ASSESSING THE IMPACT OF SUSTAINABLE SUPPLY CHAIN MANAGEMENT ON HEALTHCARE PERFORMANCE

KWADWO OWUSU BEMPAH

(Doctor of Philosophy)

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Dedication

I dedicate this thesis to my family and Dr. Matthew Opoku Prempeh for their love and support.

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ABSTRACT

Sustainable supply chain management practices (SSCMP) play a crucial role in an organisation's sustainable performance especially healthcare in fulfilling healthcare delivery. For an organisation to achieve sustainable performance (triple bottom line), identifying the right determinants of sustainability will contribute significantly toward the attainment of that objective. Despite the notoriety of sustainable supply chain management practices due to the COVID-19 pandemic's massive disruptions, determinants for SSCMP remain under-researched. This study seeks to bridge these gaps by integrating the dynamic capability theory perspective to develop a novel structural equation model examining sustainability-oriented leadership (SoL) and supply chain capabilities (SCC) as determinants of sustainability supply chain practices for facilitating sustainable healthcare performance (SHP). The structural equation modeling technique was employed for the data collected from 550 healthcare professionals in Ghana. The results demonstrate that sustainability-oriented leadership and supply chain capabilities drive sustainable supply chain practices which further enable sustainable healthcare performance. Furthermore, SCC and SSCMP without mediation positively influence sustainable economic performance (SEP), environmental sustainable performance (ESP) and sustainable social performance (SSP), however, SoL directly positively influences SEP and SSP but negatively influences ESP. For managers, the relevance of driving sustainability initiatives and adopting impactful supply chain capabilities for value addition and sustainable performance is highlighted. We reveal that the determinants will lead to SSCMP which further leads to the triple bottom line. The study also introduces a new set of determinants for SSCMP which can be further examined in future studies.

Keywords: Sustainability, supply chain, healthcare, sustainability-oriented leadership, supply chain capabilities, supply chain practices, economic, environmental, and social performance.

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GLOSSARY

Abbreviation	Description
AMOS	Analysis of Moment Structure
ASC	Agile Supply Chain
AVE	Average Variance Extracted
BDA	Big Data Analytics
CC	Cloud computing
CDC	Center for Disease Control
CE	Circular Economy
CFA	Confirmatory Factor Analysis
CFI	Confirmatory Fit Index
CHPS	Community-based Health Planning and Services
CMIN/DF	Chi-square Degrees of Freedom
CPS	Cyber-Physical Systems
CSC	Consolidated Service Centre
CSCMP	Council of Supply Chain Management Professionals
CSR	Corporate Social Responsibility
DCT	Dynamic Capabilities Theory
DO	Delivery Order
DWLS	Diagonally Weighted Least Squares
EDL	Essential Drug List
EFA	Exploratory Factors Analysis
EPA	Environmental Protection Agency
ESP	Environmental Sustainable Performance
GDP	Gross Domestic Product
GLS	Generated Least Squares
GFI	Goodness-of-fit
GHS	Ghana Health Service
GP	General Practice
GPO	Group Purchasing Organisation
HCW	Health Care Workers
IDN	Independent Delivery Networks

IHI	Institute for Healthcare Improvement
ILO	International Labour Organisation
IoT	Internet of Things
IS	Information System
IT	Information Technology
IV	Instrument Variables
LCA	Life Cycle Impact Assessment
LISREL	Linear Structural Relations
LM	Lean Management
LMIC	Low-and-Middle Income Countries
LPI	Logistics Performance Index
MDG	Millenium Development Goals
MLE	Maximum Likelihood Estimator
NCIRD	National Centre for Immunization and Respiratory Disease
NGO	Non-Governmental Organisations
ONDCP	Office of National Drug Control Policy
OOP	Out-of-Pocket
P&SCM	Purchasing and Supply Chain Management
PHC	Public Health Clinics
PO	Purchase Order
POC	Point of Care
PPE	Personal Protective Equipment
RBV	Resource-based View
RMSEA	Root Mean Square Error of Approximation
ROE	Return on Equity
ROI	Return on Investment
SCC	Supply Chain Capabilities
SCM	Supply Chain Management
SCPM	Supply Chain Performance Measurement
SCR	Supply Chain Resilience
SDG	Sustainable Development Goals
SDP	Service Delivery Points
SEM	Structural Equation Modeling
SEP	Sustainable Economic Performance

SHP	Sustainable Healthcare Performance
SME	Small and Medium Enterprise
SOL	Sustainability-oriented Leadership
SRM	Supplier Relationship Management
SRMR	Standardized Root Mean Square Residual
SSC	Sustainable Supply Chain
SSCM	Sustainable Supply Chain Management
SSCP	Sustainable Supply Chain Practice
SSP	Social Sustainable Performance
SSP	Strategy-Structure-Performance
STG	Standard Treatment Guidelines
TBL	Tripple Bottom Line
TCE	Transaction Cost Economies
TLI	Tucker and Lewis Index
TSLS	Two-Stage Least Squares
ULS	Unweighted Least Squares
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNCSD	United Nations Conference on Sustainable Development
UNCTAD	United Nations Conference on Trade and Development
UNEP	United Nations Environmental Programme
UNICEF	United Nations Children's Fund
UNMS	United Nations Millennium Summit
VMI	Vendor Managed Inventory
WEEE	Waste Electrical and Electronic Equipment
WLS	Weighted Least Squares
WHO	World Health Organisation
WSSD	United Nations World Summit on Sustainable Development

CHAPTER ONE: INTRODUCTION

1.1 Outline of the research

This chapter presents an introduction to this thesis and is divided into six broad sections. First, an overview of the research context of sustainable healthcare supply chain is briefly introduced (1.2), followed by the purpose and research questions (1.3). The objectives, scope and contribution of the study are then introduced (1.4), followed by the research design (1.5) and an overview of the thesis structure (1.6).

1.2 The research context – sustainable healthcare supply chain management

The rapid industrial growth has put doubt among legislators and decision-makers about negative environmental and social impacts worldwide (Gadenne et al., 2009). Elkington (1997) promoted the triple bottom line (TBL) of sustainable development in which companies are encouraged to follow a responsible approach and offer equivalence in decision-making to environmental, social, and economic aspects. Sustainability according to the definition by the United Nations Brundtland Commission in 1987 is “meeting the needs of the present stakeholders without compromising the ability of future generations to meet their own needs.” Carter and Rogers (2008) defined sustainability as the strategic, transparent, integration and achievement of social, environmental, and economic goals in the systemic coordination of key inter-organizational business processes for improving the long-term economic performance of the individual company and its supply chains. The sustainability of supply chain management (SCM) has been topical (Ashby et al., 2012) as it enables organisations to achieve greater efficiency in logistics performance and resource utilisation (Gold et al., 2010; Carter et al., 2011). Organisations have become increasingly well-informed about sustainable SCM (SSCM), through which they can gain competitive advantages (Genovese et al., 2017). International organisations such as Nike, Huawei and Mahindra Satyam accepted and applied SSCM in their industries (Gunasekaran et al., 2015). This success has made SSCM a subject of interest to academics and other researchers (Seuring and Müller, 2008; Pagell and Gobeli, 2009; Carter et al. 2011; Ahi and Searcy, 2013; Pagell and Shevchenko, 2014; Li et al., 2015; Marshall et al., 2015; Ferreira and Meidutė-Kavaliauskienė, 2019). Supply chain management (SCM) has emerged as one of the key strategies adopted by organisations to reduce costs and improve economic performance in today's ever-more competitive market. As a result, businesses need to modify their supply chain (SC) models considering recent difficulties like environmental protection, firm transparency, employee benefits, and security worries. To achieve harmony with nature, they must create environmentally friendly supply chains rather than concentrating simply on economic performance. Major institutions across the globe have already started implementing a variety of sustainable supply chain management (SSCM) techniques to increase their sustainable advantages (Hong, Zhang and Ding, 2018).

