = Z-Score (is **1.96** For a **95 %** Confidence level)

p = Standard Deviation (Default Value: **0.5**),

e = Margin of Error (or) Confidence Interval. (**5%)**

And thus, the sample size for each organization was as per the table below.

Company Name	**Number of Supply Chain Related Employees**	**Sample Size**
The Ethiopian Airlines	**100**	**79**
The Motor and Engineering Company of Ethiopia (MOENCO)	**35**	**32**
East Africa Bottling Share Company (COCA-COLA Sabco)	**100**	**79**
United Nations Office for Project Services (UNOPS)	**14**	**14**
Total	**249**	**205**

Table 2 Sampling

Source: Researcher's Survey, 2023

3.6.Data Collection Instrument

Questionnaires that have both open and closed ended questions were used for the data collection method. The method was chosen to leverage on its advantages such as the ability to collect data from a large and diverse population, the ability to quantify responses, and the ability to generalize findings to the larger population.

3.7.Methods of analysis

The study applied mixed approach to the research. Hence, data were analyzed both qualitatively and quantitatively. Furthermore, through the aid of Descriptive statistics: The mean, median, and standard deviation are used to summarize the main characteristics of the data. Through Inferential Statistics such as Regression Analysis and analysis of variance (ANOVA) to make conclusions about a population based on the sample will be made and finally through the Graphical representation, Various graphs and charts, such as bar charts, line charts and pie charts were used to easily identify patterns and trends.

3.8.Reliability and Validity

Content validity is a means of maintaining research validity by ensuring that the items included in a research tool or instrument accurately reflect the construct being measured (Polit and Beck, 2017) .

As suggested by (Moraes, 2021), cognitive interviews involve having a group of participants review the items in the measurement tool to determine if they understand the items and if they measure the intended construct. The researcher used the feedback obtained from the cognitive interviews to refine the measurement tool.

The research adviser, who determines the applicability of the research questions and the measuring scales, confirmed the validity of the study. Peer review with other researchers and logisticians has been conducted as a further method of evaluating the suitability of queries.

Furthermore, the reliability of the research is checked against its Cronbach's alpha coefficient. Cronbach's alpha provides a reliable estimate of the consistency or stability of a research instrument's measurements over multiple items. It is a coefficient that ranges from 0 to 1, with higher values indicating greater reliability.(Gliem and Gliem, 2003).

Reliability Statistics

Cronbach's Alpha	N of Items
.801	32

Table 3 Cronbach's alpha

Source: Researcher's Survey, 2023

3.9.Ethical Considerations

Additional ethical concerns were considered when gathering data for this study, particularly in relation to the study "The role of cloud computing and ICT services in green supply chain management practices." To ensure that all relevant data was gathered and properly explained both during data collection and after the study is complete, an appropriate debriefing process was used.

The participants in this research were not required to provide their names, and they are assured that their responses wouldn't be handled in strict confidence in order to protect the privacy of the information they provided.

This research thesis is founded on previous studies on green supply chain management and the role of technology (cloud computing and ICT services) at various times. I therefore made an effort to locate the writers and researchers in my cited literature who conducted research and established the role of cloud computing and ICT services in green supply chain management techniques.

4. Chapter 4: Result and Discussions and Interpretations

This section presents the results and discussions based on the data collected for the purpose of the study, which focuses on investigating the role of cloud computing and ICT services in green supply chain management (GSCM) practices.

Data analysis was performed through the aid of IBM-SPSS-v-27 as well as other visualizations tools such as Excel.

4.1.Results

4.1.1. Response Rate

Determining a valid response rate in research can vary depending on the research design, target population, and data collection method. However, a commonly accepted guideline is to aim for a response rate of at least **60%** to ensure the validity and representativeness of the findings (Dillman *et al.,* 2014). Additionally, a response rate below **60%** raises concerns about non-response bias and the generalizability of the results (Cook *et al.,* 2000).

The study dispersed around **205** Questionnaires through the form of Google forms. A total of **185** responses were recorded. This makes the response rate to be **90%**.

Company Name	Number of Supply Chain Related Employees	Sample Size	Received Response	Percentage
The Ethiopian Airlines	**100**	**79**	**72**	**91 %**
The Motor and Engineering Company of Ethiopia (MOENCO)	**35**	**32**	**29**	**91 %**
East Africa Bottling Share Company (COCA-COLA Sabco)	**100**	**79**	**72**	**91 %**
United Nations Office for Project Services (UNOPS)	**14**	**14**	**12**	**86 %**
Total	**249**	**205**	**185**	**90 %**

Table 4 Response Rate

Source: Researcher's Survey, 2023

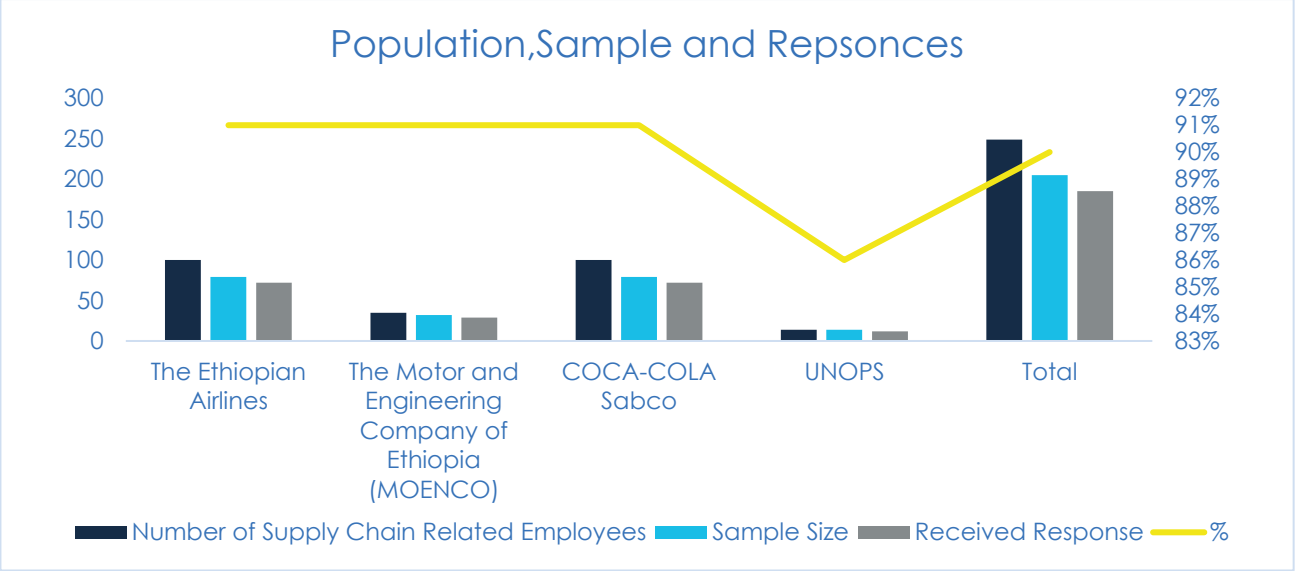

Figure 2 Population, Sample, Responses and Response rates
Source: Researcher's Survey ,2023