Sustainable supply chain management (SSCM) practices have been defined as in-house or outsourced procedures that manage suppliers, perform internal operations and handle customers to achieve sustainability goals and reduce the risk of hitting SSCM barriers (Yang, 2013). Researchers have tried to evolve supply chain management (SCM) within the context of sustainable development to explore sustainable supply chain management (SSCM) (Pagell & Wu, 2009; Tseng et al., 2015). SSCM combines the objectives of green or environmental supply chain management (GSCM/ESCM) and corporate social responsibility (CSR) to assist institutions achieve their performance (triple bottom line) (Elkington, 1998). The SSCM practices in developing countries are comparatively underdeveloped; which is why research in such countries is still scanty (Esfahbodi et al., 2016; Galal & Moneim, 2016; Kim et al., 2011; Silvestre, 2015a). This under-development is because emerging and developing economies' supply chains face relatively more sustainability barriers than those that operate in developed countries (Silvestre, 2015b). A study also argues that firms encounter new challenges and opportunities in the adoption of environment-friendly procedures (Murillo-Luna et al., 2011) and social practices (Köksal et al., 2017). Essentially, sustainable supply chains should implement such organisational practices and procedures, that align with these three pillars of sustainability, i.e., social, environmental, and economical, to create a balance among them. Failing to meet this will lead to unsustainable supply chains (Das, 2017b). Organizational sustainability cannot be achieved unless SSCM practices are integrated. Similarly, the ecological benefits of an organization tend to diminish if the supply chain participants are not engaged in sustainability practices (Özçelik & Öztürk, 2014). Research studies on SSCM practices show how firms incorporate sustainability practices into their traditional supply chains, but underlying barriers hinder such initiatives (Giunipero et al., 2012; Jia et al., 2018). These SSCM practices include but are not limited to environmental practices, social practices for employees and communities, operational practices, and supply chain integration (Das, 2017b). Environmental initiatives consist of practices like senior managers' commitment to eco-friendly SCM, middle management's support, collaboration, total quality environment management, conservational compliance and audits, accreditation of IS0-14001 or similar environment management systems, green product design, non-pollutant production, and green reusable packaging, suppliers' ISO 14001 certification, etc. (Sarkis et al., 2011; Zhu and Sarkis 2004; Zhu, Sarkis, & Geng, 2005; Zhu, Sarkis, & Lai, 2007, 2008).

In supply chains, social issues management is lagging far behind (Klassen & Vereecke, 2012). The social aspect of SSCM is influenced by the corporate social responsibility (CSR) practices of the firms. Economic and working conditions, equity and education of employees, health and safety of society and employees, and benefits to the surrounding community are the specific issues affected by businesses, and the latter cannot neglect this impact (Das, 2017a). Understanding and considering the interrelationship among social issues like human rights, safety, diversity, and the environment is an essential element of Corporate social responsibility (CSR) and necessary for incorporating sustainability in the supply chain (Carter et al., 2011; Emamisaleh & Rahmani, 2017). Numerous activities related to multiple functions within and outside the organization make the supply chain process complex. Flynn et al. (2010) elaborated supply chain integration (SCI) as “the degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages Intra- and inter-organization processes.” SCI functions include abolishing communicational barriers and solutions to problems through monitoring coordinating and control processes (Swink et al., 2007; Walton et al., 1998). SCI is deemed to be a crucial factor for sustainable supply chain performance as well (Abdul-Rashid et al., 2017; Afum et al., 2020; Hendijani et al., 2020).

Effective practices in healthcare supply chain management have proven to bring back results such as improvement in operation efficiencies and reduced costs and all these will improve the quality of care. In addition, to give the best quality of care to the customers, adequate and accurate medical supply is needed to provide the services by taking the customer needs into account. The persistent barriers or limitations continue to impede effective supply chain practices and sustainable healthcare performance (Adnan and Sahroni, 2009). This is because supply chain management is complex in healthcare. Two crucial issues need to be managed effectively such as healthcare services and costs to make sure the best quality is met. In terms of services, adequate supplies of medication for pharmacies need to be ensured to meet high standards of care for patients, while the operation cost needs extra careful estimation for hospital supplies. This has led to calls in the popular management press for the development of more sustainable supply chains (Linton and Vakil, 2020, p.1) and the development of supply chain recovery scenarios and approaches (Simchi-Levi, 2020). Amongst the approaches suggested in popular management press for improving resilience and developing a recovery plan are collaborating with suppliers (Linton and Vakil, 2020, p. 2) and accelerating technology implementation (Van Hoek and Lacity, 2020).

1.3 Research Questions

A sustainable supply chain (SSC) is the detailed approach to effectively manage an organization's supply chain to achieve equilibrium among economic, social, and environmental considerations (Yousefi and Tosarkani, 2022; Hohn and Durach, 2023; Seuring et al., 2022; Dubey et al., 2015). The important point lies in establishing, safeguarding, and augmentation of enduring environmental, social, and economic worth for all parties involved in introducing products or services to the market (Hohn and Durach, 2023). By incorporating sustainable operational concepts into the management of supply chains, organizations can effectively mitigate immediate risks and lower expenses (Sharma et al., 2021). Despite the benefits associated with SSC, several economic, environmental, and social difficulties often confront hospital supply chains. From a financial point of view, increasing healthcare expenditures demand greater efficiency in the delivery of services (Kumar and Blair, 2013; Weisz, 2011). The Organization for Economic Co-operation and Development has estimated that hospitals account for approximately 40% of total health expenditures (OECD, 2017). Between 30% and 40% of a hospital´s budget is dedicated to supply chain costs (Landry, Beaulieu, and Roy, 2016), which can be reduced by up to 8% through best practices (McKone-Sweet and Hamilton, 2005); Willis. In addition, said best practices allow clinical personnel to focus on their core mission of caring (Landry, Beaulieu, and Roy, 2016). Regarding the environmental dimension, hospital processes and services are intensive in terms of material, energy, and water consumption, generate significant amounts of waste (especially toxic waste, as compared to other sectors), and account for a large carbon footprint (Weisz, 2011; Zhu, Johnson and Sarkis, 2018; Pisters et al., 2017). In England, for instance, the Sustainable Development Unit of the National Health Service has calculated that healthcare's footprint represents 39% of public sector emissions, from which procurement contributes 57%, energy contributes 18%, travel contributes 13%, and others account for 11% (Sustainable Development Unit-NHS-UK, 2018). Moreover, acute services are responsible for the largest portion, which is approximately 50% of the total. Social problems related to hospital supply chains are also tangible. From an internal perspective, although hospitals are large-scale employers, non-standard forms of employment are frequent, pay levels have decreased in comparison to other economic sectors, women are compensated worse and recognized less often than men, daily working hours exceed legal limits, and safety considerations are often neglected (International Labour Organization, 2020; Manyisa and van Aswegen, 2017). Work characteristics such as shift work and long working hours not only increase the likelihood of occupational accidents and developing burnout and additional psychological stress than in other jobs (Weisz, 2011; da Siva et al., 2019; Wagstaff and Lie, 2011), but also impact the quality of patient care (Weigl and Schneider, 2017; Stone et al., 2007). From an external standpoint, hospitals have a deep impact on the population because health services influence, in one way or another, peoples' quality of life.