4.1.2. Demographic Profile of the respondents

Gender	Education Level	Age Range	Number of Respondents
Female	Bachelor's Degree	25-31	61
		32-39	2
		40-46	3
		47 and above	1
	College Diploma	32-39	2
		40-46	1
	Graduate or Professional Degree	25-31	3
		40-46	2
		47 and above	1
Male	Bachelor's Degree	25-31	34
		32-39	9
		40-46	38
		47 and above	1
	College Diploma	40-46	1
		18-24	1

	Graduate or Professional Degree	25-31	2
		32-39	4
		40-46	12
		47 and above	7

Table 5 Respondent's Demographics

Source: Researcher's Survey, 2023

The data gathered shows that **41. 8 %** of the total respondents are female, whereas the remaining **58.92 %** are male. Furthermore, the majority of the respondents have at least a bachelor's degree, these accounts for the **80.54 %** of the total response. Whereas Graduate or professional degree and college diploma accounted for **17.3 %** and **2.16 %** respectively.

Regarding the age range, the majority of the respondents are included on the 25-31 age range. It accounts for **54.05 %** of the total population. Whereas age ranges 40-46, 32-49 and 47 & above accounted for **30.81 %**, **9.19 %** and **5.41 %** respectively.

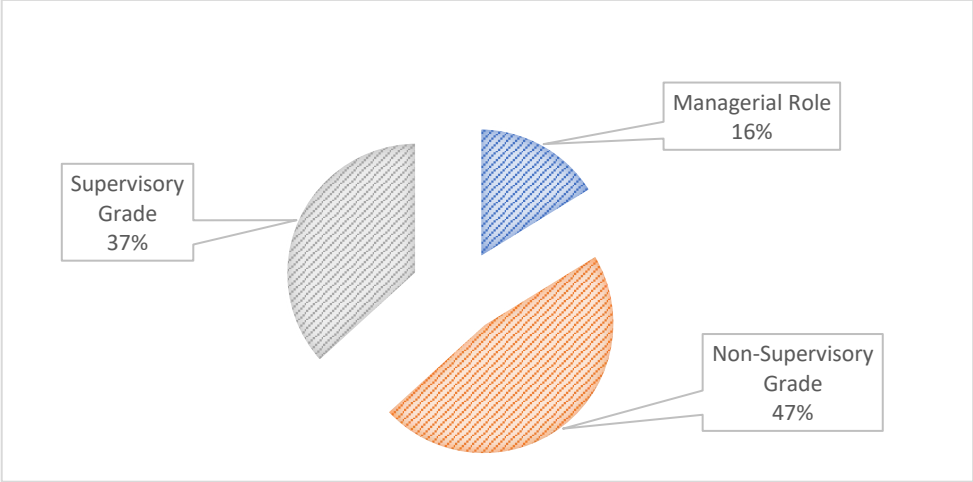

Figure 3 Respondent's role profile

Source: Researcher's Survey, 2023

4.1.3. Organizational GSCM Practices

Metric	Responses	Frequency	Percent
Respondent's GSCM Awareness	No	15	8%
	Yes	170	92%
	Total	185	100%
Total years of Experience in GSCM	Less than 1 year	30	16%
	1-5 Years	84	45%
	6-10 Years	52	28%

	11-20 Years	19	10%
	Total	185	100%
Organization's GSCM Practice Areas	None	5	3%
	Green Logistics	9	5%
	Green Sourcing (Green Procurement)	109	59%
	Green Production	43	23%
	Green Logistics, Green Production	1	1%
	Green Sourcing (Green Procurement), Green Logistics	17	9%
	Green Sourcing (Green Procurement), Green Production	1	1%
	Total	185	100%
Integration of GSCM in Organization's Performance	There is no Integration.	13	7%
	There is a weak Integration.	16	9%
	There is a moderate integration.	119	64%
	There is a Strong Integration.	37	20%
	Total	185	100%

Table 6 Respondent's awareness related questions responses

Source: Researcher's Survey, 2023

In this section respondents were asked several questions to assess their level of awareness on the concept of GSCM and their specific organizational practices.

The data gathered shows that **92 %** of the total respondents are aware of the term Green Supply chain management (GSCM whereas the remaining **8 %** were not aware of the term. The majority of the respondents were segmented in the 1-5 Years of experience range which accounts to **62 %** of the total population, the 6-10 years of experience range & the Less than year of experience accounted for the **28 %** and **16 %** of the population respectively.

Regarding the Organization's GSCM practice areas, the Majority of the respondents indicated that their organization is heavily invested in Green Sourcing (Green Procurement) operations. This accounts to the **59 %** of the total response. Green Production and the combination of Green Sourcing (Green Procurement) & Green Logistics accounted for the **23 %** and **9 %** of the total responses respectively. Only **1 %** of the population indicated that their origination is involved in all three GSCM operations (Green Sourcing, Green Logistics and Green Production).

The majority of the respondents accounting for the **64 %** of the total response indicated that there exists a moderate integration of GSCM in their organization's performance. Responses indicating the existence of a strong integration and the presence of a weak integration accounted for the **20 %** and **9 %** of the total responses respectively.

Organizational GSCM Practices	Mean	Std. Deviation
My organization currently has a green supply chain management plan in place.	3.616	1.1367
My organization has a process for evaluating the environmental performance of its suppliers.	3.61	1.104
My organization practices environmentally friendly processes and technologies in production.	3.5	1.094
My organization has a program in place to promote sustainable transportation and logistics in the supply chain.	3.48	1.064
My organization actively tracks and measures the environmental impact of its supply chain operations.	3.52	1.104
My organization has a target or goal for reducing its carbon footprint in the supply chain.	3.6	1.094
My organization has a system in place for managing and reducing waste in the supply chain.	3.55	1.098
My organization has a communication plan in place to inform stakeholders about its green supply chain management practices.	3.49	1.089
My organization actively seeks out and collaborates with suppliers that have strong environmental performance.	3.48	1.109

Table 7 Organization's GSCM Practices related questions responses

Source: Researcher's Survey, 2023

In this section respondents were asked to measure their organization's performance regarding metrics aligned to GSCM practices, specifically Green Procurement, Green Logistics and Green Production.

Averages (means) were generated for each construct on the Likert Scales, ranging from Strongly Disagree=1 to Strongly Agree=5. To comprehend the mean values, the numbers entered into SPSS version 27 indicated the weight, and the weighted averages for the scales were determined. This was achieved by dividing the distances between the scale values (4 on

a 5-point Likert Scale) by the number of possible values (5). As a result, the period length is 4/5=0.80, which is utilized to compute weighted averages(Alfarra, 2009).

The degree of agreement for each element is derived based on the weighted average categories (mean value) (Alfarra, 2009).

Weighted Averages	Labels / Responses	Degree of Agreement
1.0 – 1.79	Strongly Disagree	Very Un-Influential
1.8 – 2.59	Disagree	Un-Influential
2.6 – 3.39	Neutral	Neutral /Don't Know
3.4 – 4.19	Agree	Influential
4.2 - 5.00	Strongly Agree	Very Influential

Table 8 Weighted Means & Their Interpretations for a Five Point Likert Scale

Source: (Alfarra, 2009)

Based on the above interpretation metrics, Respondents agreed that there exists a GSCM plan in place in their organization. Having a mean of **3.62**. Furthermore, Respondents Agreed that their organization have a process for evaluating the environmental performance of its suppliers. Having a mean of **3.61.**

Regarding The practices of Environmentally friendly production, the respondents agreed on the presence of such operations & practices in their organization. Having a mean of **3.50**. Similarly, the respondents also agreed that a program is in place to promote sustainable transportation and logistics in the supply chain in their organization. Having a mean of **3.48.**

In addition, Respondents agreed on the presence of active tracking and measurement of the environmental impact of their supply chain operations as well as having a target or goal for reducing their carbon footprint in the supply chain. With a mean of **3.52** & **3.60** respectively.

Respondents also agreed on the concepts such as having a system in place for managing and reducing waste in the supply chain, having a communication plan in place to inform stakeholders about their green supply chain management practices & actively seeking out and collaboration with their suppliers that have strong environmental performance. With means **3**.**55**, **3.49** and the **3.48** respectively.

The overall results indicate on the presences of a strong Green Supply Chain management practices across the organizations, with a combined mean of **3.53.**

4.1.4. GSCM Practices and The Role of Cloud Computing and ICT Services

Impact of CC& ICT Services	Mean	Std. Deviation
My company has been able to reduce its environmental footprint in manufacturing due to the adoption of cloud computing and ICT services.	3.79	0.762
Cloud computing and ICT services have helped my company to reduce waste and improve resource efficiency in production.	3.5	1.094
My company has been able to better comply with environmental regulations and standards in production due to the adoption of cloud computing and ICT services.	3.55	1.098
The use of cloud computing and ICT services has enabled my company to source sustainable materials and reduce the environmental impact of procurement processes.	3.77	0.857
The use of cloud computing and ICT services has enabled my company to evaluate the sustainability performance of our suppliers.	3.7	0.894
My company has been able to reduce its carbon footprint in transportation and logistics due to the adoption of cloud computing and ICT services.	3.81	0.767
Cloud computing and ICT services have facilitated the adoption of sustainable transportation practices in my company.	3.48	1.064
My company has been able to optimize transportation routes and reduce fuel consumption in logistics due to the use of cloud computing and ICT services.	3.58	0.805
Cloud computing and ICT services have enabled my company to track and monitor the environmental impact of logistics operations.	3.6	1.094
The adoption of cloud computing and ICT services has enabled my company to reduce waste and emissions in warehousing and distribution.	3.61	1.104

My company has been able to better communicate its sustainability performance to stakeholders due to the adoption of cloud computing and ICT services.	3.61	1.104
Cloud computing and ICT services have influenced my company's long-term sustainability strategy and goals.	3.5	1.094
My company has been able to achieve a significant reduction in its environmental impact due to the adoption of cloud computing and ICT services in green supply chain management practices.	3.85	1.045

Table 9 impact of CC & ICT Service on company's GSCM practices related questions Responses

Source: Researcher's Survey, 2023

In this section respondents were asked to measure the impact of Cloud Computing and Information communication technology services on their green supply chain management practices, specifically Impacts on Green Procurement, Green Logistics and Green Production. The respondents agreed that their company have been able to reduce its environmental footprint in manufacturing due to the adoption of cloud computing and ICT services. Having a mean of **3.79.** Furthermore, Respondents also Agreed that Cloud computing and ICT services have helped their company to reduce waste and improve resource efficiency in production. Having a mean of **3.50**.

Regarding the compliance of environmental regulations and standards in production due to the adoption of cloud computing and ICT services, the respondents agreed on the better compliance of their organization's operations. Having a mean of **3.55**. Similarly, the respondents agreed that the use of cloud computing and ICT services have enabled their company to source sustainable materials and reduce the environmental impact of procurement processes. Having a mean of **3.77.**

In addition, Respondents agreed on the use of cloud computing and ICT services to evaluate the sustainability performance of their suppliers. as well as the reduction of their carbon footprint in transportation and logistics. with each having a mean of **3.7** & **3.81** respectively.

Respondents also agreed on the concepts such as adoption of sustainable transportation practices, optimization of transportation routes and reduction of fuel consumption in logistics & tracking and monitoring of the environmental impact of logistics operations due to the use of cloud computing and ICT services. They each have a mean of **3.48, 3.58 & 3.60** respectively.

The other key areas of GSCM where the respondents agreed on the impact of cloud computing and ICT services were the reduction of waste and emissions in warehousing and distribution, better communication of their sustainability performance to stakeholders & the influence on

the company's long-term sustainability strategy and goals. with each having a mean of **3.61, 3.61 & 3.50** respectively.

Finally, the respondents agreed on the significant reduction in their company's environmental impact due to the adoption of cloud computing and ICT services in green supply chain management practices. Having a mean of **3.85.**

The overall results indicate on positive impact of the cloud computing and ICT services on the company's green supply chain management operations, specifically green procurement, green logistics and green manufacturing. With an aggregate mean of **3.64.**

To further indicate the correlation between the green supply chain management practices and the Cloud computing and ICT services variables, a regression analysis was carried out after a variable transformation was carried out. Where the dependent variable question's responses were summed up as a single variable and similarly the independent variable question's responses were summed up as a single variable.