Nevertheless, reported global problems include unsatisfactory health service coverage for the needs of the population, in terms of access and delivery (International Labour Organization, 2020). The assertions made by proponents of supply chain management led to the development of three research questions that served as the purpose of this study. The main purpose of this study is to advance theory on the links between sustainable supply chain management practices and sustainable performance and proffer recommendations to re-engineer the healthcare supply chain to become sustainable addressing the questions below. The three questions set for the study are:

RQ1: What are the determinants of sustainable supply chain practice in the public health sector?

RQ2: What framework could be developed to measure the determinants of sustainable supply chain management practice in the health sector?

RQ3: Which strategies could be developed to re-engineer the supply chain management practices to achieve the desired sustainability for improvement in performance in public healthcare?

Universal health coverage can only be achieved when there is affordable access to safe, effective and quality medicines and health products (WHO, 2024). World Health Organization (WHO) estimates that health, nutrition, growth, and other factors are at levels considerably lower than in more developed countries (WHO, 2014). Arvis et al. (2014) state that among the explanations for the situation are bottlenecks in logistical systems. To solve the current situation, many problems must be addressed; that is, the efficiency of logistical systems must be improved so that the supply of food and medicines flows smoothly. In addition, infrastructural factors, the quality of education, and political circumstances must be considered (Logistics Performance Index, 2014). According to Carter and Rogers (2008) institutions that engage in sustainable supply chain (SSC) practices achieve higher economic, social, and environmental performance compared to businesses that focus solely on economic performance. Quality healthcare commodities such as surgical supplies, medical devices, and pharmaceuticals should be readily available in adequate quantities to meet the needs of clients (Marks, 2011). The availability of requirements and low cost of transport services compared to the cost of maintaining inventory prompted organizations during the 1990s and the first part of the 21st century to prioritize quick, regular delivery to consumers through means such as just-in-time delivery (Russell, 2014). Volland et al. (2017) report that stockout of anything that could deter clinicians from discharging their duties such as essential medicines and other healthcare logistics at the point of need could be detrimental to a patient’s life which when lost cannot be brought back. Healthcare providers do not see any compelling reasons to optimize logistics costs as group purchasing organisations

(GPO) dominate the transactional as well as the operational side of logistics operations (Kwon and Hong, 2011). Transportation and inventory costs in the supply chain are a major component of overall supply chain cost ($1.45 trillion, 8.3% of GDP in 2014) (CSCMP, 2015). Nevertheless, decision-makers in the healthcare industry have not paid much attention to these areas. Manso, Annan, and Anane (2013) report that studies have shown that 30% to 46% of hospital expenses are invested in various logistical activities and that almost half of the costs associated with supply chain processes could be eliminated using best practices. In addressing the research question and thoroughly reviewing the operations and supply chain management literature to establish the gaps in identifying the right determinants, the n

1.4 Objectives of the study

As the major research gaps in the SSCM literature have been established and classified, the study's objectives must be explicitly defined. The goals of this analysis are triple. Specifically, this study seeks to determine the impact of SSCM practices on public healthcare performance in the Ashanti region of Ghana and accordingly recommend better alternatives for improvement. Shrivastava (1995a, p.955) outlines that, “by systematically addressing these long-term (sustainability) issues early, companies can become aware of and manage these risks” associated with scarcity in natural resources used as inputs to the supply chain and fluctuations in energy costs. Furthermore, constructive involvement in sustainable activities decreases the likelihood of new and expensive legislation being implemented (Porter and van der Linde, 1995). The definition of the value chain explains the chain of operations that a company must conduct to provide its clients or consumers with a product or service. A well-constructed value chain produces more value than the value chain's number of individual activities (Porter, 1985). Like every other area in healthcare, performance enhancement depends on developing and achieving common objectives that unite all stakeholders (Mofidi et al., 2016). Therefore, the objective of accomplishing the triple targets of being more efficient, more environmentally friendly, and offering better conditions to both workers and communities served, leads to the subjects of SSCM practices and sustainable performance. Regardless of how the practices are defined, whether as organizational routines, rules, or standard procedures (Parmigiani, 2011), best practices are linked to the objective of that which is recognized as superior by a majority (Landry, Beaulieu and Roy, 2016). In other words, poor performance can be considered a consequence of a lack of best practices (Adebanjo, Laosirihongthong and Samaranayake (2016).

The specific objectives of the study are:

RO1: To develop a framework to reveal the determinants of sustainability of the public health care supply chain system in Ghana.

RO2: To measure the determinants of sustainable supply chain management practice in the health sector using the framework.

RO3: To develop strategies to re-engineer a sustainable public healthcare system supply chain in the Ashanti region.

The answers to these research objectives will help to determine why the health sector needs to prioritize supply chain sustainability which could ensure accessible, effective, and efficient quality healthcare. Everard (2001) examined that lack of improvement in the supply chain may be due to the lack of senior managers, he suggested that an effective supply chain manager can learn from best practices in other industries, has a broad business education, an understanding of supply chain drivers and influencers, and the ability to participate in strategic thinking and influence the company. Stimson (2002) illustrates a profile of leadership skills in procurement performance, which includes: consistent implementation of performance metrics; leadership capacity; ability to apply strategic and governance principles; awareness and ability to navigate organizational structure; ability to integrate through the enterprise; commitment to the management and creation of procurement resources; and the potential for organizational structure. As outlined by Fawcett and Magnan (2001), "supply chain education and training are one of the unique conditions for success in the implementation of supply chain." Lastly, the lack of success in SCM was attributed to the fact that each link in the supply chain of healthcare institutions operates solely in its own best interests (Everard, 2001). Although most healthcare professionals typically accept that reform is required, the uncertainty of making the first step restricts progress.

1.4.1 Significance of the research

In many sectors, substantial changes have been made in supply chain management, but there has been little progress in the healthcare industry in making system-wide supply chain management improvements. Still, there is substantial evidence that wider reforms are needed in this industry "Without healthcare, how can children reach their full potential? And without a healthy productive population, how can societies realize their aspirations?" according to UNICEF Executive Director. "Universal health coverage can help level the playing field for mankind today and help them break intergenerational cycles of poverty and poor health tomorrow " (World Health Organization, 2017). In healthcare services, resilience is more important than in manufacturing because failure to provide patients with timely care could have fatal consequences on them (Mandal, 2017). The accessibility and affordability of quality healthcare cannot be achieved without the availability of quality healthcare commodities (Grol, 2001). The Pricewaterhouse Health Research Institute reported in 2008 that more than $1.2 trillion out of $2.2 trillion spent on healthcare each year is a waste of money (Kavilanz, 2009). Progress in the implementation of supply chain strategies in the entire supply chain arena of healthcare has been painfully slow (Dacosta-Claro, 2002; Oliveira and Pinto, 2005).