Where:

For the Dependent Variable

Organizational Green Supply Chain Management Practices with Respect to Green Sourcing / Procurement = The summation of responses from questions 12 & 19. Here the maximum score is **10**, indicating the presence of a strong green procurement / sourcing practices within the target organizations.

Organizational Green Supply Chain Management Practices with Respect to Green Logistics = The summation of responses from questions 14 & 16. Here the maximum score is **10**, indicating the presence of a strong green logistics practices within the target organizations.

Organizational Green Supply Chain Management Practices with Respect to Green Production = The summation of responses from questions 13 & 17. Here the maximum score is **10**, indicating the presence of a strong green production practices within the target organizations.

Similarly, For the independent Variable

The Role of Cloud Computing and ICT Services in Organizational GSCM Practices with Respect to Green Sourcing / Procurement= The summation of responses from questions 23,24 & 29. Here the maximum score is **15**, indicating the presence of a strong green procurement / sourcing practices within the target organizations.

The Role of Cloud Computing and ICT Services in Organizational GSCM Practices with Respect to Green Logistics = The summation of responses from questions 25,26,27 & 28.

Here the maximum score is **20**, indicating the presence of a strong green logistics practices within the target organizations.

The Role of Cloud Computing and ICT Services in Organizational GSCM Practices with Respect to Green Production = The summation of responses from questions 20,21 & 22. Here the maximum score is **15**, indicating the presence of a strong green production practices within the target organizations.

As per the above variable transformations, the below are the regression results.

Regarding Green Procurement/ Sourcing and the role of CC & ICT Services,

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.938[a]	.880	.879	.56392

Table 10 Regression Analysis on Organizational Green Procurement practices and the Role of CC & ICT Services

Source: Researcher's Survey, 2023

The coefficient of correlation denoted as the R value indicates a simple correlation and has a value of **0. 938**, as reflected in the "R" column. This value suggests a substantial level of correlation. The R-squared value, stated as a numeric representation in the "R Square" column, signifies the degree to which the variation in the dependent variable, namely Green Procurement/ Sourcing Practices, can be elucidated by the independent variable, specifically Cloud Computing and ICT Services. According to the available data, there is potential for the explanation of **88. 0%,** a notable and significant proportion.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	425.590	1	425.590	1338.332	.000[b]
	Residual	58.194	183	.318		
	Total	483.784	184			

Table 11 Analysis of Variance (ANOVA) Test for Organizational Green Procurement Practices and the role of CC & ICT Services

Source: Researcher's Survey, 2023

The statistical significance of the implemented regression model was tested. And the data reveals a statistically significant performance of the regression model in predicting the outcome variable, as indicated by a p-value of less than **0. 000** (i.e., "Sig" column) which is below the

customary threshold of **0. 05** This finding demonstrates that the model is a suitable fit for the given data.

The Linear Relation Ship b/n the Two Variables is further illustrated by the figure below, where both increments and decrements of the variables are mirrored by each other. This indicates a strong correlation in between.

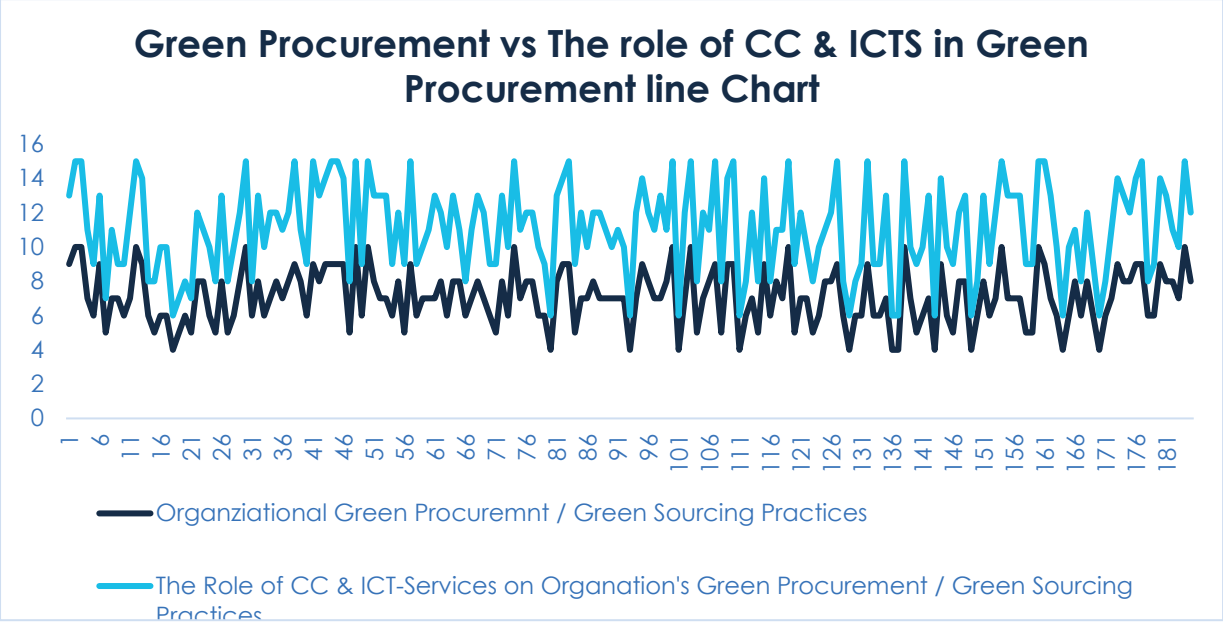

Figure 4 Green Procurement vs the role of CC & ICTS in Green Procurement line Chart

Source: Researcher's Survey, 2023

Regarding Green Logistics and the role of CC & ICT Services,

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.987[a]	.974	.974	.22545

Table 12 Regression Analysis on Organizational Green Logistics practices and the Role of CC & ICT Services

Source: Researcher's Survey, 2023

The coefficient of correlation denoted as the R value indicates a simple correlation and has a value of **0. 987**, as reflected in the "R" column. This value suggests a substantial level of correlation. The R-squared value, stated as a numeric representation in the "R Square" column, signifies the degree to which the variation in the dependent variable, namely Green Logistics Practices, can be elucidated by the independent variable, specifically Cloud Computing and ICT Services. According to the available data, there is potential for the explanation of **97. 4%,** a notable and significant proportion.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	349.639	1	349.639	6879.005	.000[b]
	Residual	9.301	183	.051		
	Total	358.941	184			

Table 13 Analysis of Variance (ANOVA) Test for Organizational Green Logistics Practices and the role of CC & ICT Services

Source: Researcher's Survey, 2023

The statistical significance of the implemented regression model was tested. And the data reveals a statistically significant performance of the regression model in predicting the outcome variable, as indicated by a p-value of less than **0. 000** (i.e., "Sig" column) which is below the customary threshold of **0. 05** This finding demonstrates that the model is a suitable fit for the given data.