According to Cohen and Illingworth (2003), while Ghana has made strides in improving public health, the country has urgent and severe health needs that the current system cannot meet. Amegashie-Viglo and Kotei (2014) demonstrated that successful supply chain management in Ghana would influence and improve virtually all business processes, such as data quality, reduced operational complexity, product selection, procurement, warehousing, and delivery. Despite the critical roles supply chain management plays in the commercial sector, the health sector and specifically Ashanti regional medical store in supplying medicines, surgical supplies, medical devices, pharmaceuticals, and non-drug commodities to all the public and some private hospitals is grappling with adequate supplies. WHO describes access to healthcare and medicines as a priority for people and must always be available and accessible in adequate amounts, in acceptable dosages, consistent and at an affordable price for individuals and communities (Mark, 2009; Yadav et al., 2011). To ensure that people have access to essential medicines and non-medicine commodities needed, a functioning supply chain must be implemented strategically which includes procurement, appropriate logistics management, and effective transportation (Yadav et al., 2011).

Mazzocato et al. (2010) claim that hospital managers have also implemented various tools and methods of lean management allowing a continuous improvement approach, yet it continues to lag the commercial sector. Significant results were achieved in reducing errors; improving process quality and reducing wait times. The healthcare sector has changed enormously in response to the increased competition, the growing influence of patients, and the necessity to deliver health services more efficiently and effectively (Aptel and Pourjalali, 2001; de Vries and Huijsman, 2011). Focusing more on sustainable supply chain management (SSCM) at the regional medical stores which are the sources of these essential logistics at various health facilities will help save many lives. Supply chain principles call for optimizing its operations throughout the supply chain arena and enabling an environment where supply chain surplus can be created. Evidence shows supply chain indeed creates a surplus for the entire supply chain operations (Duffy, 2009; Poirier et al. 2010; PRTM, 2010). The connection of supply chain management is to improve operational efficiency while enhancing responsiveness to customers (patients). Consequently, there is currently limited comprehensive review of SSCM at hospitals towards building resilience and sustainability in the healthcare sector. Kwon and Hong (2011) examined how two supply chains differ, which can provide a basis for further study. This study fills the investigative gap. The findings of this study will contribute immensely to authorities in developing, monitoring, supervising and evaluating measures to remove any bottlenecks along the supply chain to ensure timely availability and visibility of supplies. The study will help authorities of both the regional health directorate and the regional medical store to intensify sustainability measures. The findings of the study will help to eliminate if not reduce stock-outs, and avoidable wastage, make the supply system more sustainable and robust to save the lives of my fellow Ghanaians and make the country's healthcare system better. Evidence indicates that the supply chain typically produces a surplus for the whole supply chain activities (Duffy, 2009; Poirier et al., 2010; PRTM, 2010). In conclusion, the topic is worthy of investigation because of the pivotal role regional medical stores play in saving lives and anything that hinders this service must be critically analysed and dealt with as a matter of urgency.

1.4.2 Justification of the study

Research into sustainability in healthcare is reported to have begun from the global comparison of clinical practices (MacNeill, Lillywhite and Brown, 2017) including between developed nations as well as between developed and developing nations (Thiel et al., 2017). The efficiencies designed into more resource-constrained structures provide instructive models of treatment for health systems in which duplication and inefficiency are entrenched (Morris et al., 2013). As the sustainable goals for Agenda 2030 are driving the world, Africa seems to be behind the other continents. Ghana which is part of Africa has many sustainable issues to deal with across all sectors of the economy including healthcare. A sustainable supply chain necessitates the successful implementation of immunization as WHO reports that immunization currently prevents 2 - 3 million deaths annually from diseases like diphtheria, tetanus, pertussis, influenza and measles. There are now vaccines to prevent more than 20 life-threatening diseases, and work is ongoing at unprecedented speed to also make COVID-19 a vaccine-preventable disease (www.who.int/csr/disease/avian_influenza/guidelines/infectioncontrol1/en).

Digital technologies and growing knowledge have brought about considerable changes in the healthcare sector, one of the most vital service industries (Kraus, Schiavone, Pluzhnikova, & Invernizzi, 2021). Overcrowding, unavailability, and inaccessibility are variables that seriously disrupt customer service in healthcare systems. Unexpected calamities, such as fires, floods, earthquakes, and pandemic outbreaks, exacerbate the disruptions and cause irreversible economic, environmental, and social harm not only to the healthcare industry but to many other crucial sectors as well (Kristoffersen, Mikalef, Blomsma, & Li, 2021). These unexpected eventualities make the healthcare systems inefficient and off-balance and push them into bottlenecks (Leone, Schiavone, Appio, & Chiao, 2021). To tackle these challenges, particularly in crises, different parts of healthcare supply chains (HSCs) should play their pivotal roles effectively (Sharma & Sehrawat, 2020). The recent COVID-19 pandemic has shown that different components of HSCs are unable to play their roles in case of crises and are ineffective owing to the lack of applying advanced digital technologies (El Baz & Ruel, 2021). Therefore, developing operative HSCs using advanced digital technologies is unavoidable (Tortorella et al., 2021). HSCs consist of different components such as vendors, manufacturers, hospitals, blood centres, and pharmacies in a network structure purposely to supply required demands and provide high-quality service to patients (Beaulieu & Bentahar, 2021). The first tier of HSCs usually consists of suppliers who supply medical equipment and devices; the last echelon consists of patients. Each echelon in HSCs plays a fundamental role as any mistake or disruption can threaten human lives as well as result in irretrievable outcomes. HSCs are distinguished from other supply chains (SCs) in terms of intricacy, variety, type of services, uncertainty, and targets (Imran, Kang, & Ramzan, 2018). Digital technologies such as big data analytics, artificial intelligence, Blockchain, and cloud computing have improved HSCs significantly over the last decade (Kokshagina, 2021). Applying and developing these technologies in healthcare systems provide many novel business opportunities as well as creating novel business models for improving performance and creating expected values (Kraus et al., 2021). As such, investigating potential opportunities for advanced digital technologies to manage omnichannel HSCs effectively has been a hot topic for scholars and healthcare managers. A case in point is applying and developing these technologies with a combination of methods such as statistics and mathematics to produce the Covid-19 vaccine. In SCs, the rise of interactions and the impact of unexpected occurrences such as earthquakes and pandemic outbreaks have forced organizations to seriously assess and forecast their capabilities for facing unusual disruptions using data-driven methods (Punia, Singh, & Madaan, 2020). Applying data-driven approaches, including deep learning and big data analytics can improve SC capability in organizations for mitigating the impacts of unforeseen disruptions (Cadden, Dennehy, Mantymaki, & Treacy, 2021). Performance evaluation of sustainable SCs has received substantial attention over the last decade (Liu, Eckert, Yannou-Le Bris, & Petit, 2019; Mariadoss, Chi, Tansuhaj, & Pomirleanu, 2016). Despite the considerable significance of performance assessment in many key areas, it has not been addressed sufficiently in healthcare.

1.4.3 Problem Statement

According to the World Bank and WHO, "Half of the world lacks access to essential health services and 100 million people are pushed into extreme poverty because of health expenses" (World Health Organization, 2017). Therefore, WHO focuses on regulations, access, safety and fair usage to ensure the availability of medical products and quality healthcare (Schöpperle, 2017). Pricewaterhouse Health Research Institute report in 2008, indicates that more than $1.2 trillion out of $2.2 trillion spent on healthcare each year is a waste of money (Kwon, Kim, and Martin, 2016). Pollution is also a major cause of morbidity and mortality, accounting for 9 million premature deaths worldwide in 2015, or 16% of all fatalities (Landrigan et al., 2018). Due to climate change-mediated health threats such as severe weather conditions deteriorating air quality, food and water-borne illnesses, vector-borne diseases, food and water shortages, and social unrest, an estimated 150,000 deaths occur annually worldwide due to climatic conditions. Additionally, 250,000 lives each year are expected to occur between 2030 and 2050 from climate change (World Health Organization, 2009). There has been little progress made in exploring various tools available in the commercial areas to the healthcare field even though there are billions of dollars in value to be realized in the healthcare industry by utilizing supply chain tools in the entire healthcare operations (Harrington, 2015). However, the prevailing operating paradigm in the supply chain of healthcare is still "pull" as a consistent definition of planning and forecasting is not part of their strategic business strategy. Therefore, inventory is overstocked and becomes redundant putting pressure on the cost of the supply chain. Considering supplies are the second-largest expense after workers, sound preparation and forecast for mapping the entire supply chain may have reduced waste (Kwon, Kim and Martin, 2016).

The commercial supply chain effectively utilizes push-pull boundaries to optimize their entire operations but consequently, hospitals cannot gain profits from the surplus of the supply chain that the industrial supply chain regularly expects to achieve (Kwon, Kim and Martin, 2016). Evidence from the African region shows that the problem of scarcity of resources is also compounded by technical inefficiency that leads to the wastage of the available meager resources (WHO, 2006). African Union report also illustrates that corruption accounts for as much as 25% of African states' GDP each year, which amounts to $148 billion nevertheless research by the WHO states that the countries can still improve health outcomes even with low levels of investment due to good governance in procurement (Hart, 2019). The world as a whole and Ghana face a host of healthcare challenges ranging from pestilence, poor and inadequate health facilities, and lack of logistics and personnel for effective and efficient delivery of health services. Such factors have adverse effects on the health sector such as high mortality rates and inadequate service delivery (Manso, Annan, Anane, 2013). The frequency of stockouts of essential medicines and consumables at the various metropolitan, municipal, district, and tertiary hospitals in the public sector and to some extent the private health facilities need to be addressed urgently to curtail needless deaths. Furthermore, patient relatives also encounter challenges regarding access to medication and healthcare consumables due to stock-outs at healthcare facilities since they are compelled to purchase from the open market and sometimes they become victims to unscrupulous sellers who offer medicines whose authenticity becomes difficult to determine and this is common in the remote places. At times, the distance to purchase medication from the open market becomes a big problem. Some facilities also due to poor forecasting overstock the healthcare commodities to the point where expiration and obsolescence set in which negatively affects their limited finances and economic performance.

In addition, there are also environmental concerns arising from the disposal of clinical waste. Disposal of clinical waste in some of the healthcare facilities is not done in an environmentally friendly manner which poses threats to patients and their relatives, healthcare personnel, and the community at large. Although the budget management committees at the various health facilities are pursuing the sustainability agenda, substantial effort is required to achieve the sustainable goals needed to enable them to function economically, environmentally, and socially sustainable. By adopting sustainable supply chain practices, the limited resources of the facilities could be invested more productively to achieve value for money and reduce if not eliminate most of the avoidable challenges facing the sector. The Ashanti regional medical store should be properly resourced since most primary healthcare facilities are mandated to procure the medicines and consumables from the regional medical store as the first port of call before sourcing from the open market or registered private suppliers. The study seeks to identify the key determinants of sustainable supply chain management practices and empirically examine their effects on healthcare performance since there is a gap in examining these determinants.

1.4.4 Barriers to implementing sustainability in Ghana health service

Numerous barriers impede the integration of sustainability in the organisation’s supply chain (Giunipero et al., 2012). Organizations encounter various obstacles while implementing SSCM practices in their operations, which have also been identified in literature through industry or country-specific studies (Luthra et al., 2011; Moktadir et al., 2018; Al Zaabi et al., 2013). These barriers include lack of commitment from top management, difficulty in aligning short-term and long-term plans, difficulty in changing company practices and policies, the requirement of high investment, unavailability of environment-related standards as well as regulations, scarcity of customer awareness, and problems in creating such consciousness, suppliers lack resources, etc. under the various categorization of these barriers like internal and external, social, technological, financial, governmental, economic, managerial, etc. (Moktadir et al., 2018; Murillo-Luna et al., 2011; Trianni et al., 2017). Organisations pursue SSCM-related initiatives due to the underlying pressures, particularly from government, NGOs, and other stakeholders (Diabat et al., 2014; Meixell & Luoma, 2015). Weak regulatory checks and controls act as a significant barrier to sustainability initiatives (Giunipero et al., 2012; Oelze, 2017). Stakeholders are at the top among the influential sustainability groups following customers and governments. In developing countries, stakeholders, notably supply chain partners lack awareness about sustainability and their part in its achievement (Moktadir et al., 2018; Soda et al., 2015). They result in an unwillingness to pay and a lack of demand for sustainable products (Jia et al., 2018). Jabbour et al. (2016), in their study about the impact of barriers on environment-proactive green operational practices and firm performance, discovered that internal barriers negatively impact the implementation of environment-friendly operations practices. Researchers have mainly focused on identifying the barriers through qualitative studies, but the empirical evidence by primary data is scarce in this context, which validates these qualitative findings (Sajjad et al., 2020). Due to the global nature of textile supply chains and the extreme importance of the sector in terms of its role in economic development, employment, environmental degradation, and social impact, it is pertinent to identify and examine the impact of sustainability barriers on implementing SSCM practices. To compete at the supply chain level, firms must adopt a sustainable supply chain management strategy and the strategy must be integrative and coordinated throughout the supply chain to generate the performance of supply chain members (Green Jr. et al., 2008; Cohen and Roussel, 2005; Wisner, 2003).

According to the Alliance for Health Policy and Systems Research, World Health Organisation, Geneva. The levels of barriers are as follows: Physical barriers faced by individuals, households, and communities (geographic location, hours of operation); Medicines and healthcare services' perceived quality; Inadequate health-seeking behaviour and pharmaceutical demand; Inadequate medication use; Barriers of social and cultural origin (stigma related to poverty, ethnicity, gender, etc.) Low healthcare service quality, including personnel capacity and motivation, infrastructure, and so on. The competition in the provision of health services by the public and private sectors; Funding for service delivery is insufficient; Medicines are in short supply and are difficult to come by; Prescription and dispensing errors; Medicines are of poor quality or aren't up to par; Medicines are very expensive. In the Healthcare industry, poor governance also has an impact on all building blocks: Absence of stewardship over a pluralistic health system, which includes both the private and informal sectors; There is no relationship with civil society or participation in governance by civil society; Human resource planning and capacity development are lacking; Inadequate health information system and monitoring and assessment capacity; Health financing is insufficient, there is inefficiency in the utilisation of cash, prepayment and social protection programmes are underfunded, and over-reliance of donor funding. Weak governance of the pharmaceutical sector affects all functions: Registration, selection, procurement, distribution, licensing of pharmaceutical establishments, inspection, control of medicines promotion, etc. Public policies cutting across sectors: Low public accountability and transparency; low social priority; high government bureaucracy; conflict between trade and economic targets for pharmaceutical markets; and public health goals. International and regional level: International donors' agenda, including medicines; Weak regional development and economic cooperation mechanisms; Unethical use of patents and intellectual property rights; Research and development not targeting disease burden in logistics management information centres. Until most of the above factors are addressed, the Ghana health service supply chain will continue to be unsustainable. Therefore, fully automating the system, developing and applying advanced digital technologies such as blockchain, deep learning and text learning can be applied successfully to forecast and analyze results and tackle such situations sustainably (Sharma, Adhikary, & Borah, 2020; Toorajipour, Sohrabpour, Nazarpour, Oghazi, & Fischl, 2021; Zhu, Chang, Ku, Li, & Chen, 2021). When the leaders in the healthcare sectors become more sustainability-oriented, they will drive sustainable goals by focusing their directives on economic, environmental and social factors collectively rather than the usual focus on economic outcomes and neglecting environmental and social concerns.