The Linear Relation Ship b/n the Two Variables is further illustrated by the figure below, where both increments and decrements of the variables are mirrored by each other. This indicates a strong correlation in between.

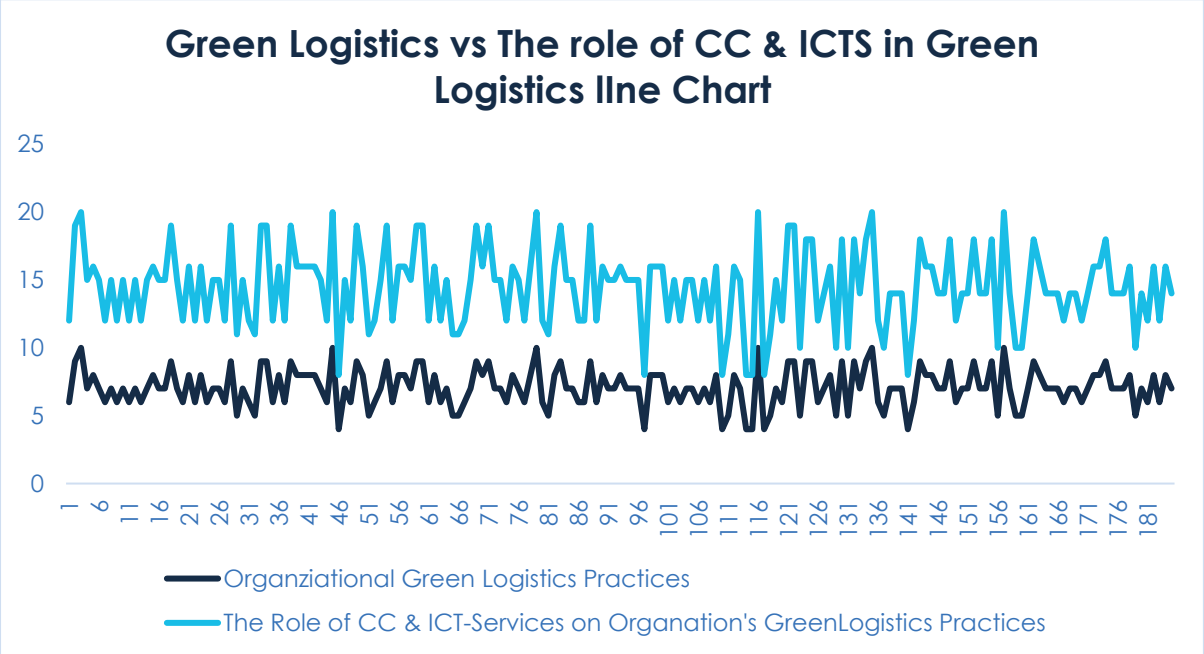

Figure 5 Green Logistics vs the role of CC & ICTS in Green Logistics line Chart

Source: Researcher's Survey, 2023

Regarding Green Production and the role of CC & ICT Services,

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.994[a]	.987	.987	.16718

Table 14 Regression Analysis on Organizational Green Production practices and the Role of CC & ICT Services

Source: Researcher's Survey, 2023

The coefficient of correlation denoted as the R value indicates a simple correlation and has a value of **0. 994**, as reflected in the "R" column. This value suggests a substantial level of correlation. The R-squared value, stated as a numeric representation in the "R Square" column, signifies the degree to which the variation in the dependent variable, namely Green Production Practices, can be elucidated by the independent variable, specifically Cloud Computing and ICT Services. According to the available data, there is potential for the explanation of **98. 7%,** a notable and significant proportion.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	397.447	1	397.447	14219.900	.000[b]
	Residual	5.115	183	.028		
	Total	402.562	184			

Table 15 Analysis of Variance (ANOVA) Test for Organizational Green Production Practices and the role of CC & ICT Services

Source: Researcher's Survey, 2023

The statistical significance of the implemented regression model was tested. And the data reveals a statistically significant performance of the regression model in predicting the outcome variable, as indicated by a p-value of less than **0. 000** (i.e., "Sig" column) which is below the customary threshold of **0. 05** This finding demonstrates that the model is a suitable fit for the given data.

The Linear Relation Ship b/n the Two Variables is further illustrated by the figure below, where both increments and decrements of the variables are mirrored by each other. This indicates a strong correlation in between.