1.4.5 Contribution of the study

This study will develop a theoretical model deriving constructs from a wide range of multi-disciplinary literature, such as supply chain management (SCM), sustainable supply chain management (SSCM), sustainability, human resource management (HRM), operations management (OM) and information systems management, to examine the relationship between sustainability-oriented leadership, supply chain capabilities, sustainable supply chain practices, sustainable healthcare performance, sustainable economic performance, environmental sustainable performance and sustainable social performance. From a theoretical perspective, this study will employ a multidisciplinary approach and multidimensional theoretical base to demonstrate the determinants of SSC and SHP, bridging different fields of research and creating opportunities for multisided perspectives on operations and supply chain management OSCM, productions research, technology management, and sustainability. The comprehensive model will influence research developments in SSCM and circular economy and contribute to changing practices towards an Industry 5.0 vision oriented towards humans and sustainability (Breque, De Nul, and Petridis 2021). The study's theoretical and practical contributions are discussed below.

1.4.5.1 Theoretical contributions

The theoretical contributions of this study are significant for advancing future academic studies in operations and sustainable supply chain management discipline:

1. Integration of leadership and supply chain management theories

This research advances the theoretical understanding of how sustainability-oriented leadership influences sustainable performance through sustainable supply chain practices. By integrating leadership theory with supply chain management (SCM) frameworks, this study bridges two traditionally separate fields, offering a more comprehensive model for understanding organizational sustainability. Gölgeci and Kuivalainen (2020) highlighted the importance of leadership in shaping supply chain resilience, and this study builds on that by demonstrating that sustainability-oriented leadership is pivotal in embedding sustainable practices within supply chains, which, in turn, drives sustainable performance.

2. Enhancement of the resource-based view (RBV)

The research also contributes to the resource-based view (RBV) by showing how supply chain capabilities act as a strategic resource that enhances sustainable performance. Supply chain capabilities, such as integration and flexibility, are identified as key resources that enable organisations to implement sustainable supply chain practices effectively. Dubey et al. (2022) argued that these capabilities mediate the relationship between leadership and sustainable performance, supporting the notion that organisational resources must be leveraged strategically to achieve sustainability goals.

3. Contribution to sustainable supply chain management (SSCM) literature

This study enriches the SSCM literature by providing empirical evidence on the critical role of sustainable supply chain practices in achieving sustainable performance across economic, environmental, and social dimensions. It confirms the findings of Zhu et al. (2020) that sustainable practices, such as green procurement and waste reduction, lead to improved performance outcomes. The study also introduces a nuanced understanding of how leadership and supply chain capabilities interact to influence the effectiveness of these practices, thereby adding depth to existing SSCM frameworks.

1.4.5.2 Practical contributions

The practical contributions of this study are significant for organisations aiming to enhance their sustainable performance:

1. Leadership development for sustainability

One of the key practical implications is the emphasis on the development of sustainability-oriented leadership within organizations. The findings suggest that organizations should invest in leadership development programs that focus on sustainability, equipping leaders with the skills and knowledge necessary to drive sustainable initiatives. Leaders who prioritise sustainability can effectively influence supply chain practices and align them with broader sustainability goals, as demonstrated by Golicic and Smith (2021). This focus on leadership is crucial for fostering a culture of sustainability throughout the organization.

2. Building and enhancing supply chain capabilities

The study underscores the importance of supply chain capabilities in achieving sustainable performance. Organizations are encouraged to invest in building and enhancing these capabilities, particularly in areas such as supply chain integration, collaboration, and flexibility. These capabilities enable the effective implementation of sustainable supply chain practices and enhance the organization's ability to respond to environmental challenges. Gold et al. (2020) emphasised that organizations with strong supply chain capabilities are better positioned to optimise resource use, reduce waste, and improve overall performance.

3. Implementation of sustainable supply chain practices

Finally, the research provides actionable insights for the implementation of sustainable supply chain practices. Healthcare organisations are advised to prioritise practices such as green procurement, waste reduction, and the adoption of circular economy principles, as these have been shown to significantly improve sustainable performance outcomes. Yildiz Çankaya and Sezen (2020) demonstrated that these practices not only enhance environmental performance but also contribute to economic and social sustainability. By integrating these practices into their supply chains, organisations can achieve a more balanced and sustainable approach to performance.

1.4.6 Essential Drug List (EDL)

Essential medicines are a set of medicines that meet the priority healthcare needs of the population. They can save lives, reduce suffering and improve health (WHO, 2021). They are chosen based on public health significance, efficacy and safety evidence, and comparative cost-effectiveness. Essential medicines are meant to be always available in acceptable amounts, in the proper dose forms, with assured quality and adequate information, and at a price that the individual and the community can afford within the framework of functioning health systems. Ghana's Essential Drug List (EDL) and Standard Treatment Guidelines (STG) are two of the most important instruments for delivering high-quality healthcare across the country. The EDL and STG are updated with input from members of the EDL Review Committee, STG Expert Committee, Regional Directors of Health Services and Health Program Managers, teaching hospital employees, and members of suitable professional groups. Safety, efficacy, and affordability are all considerations evaluated while reviewing products with generic taking precedence. The EDL and local morbidity patterns are meant to inform procurement decisions at the special drug program (SDP) level. However, 46% of surveyed facilities believed that the EDL does not address local realities and is not adhered to when making ordering decisions. According to the WHO framework for medicine accessibility (Bigdeli, 2011; WHO):

Figure 1.1 WHO framework for access to medicine

Per the framework there needs to be:

- Rational selection and use of medicines
- Affordable price for all actors including patients and
- Sustainable financing mechanisms

- Reliable health and supply systems to deliver medicines

While each of these elements is critical in itself, they are also interconnected and cross-cutting. For example, rational selection will ensure that the most relevant commodities are chosen in terms of efficacy, quality, and cost-effectiveness, allowing for more long-term financing and affordability. According to the WHO framework for medicine accessibility (Bigdeli, 2011; WHO), the top three priorities are:

Table 1.1 WHO Priorities for access to medicine

1. **Rational Selection and Usage**	**2. Medicines Quality**	**3. Sustainable Financing**
Medicines promotion	Substandard is more important than counterfeit,	The funding mechanism, incl. statutory health insurance (SHI) is more important than the funding type and amount.
Financial and non-financial incentives	Regulatory aspects including HR and capacity	Out-of-pocket (OOP)
Prescribers and providers	Sustainable QA system	Sustainability
Health Seeking behaviour STG and EDL		Efficiency

Source: (WHO, EMRO, 2021)

1.5 Research design

Every research problem requires its unique emphases and techniques because every research problem is distinctive in some manner, hence no one research method can be employed as the ideal for all data-gathering operations (Iacobucci and Churchill, 2010 quoted in Glanfield, 2012, pp. 15 -18). Given that the purpose of this research is to extend theory on the relationship between sustainable supply chain management practices and healthcare performance for improvement, exploratory and descriptive research methods are adopted. Exploratory research is adopted to gain background information into the nature of a research problem, define and clarify terms, develop hypotheses and establish priorities where a review of the existent literature is considered an appropriate form of exploratory research (Iacobucci and Churchill, 2010; Stuart, 1998; Alessandri, 2001; Malewar and Jenkins, 2002; Malewar, 2003; Suvatjis and de Chernatory, 2005). Whilst based upon an initial proposition or set of hypotheses, descriptive research seeks to identify the frequency of a particular occurrence or the relationship between two variables in the exploratory stage conducted in the form of longitudinal or cross-sectional quantitative research studies (Iacobucci and Churchill, 2010). Therefore, in line with the traditional methodology adopted in the supply chain management literature for developing sustainable supply chain models, the proposed study takes a deductive approach to developing a sustainable supply chain framework for healthcare facilities (Dey et al., 2020; 2022; Hong, Zhang and Ding, 2018; Stuart, 1998; Alessandri, 2001; Malewar and Jenkins, 2002; Malewar, 2003; Suvatjis and de Chernatory, 2005). Empirical findings will be validated using focus group discussions with experienced supply chain practitioners and a case study in the health sector within the region of study. A broader and more in-depth discussion of the methodological choices made within this thesis is available in chapter four of this thesis. The term of the research access precluded clinical care, healthcare structures and a longitudinal study due to timing constraints.

1.6 Structure of the study

To achieve the research objectives outlined above, the study follows the research layout provided in Table 1.2 First; to promote sustainable supply chain conceptualization, a summary of the current literature is given. Therefore, related literature that has linked sustainability and supply chain management to healthcare performance is evaluated. The purpose of the literature review is to assess how much research has been done on sustainable supply chain management in the context of healthcare. Therefore, areas to be focused on include supply chain management, sustainable supply chain, sustainable supply chain drivers for health care, health efficiency, the conceptualization of the sustainability dimensions, the research unit used, the types of independent and dependent variables analysed, and an indication of whether moderators were used. Finally, the literature review offers a rationale for the study of the sustainable supply chain in healthcare practices the study of the relationship between SSCM (and its parts) and the performance of healthcare, and the study of the influence of moderators.

Table 1.2 Thesis layout

CHAPTERS	RESEARCH ACTIVITIES
Chapter One	Introduction to the study
Chapter Two	Sustainable supply chain and its relationship with healthcare performance: a literature-based assessment
Chapter Three	Conceptual framework and hypothesis
Chapter Four	Research Methodology
Chapter Five	Data Analysis
Chapter Six	Findings/ / outcome of data analysis
Chapter Seven	Discussion of research findings
Chapter Eight	Research implications of study results and conclusion

In drawing on the results of the literature review (i.e., chapter two), and consistent with the study research objectives, chapter three of the thesis develops the study's conceptual framework and discusses its hypotheses. Concerning the major theoretical lenses that underpin the study, this study will adopt Dynamic capability and resource-based theories as demonstrated by Hong, Zhang and Ding (2018). This is because sustainability-oriented leadership, supply chain capabilities, sustainable supply chain practices and performance are considered internal resources that can enable organisations to achieve sustainability and competitive advantage. It is argued that these two theoretical perspectives are complementary and can both help to better explain the link between sustainable supply chain management practices and sustainable healthcare performance.

Regarding the hypotheses, seventeen components are identified:

Hypothesis 1: Sustainability-oriented leadership positively and significantly impacts sustainable supply chain practices.

Hypothesis 2: Supply chain capabilities have a positive and significant relationship with sustainable supply chain practices.

Hypothesis 3: Sustainable supply chain practice has a positive and direct effect on sustainable healthcare performance.

Hypothesis 4: Sustainable healthcare performance positively and significantly impacts economic performance.

Hypothesis 5: Sustainable healthcare performance significantly and positively impacts environmental sustainability.

Hypothesis 6: Sustainable healthcare performance is positively and significantly related to social performance in an organisation.
Hypothesis 7: Sustainable supply chain practices positively and significantly impact sustainable economic performance.

Hypothesis 8: Sustainable supply chain practices positively and significantly impact environmental sustainability.

Hypothesis 9: Sustainable supply chain practices positively and significantly influence sustainable social performance.

Hypothesis 10: Sustainability-oriented leadership has a positive and significant impact on sustainable economic performance.

Hypothesis 11: Sustainability-oriented leadership positively and significantly influences environmental sustainable performance.

Hypothesis 12: Sustainability-oriented leadership has a positive and significant influence sustainable social performance.

Hypothesis 13: Supply chain capabilities positively and significantly impact sustainable economic performance.

Hypothesis 14: Supply chain capabilities have a positive and significant impact on environmental sustainable performance.

Hypothesis 15: Supply chain capabilities positively and significantly influence sustainable social performance.

Hypothesis 16: Sustainability-oriented leadership positively and significantly influences sustainable healthcare performance.

Hypothesis 17: Supply chain capabilities positively and significantly impact sustainable healthcare performance.

Sustainable supply chain practices and sustainable healthcare performances moderate the relationship between the antecedents and the outcomes.

Chapter four discusses the study's research methodology. The chapter provides information on the choice of cross-sectional research design, the study's sampling procedures, the survey data collection method, questionnaire administration activities and assessments of survey bias.

Chapter five focuses on information on the descriptive statistics of the organisations that are studied and the measure development strategies that are used in the study. First, the descriptive statistics provide an account of the general characteristics of the respondents and their facilities. This account is important because it helps to develop a fundamental understanding of the subjects that are studied. Second, the chapter addresses the strategies for measurement development used in this study to evaluate the unidimensionality, reliability and validity of measurement items and scales. The analytical strategy and techniques that are adopted to test the study's system of hypotheses are also described in this chapter. Like the measurement model assessment, the hypotheses in this study are tested with the aid of the structural equation modeling technique implemented in SmartPLS4 and AMOS version 28 using a maximum likelihood estimation method. In using Anderson and Gerbing's (1988) two-way model assessment approach, this chapter builds on the measure development procedures described in chapters four and five.

Chapter six focuses on the findings/outcome of the data analysis that will be conducted using structural equation modeling and focus group discussions with experienced supply chain management practitioners in the health sector within the region of study.

Chapter seven presents the discussion of the results of the item and scale assessments of the key constructs used in the study. Thus, the psychometric properties of the scales are assessed following the standard procedures outlined in the methodology literature. Here, reports are presented on the results of the scale on reliability, unidimensionality and validity assessments.

Finally, chapter eight provides information on the research implications and conclusion resulting from chapters five, six and seven. This chapter of the thesis also focuses on the conclusions drawn from the study results. Specifically, summaries of key findings relating to the study's objectives are provided. Moreover, the chapter presents the theoretical, managerial and policy implications of the study results. The chapter concludes with a discussion of the limitations and replication of the study and highlights several useful areas for future research.