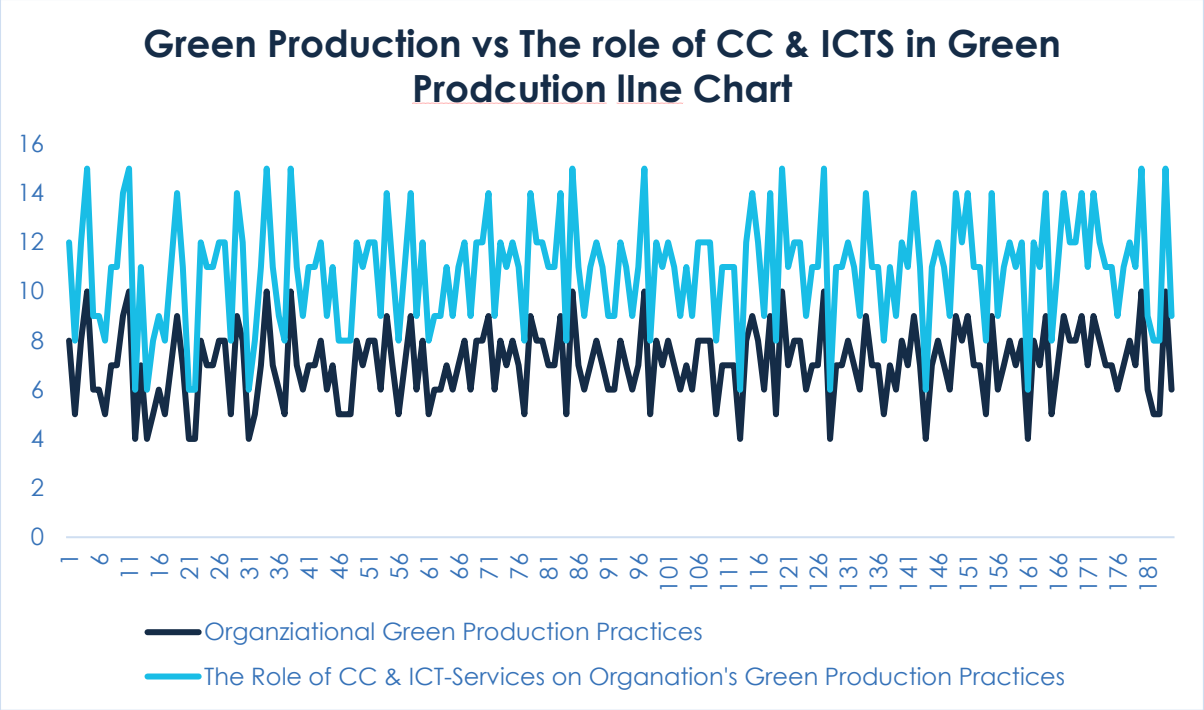

Figure 6 Green Production vs. the role of CC & ICTS in Green Production line Chart

Source: Researcher's Survey, 2023

Pearson's correlation coefficient is widely used in research and data analysis to assess the strength and direction of relationships between variables in various fields. It provides a standardized measure to assess the degree of association between variables, allowing researchers to quantify how closely related two variables are in a linear manner. This is valuable in understanding the nature and strength of the relationship between variables and exploring potential cause-effect relationships.(Field *et al.*, 2012)

		The Role of Cloud Computing and ICT Services in Organizational GSCM Practices with Respect to Green Sourcing / Procurement
Organizational Green Supply Chain Management Practices with Respect to Green Sourcing / Procurement	Pearson Correlation	.938**
	Sig. (2-tailed)	0
	N	185

Table 16 Correlation Analysis for Organizational Green Procurement Practices and the role of CC & ICT Services

Source: Researcher's Survey, 2023

As seen from the correlation table below, there exists a strong correlation between the Organizational Green Supply Chain Management Practices with Respect to Green Sourcing / Procurement and Cloud Computing & ICT Services.

		The Role of Cloud Computing and ICT Services in Organizational GSCM Practices with Respect to Green Logistics
Organizational Green Supply Chain Management Practices with Respect to Green Logistics	Pearson Correlation	.987**
	Sig. (2-tailed)	0
	N	185

Table 17 Correlation Analysis for Organizational Green Logistics Practices and the role of CC & ICT Services

Source: Researcher's Survey, 2023

As seen from the correlation table below, there exists a strong correlation between the Organizational Green Supply Chain Management Practices with Respect to Green Logistics and Cloud Computing & ICT Services.

		The Role of Cloud Computing and ICT Services in Organizational GSCM Practices with Respect to Green Production / Manufacturing
Organizational Green Supply Chain Management Practices with Respect to Green Production / Manufacturing	Pearson Correlation	.994**
	Sig. (2-tailed)	0
	N	185

Table 18 Correlation Analysis for Organizational Green Production / Manufacturing Practices and the role of CC & ICT Services

Source: Researcher's Survey, 2023

The linear relationship b/n the dependent and independent variables, i.e., GSCM practices: Denoted by GSCM_Score and the CC and ICT services is further illustrated by the following scatter and line plots.

4.1.5. Hypothesis Test

By utilizing the Coefficients from the Regression test, the study was able to test the hypothesis.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.688	.180		3.830	.000
	The Role of Cloud Computing and ICT Services in Organizational GSCM Practices with Respect to Green Sourcing / Procurement	.578	.016	.938	36.583	.000

Table 19 Regression Co-efficients for Organizational Green Procurement Practices and the role of CC & ICT Services

Source: Researcher's Survey, 2023

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.143	.085		1.676	.096
	The Role of Cloud Computing and ICT Services in Organizational GSCM Practices with Respect to Green Logistics	.479	.006	.987	82.940	.000

Table 20 Regression Co-efficients for Organizational Green Logistics Practices and the role of CC & ICT Services

Source: Researcher's Survey, 2023

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-.149	.062		-2.418	.017
	The Role of Cloud Computing and ICT Services in Organizational GSCM Practices with Respect to Green Production / Manufacturing	.664	.006	.994	119.247	.000

Table 21 Regression Co-efficients for Organizational Green Production Practices and the role of CC & ICT Services

Source: Researcher's Survey, 2023

As seen from the above tables, the existence of a positive beta with a statistical significance less than 0.05 is present. are leads to the conclusion that we will reject the null hypothesis., i.e., Hypothesizes **$H0_a$**, **$H0_b$** & **$H0_c$** will be rejected.

Hypothesis	**Interpretation**	**Beta**	**Sig Value**	**Results**
$H1_a$	CC&ICTS ⟶ GrenProc	0.578	0.000	Supported
$H1_b$	CC&ICTS ⟶ GrenLog	0.479	0.000	Supported
$H1_c$	CC&ICTS ⟶ GrenProd	0.664	0.000	Supported

Table 22 Hypothesis Test Summary

Source: Researcher's Survey, 2023

4.2.Discussions and Interpretations

The study aimed at investigating the existing origination Green Supply Chain management practices with respect to Green Procurement / Sourcing, Green Logistics and Green Production As well as the specific impact of Cloud Computing and ICT Services on each of these practices. In the study, **41. 8 %** of the total respondents were female, whereas the remaining **58.92 %** are male. With 54 % of the total respondents fall under the age Category 25-31. Furthermore, the majority of the respondents have at least a bachelor's degree, this account for the **80.54 %** of the total response. Whereas Graduate or professional degree and college diploma accounted for **17.3 %** and **2.16 %** respectively.

The Study's responses were grouped under two sections. The first examining the current GSCM practices. In the is section The data gathered shows that **92 %** of the total respondents

are aware of the term Green Supply chain management (GSCM whereas the remaining **8 %** were not aware of the term. Most of the respondents were segmented in the 1-5 Years of experience range which accounts to **62 %** of the total population, the 6-10 years of experience range & the Less than year of experience accounted for the **28 %** and **16 %** of the population respectively.

Weighted means were used to interpret the responses collected from the 5-point Likert style questions. The mean values were all above **3.40**, which is the least acceptable value to consider a metric / value to be an influential one as suggested by the literatures. The maximum mean recorded was **3.616** which belong to the organization's having a green supply chain management plan in place. Whereas the lowest mean recorded were **3.48** which belong to the organization having a program in place to promote sustainable transportation and logistics in the supply chain as well as the organization actively seeking out and collaborate with suppliers that have strong environmental performance.

The aggregated mean of **3.53** indicates on the presence of a strong Green Supply Chain management practices across the organizations.

The Second Section Examined the Role of Cloud Computing and ICT Services in Green Supply Chain Management Practices. Like the previous section, Weighted means were used to interpret the responses collected from the 5-point Likert style questions. The mean values were all above **3.40**, which is the least acceptable value to consider a metric / value to be an influential one as suggested by the literatures. The maximum mean recorded was **3.85** which belongs to the organization's being able to achieve a significant reduction in its environmental impact due to the adoption of cloud computing and ICT services in green supply chain management practices. Whereas the lowest mean recorded was **3.48** which belongs to the facilitation for the adoption of sustainable transportation practices in the company due to the cloud computing and ICT services

The aggregated mean of **3.64** indicated a positive impact of the cloud computing and ICT services on the company's green supply chain management operations, specifically green procurement, green logistics and green manufacturing.

A further illustration of the relationship b/n the Company's Green Supply Chain Management Practices with respect to Green Production, Green Logistics and Green Procurement and the cloud computing and ICT services was carried out through variable transformation and regression analysis.

The regression analysis b/n Organization's Green Procurement/ Sourcing practices and the role of CC & ICT Services had a coefficient of correlation of **0. 938** with the explanation of **88. 0%**

of the total observed variance. Furthermore, a beta value of **0.578** indicated the rejection of the null hypothesis (**$H0_a$**).

The regression analysis b/n Organization's Green Logistics practices and the role of CC & ICT Services had a coefficient of correlation of **0. 987** with the explanation of **97. 4%** of the total observed variance. Furthermore, a beta value of **0.479** indicated the rejection of the null hypothesis (**$H0_b$**).

The regression analysis b/n Organization's Green Production practices and the role of CC & ICT Services had a coefficient of correlation of **0. 994** with the explanation of **98. 7%** of the total observed variance. Furthermore, a beta value of **0.664** indicated the rejection of the null hypothesis (**$H0_c$**).

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This section presents the summary of major findings based on analysis performed on the previous chapter. Based on the findings, conclusions are made and recommendations from the author are reflected.

5.1.Summary of Major Findings

The research is aimed at investigating the impacts of Cloud computing and ICT services in organizational Green Supply Chain Management practices with respect to Green Logistics, Green Production and Green Procurement. The research Utilized Descriptive and Exploratory research designs to answer the specific research questions.

A total of 185 respondents from four companies participated in this research. Data gathered form the respondents were analyzed through the aid of SPSS v-27.

- The study had a Cronbach's alpha value of .801 indicating a higher reliability.
- All questions regarding the existing organizational GSCM practices had a mean value above 3.4, with an aggregate mean of **3.53**. This indicates that there exists a strong GSCM practices on the organizations.
- Organization's green procurement/ Sourcing practices are reflected through acts such as
    - Having a process for evaluating the environmental performance of the suppliers.
    - Actively seeking out and collaborating with suppliers that have strong environmental performance.
- Organization's green logistics practices are reflected through acts such as
    - Having a program in place to promote sustainable transportation and logistics in the supply chain.
    - Having a target /goal to reduce the carbon footprint across the supply chain.
- Organization's green production practices are reflected through acts such as
    - Utilizing Environmentally friendly processes and technologies in production.
    - Having a system in place to manage and recuse waste across the supply chain.
- All questions regarding the role of Cloud computing and ICT services on organizational GSCM practices had a mean value above 3.4, with an aggregate mean of **3.64**. This

indicates that there exists a positive influence of Cloud Computing and ICT service on the GSCM practices of the organizations.

- The Role of Cloud Computing and ICT Services in Organizational GSCM Practices with Respect to Green Sourcing / Procurement are reflected through acts enabling the
    - Better sourcing of sustainable materials and reduction of the environmental impact of the procurement operation.
    - Better evaluation of the sustainability performance of their suppliers.
- The Role of Cloud Computing and ICT Services in Organizational GSCM Practices with Respect to Green Logistics are reflected through acts enabling the
    - Reduction of the carbon footprint in transportation and logistics.
    - Facilitation for the adoption of sustainable transportation practices.
    - Optimization of transportation routes and reduction of fuel consumption.
    - tracking and monitoring of the environmental impact of logistics operations.
    - Reduction of waste and emissions in warehousing and distribution.
- The Role of Cloud Computing and ICT Services in Organizational GSCM Practices with Respect to Green Logistics are reflected through acts enabling the
    - Reduction of the environmental footprint.
    - Reduction of waste and improvement of resource efficiency.
    - Better compliance with environmental regulations and standards.
- The regression analysis b/n Organization's Green Procurement/ Sourcing practices and the role of CC & ICT Services had a coefficient of correlation of **0. 938** with the explanation of **88. 0%** of the total observed variance.
- The regression analysis b/n Organization's Green Logistics practices and the role of CC & ICT Services had a coefficient of correlation of **0. 987** with the explanation of **97. 4%** of the total observed variance.
- The regression analysis b/n Organization's Green Production practices and the role of CC & ICT Services had a coefficient of correlation of **0. 994** with the explanation of **98. 7%** of the total observed variance.

5.2.Conclusion

In order to fulfill the research objectives and the answer the research questions, the data collected went through rigorous testing and analyses. Based on this the below conclusion is made.

There exists a strong Organizational Green supply chain management practices specifically green Logistics, green procurement, and green production in the target organizations, with at least one practices being present. Such practices are supported by the presence of cloud computing and ICT services. The study indicated that Cloud computing and ICT services positively impact the organization’s GSCM practices.

5.3.Recommendations

Based on the study's findings, which showed a positive correlation between CC and ICT services and GSCM practices in target organizations. The below recommendations are made. These suggestions are meant to enhance supply chain operations' efficiency, sustainability, and environmental performance.

- With the ever-growing need for sustainable business practices, Organizations should incorporate their Cloud Computing and ICT infrastructure with their green supply chain management operations.
- Business engaged in procurement of goods and services should utilize Cloud computing and ICT services as it allows them to reduce their environmental impact and source sustainable materials.
- Business engaged in logistics operations should utilize Cloud computing and ICT services as it allows them to reduce fuel consumption and optimization of routes.
- Business engaged in production / manufacturing operations should utilize Cloud computing and ICT services as it allows them to implement environmentally friendly technologies and methods as well as result in better efficiencies.

In conclusion, it is advised that organizations actively embrace, integrate, and leverage these technologies within their supply chain operations based on the positive correlation found between Cloud Computing (CC) and Information Communication Technology (ICT) services with Green Supply Chain Management (GSCM) practices. Companies may improve their sustainability efforts and generate good environmental results throughout the supply chain by

promoting cooperation, investing in ICT infrastructure, taking environmental effect into account, encouraging supplier participation, and putting performance assessment tools in place. As the research is based on several target organizations, the application of these recommendations should be adapted and tailored to the specific context and requirements of each organization.

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Annex

Questionnaire

Addis Ababa University

College of Business and Economics

School of Commerce

Department of Logistic and Supply Chain Management

Questionnaires to be filled by Employees and the Management

Dear Participants

I would like to express my heartfelt appreciation, in advance, for taking time to fill out the questionnaire. The questionnaire is designed for the preparation of a research for the fulfilment of MA degree in Logistic and Supply Chain Management. The purpose of this questionnaire is assessing the impact of Cloud Computing and IT Services in green Supply Chain Management Practices across several target organizations.

In this study, the concept of Green Supply Chain Management practices can be exhibited in various forms, such as green purchasing, green manufacturing, and green logistics. Green purchasing involves selecting suppliers based on their environmental performance and sustainability practices. Green manufacturing involves adopting environmentally friendly processes and technologies in production. Green logistics involves adopting environmentally friendly practices in transportation, warehousing, and inventory management.

Be confident that the information you provide will be kept and used only for academic research purpose. So, you are kindly requested to give your genuine answer and respond to each of the information.

Yours Sincerely

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Section 1 : Demographic Profile of the respondent

1. Please Select your Age Range

    a) 18-24
    b) 25-34
    c) 35-44
    d) 45-54
    e) 55 or older

2. Please select your gender

    a) Male
    b) Female

3. What is your highest level of education completed?

    a) Less than high school
    b) High school diploma or GED
    c) Some college or associate degree
    d) Bachelor's degree
    e) Graduate or professional degree

4. What is your current position in your organization?

    a) Non-Supervisory Role
    b) Supervisory Grade
    c) Managerial role
    d) Other

Section 2: Respondent's Awareness Related Questions

5. To which organization are you affiliated with?

    a) Ethiopian Airlines
    b) UNOPS
    c) MOENCO
    d) ABIG
    e) Coca-Cola Sabco

6. How many years of total experience do you have in the field of Logistics and Supply Chain Management.

    a) Less than 1 year
    b) 1-5 years
    c) 6-10 years
    d) 11-20 years

e) More than 20 years

7. Have you heard of the term “green supply chain management”?

    a) Yes
    b) No

8. How many years of total experience do you have in the field of Green Logistics and Supply Chain Management.

    f) Less than 1 year
    g) 1-5 years
    h) 6-10 years
    i) 11-20 years
    j) More than 20 years

Section 3 : Organization related Questions

9. Which of the following green supply chain operations is your company associated with?

    a) Green Logistics
    b) Green Procurement
    c) Green Manufacturing
    d) All
    e) None

10. What is the Level of integration of green Supply chain management operations in the company’s core values?

    a) There is no integration.
    b) There is weak integration.
    c) There is a moderate integration.
    d) There is a strong integration.

This Section Contains Set of Question to be answered in a comparative manner, hence, indicate your level of agreement using a 5-point Likert scale where:

1 = Strongly disagree 3 = Neutral 5 =Strongly Agree

2 = Disagree 4 = Agree

No	Questions	Response				
		1	2	3	4	5
11.	My organization currently have a green supply chain management plan in place.					
12.	My organization have a process for evaluating the environmental performance of its suppliers.					
13.	My organization practices environmentally friendly processes and technologies in production.					
14.	My organization have a program in place to promote sustainable transportation and logistics in the supply chain.					
15.	My organization actively tracks and measures the environmental impact of its supply chain operations.					
16.	My organization have a target or goal for reducing its carbon footprint in the supply chain.					
17.	My organization have a system in place for managing and reducing waste in the supply chain.					
18.	My organization have a communication plan in place to inform stakeholders about its green supply chain management practices.					
19.	My organization actively seek out and collaborate with suppliers that have strong environmental performance.					

Section 4: Cloud and ICT Services Related Questions

This Section Contains Set of Question to be answered in a comparative manner, hence, indicate your level of agreement using a 5-point Likert scale where:

1 = Strongly disagree 3 = Neutral 5 =Strongly Agree

2 = Disagree 4 = Agree

No	Question	Response				
		1	2	3	4	5
20.	My company has been able to reduce its environmental footprint in manufacturing due to the adoption of cloud computing and ICT services.					
21.	Cloud computing and ICT services have helped my company to reduce waste and improve resource efficiency in production.					
22.	My company has been able to better comply with environmental regulations and standards in production due to the adoption of cloud computing and ICT services.					
23.	The use of cloud computing and ICT services has enabled my company to source sustainable materials and reduce the environmental impact of procurement processes.					
24.	The use of cloud computing and ICT services has enabled my company to evaluate the sustainability performance of our suppliers.					
25.	My company has been able to reduce its carbon footprint in transportation and logistics due to the adoption of cloud computing and ICT services.					
26.	Cloud computing and ICT services have facilitated the adoption of sustainable transportation practices in my company.					
27.	My company has been able to optimize transportation routes and reduce fuel consumption in logistics due to the use of cloud computing and ICT services.					
28.	Cloud computing and ICT services have enabled my company to track and monitor the environmental impact of logistics operations.					
29.	The adoption of cloud computing and ICT services has enabled my company to reduce waste and emissions in warehousing and distribution.					
30.	My company has been able to better communicate its sustainability performance to stakeholders due to the adoption of cloud computing and ICT services.					
31.	Cloud computing and ICT services have influenced my company's long-term sustainability strategy and goals.					
32.	My company has been able to achieve a significant reduction in its environmental impact due to the adoption of cloud computing and ICT services in green supply chain management practices.					

Any addition feedback/comments you want to mention with respect to the Green Supply Chain management practices of your company.

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_____
_____

Thank you for your Valuable Time and Effort!

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