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

This chapter reviews the existing literature in sustainability, operations and supply chain management, supply chain management, sustainable supply chain management and healthcare supply chain that were thoroughly considered in identifying and addressing the gaps. The first section of the literature review introduces the chapter, followed by 2.2 the various relationship and research gaps in sustainability, supply chain practice, sustainable supply chain practice and sustainable healthcare supply chain. It also discusses the empirical studies establishing the inter-relationship between sustainability and supply chain practice, sustainability and healthcare supply chain and sustainable healthcare performance in section 2.3. supply chain management 2.3.1 evolution of supply chain 2.3.2 drivers of supply chain 2.3.3 supply chain management practices 2.3.4 sustainable supply chain management 2.4 healthcare supply chain 2.4.1 healthcare supply chain challenges 2.4.2 sustainable healthcare supply chain 2.4.3 evolution of sustainability 2.4.4 sustainable development goals (SDGs) 2.4.5 economic sustainability 2.4.6 environmental sustainability 2.4.7 social sustainability 2.5 theoretical background 2.5.1 sustainability-oriented leadership (SoL) 2.5.2 supply chain capabilities (SCC) 2.5.3 sustainable supply chain practices (SSCP) 2.5.4 sustainable healthcare performance (SHP) 2.5.5 sustainable economic performance (SEP) 2.5.6 environmental sustainability performance 2.6 (ESP) 2.5.7 sustainable social performance (SSP) 2.6 brief country profile – Ghana 2.6.1 Ghana health service 2.6.2 Ghana health commodity flow 2.6.3 Covid supply chain requirements for vaccine 2.6.4 Supply chain performance measurement 2.6.5 Global supply challenges 2.7 addressing the research gap 2.8 study limitation 2.9 literature review summary.

2.2 Discussion of relationship and knowledge gaps

Several studies have associated sustainability to supply chain management (Ghadimi *et al.,* 2019; Magon *et al.,* 2018; Duque-Uribe, Sarache and Gutiérrez, 2019; Leksono, Suparno and Vanany, 2019; Daú *et al.,* 2019; Pate and Desai, 2019; Lintukangas, Kähkönen and Hallikas, 2019; Khan et al. 2018; Mirghafoori *et al.,* 2018; Scavarda *et al.*, 2018; Wu *et al.*, 2018; Tooranloo, Karimi and Vaziri, 2018; Sari 2017; Ashby, Leat and Hudson-Smith, 2012; Hussain *et al.,* 2014; Chiarini, Opoku and Vagnoni, 2017; Dey and Cheffi, 2013; Carter and Rogers, 2008). Many scholarly papers have also reported the association between sustainable supply chain and healthcare performance (Reiner *et al.,* 2018; Duque-Uribe, Sarache and Gutiérrez, 2019; Hussain *et al.,* 2014; Ahsan and Raman, 2017; Scavarda, Dau and Korzenowski, 2018; Lekono *et al.*, 2019; Tooranloo, Karimi and Vaziri, 2018; Jan De Vries, Horijsman, 2011). These writers argue the association between supply chain management and healthcare performance (Elmuti et al. 2013;

Sukati *et al.,* 2012; McKone-Sweet, Hamilton and Willis, 2005; Sung-Ho and Kwon 2015; Rivard-Royer, Landry, Beaulieu, 2002). However, some scholars argue that the healthcare supply chain is completely different and therefore cannot be compared to the supply chain system in the commercial sector (Ahmadi *et al.,* 2017; Koksal *et al.,* 2017; Oeze, 2017; Cecere, 2014; de Vries and Huijsman, 2011; Singh *et al.*, 2006; Schneller and Smeltzer, 2006), however, scholars such as (Kim and Kim, 2019; Mustaffa and Potter 2009) among many others disagree.

Other scholarly works have also employed different approaches in investigating the relationship between sustainable supply chain and healthcare performance. Studies are examining the relationship between lean and environmental practices (Inman and Green, 2018) using varied approaches. These include a questionnaire survey (Lekono, Suparno and Vanay, 2018; Lintukangas, Anni-Kaisa and Hallikas, 2018; Chauhan and Singh 2016; Khan *et al.,* 2018; Chiarini, Opoku and Vagnoni, 2017; Matloub *et al.,* 2014;), systematic literature reviews (Patel and Desai, 2019; Nosratabadi *et al.,* 2019; Duque-Uribe *et al.,* 2019; Kwon, Kim and Martin, 2016: De Vries, Ashby, Leat and Hudson-Smith, 2012; Horijsman, 2011; Carter, and Rogers, 2008), interviews (Buttigieg *et al.,* 2019; Mirghafoori, Sharifabadi and Takalo 2018; Ahsan & Rahman, 2017), observation (Dau *et al.,* 2019; Buttigieg, Xuereb and Dey, 2019), case study (Bhakoo and Chol, 2013; Kjær *et al.,* 2015), literature review and case study (McKone-Sweet, Hamilton and Willis, 2005), Observation and secondary data (Renggli, 2018). However, theoretical and empirical studies on sustainable supply chain practices are limited in the literature. More distinctively, to the best of the knowledge of the author, there is no empirical study about the determinants of sustainability in the Ghana health supply chain. Moreover, no study has ever adopted the determinants of sustainability proposed by this study to fill the gap in the literature. In the literature review, previous researchers have not specifically discussed sustainability-oriented leadership as an antecedent of a sustainability supply chain in any discipline.

A study used a case study technique and collected data through process mapping, interviews, and data analysis, 28% of orders could not be delivered on time due to stock availability concerns or mismatched packing sizes. Furthermore, due to weak inventory control systems, many clinics were placing urgent orders, which had a negative influence on transportation costs. As a result, the corporation will need to develop a new strategy to lower operating costs while also improving customer service. A VMI strategy was recommended to be the greatest solution for the organization's present inventory management. This should mitigate some of the potential flaws in the case study company's JIT implementation (Mustaffa and Potter, 2009). The topic of SSC has caught the attention of scholars and practitioners due to Covid-19 challenges. For example, Bag et al. (2020) explored operational excellence to improve sustainability, de

Sousa Jabbour et al. (2020) addressed the trends and challenges in SSC, and Gupta et al. (2020) examined sustainability innovation to support policymakers in decision-making. Recent history has demonstrated that supply chain leaders must invest more in different sectors like emerging technology (blockchain, 3D printing solutions, automation, etc.), supply chain digitization, resilient transportation systems, health protocols, etc (Liao *et al.,* 2020; Kilpatrick and Barter, 2020). Extensive financial support from supply chain partners as well as the government will boost the sustainability process.

In combination, sustainable supply chain management is seen as a useful driver to help the health sector achieve similar successes in the commercial sector since the same supply chain basic principles are employed (Dooner, 2014; Elmuti *et al.,* 2013; Kwon and Hong and Martin, 2011; Duffy, 2009; Poirier, *et al.,* 2010; PRTM, 2010; Nachtmann and Pohl, 2009). It is, therefore, suggested that researchers should model the healthcare supply chain to discover the level of sustainability and make recommendations for sustainable improvement (Scavarda *et al.*, 2018; Duque-Uribe, Sarache and Gutiérrez, 2019). Based on supply chain principles, there are advantages in ensuring standardized and supply chain integration as it tends to reduce transaction costs, which, according to many studies, represent as much as 35% to 40% of the costs associated with economic activities (Butler *et al.,* 1997; North, 1990) and as high as 50% in IT outsourcing (Rottman and Lacity, 2006). However, in the sustainable supply chain literature for healthcare, theoretical and empirical evidence on these relationships is minimal and more importantly the determinant of sustainability is scanty.

2.3 Supply chain management

An emerging concern in the value chain puts pressure on healthcare organizations to look for ways to increase operating efficiencies and reduce costs while continuing to improve the quality of care (Hanna and Sethuraman, 2008; 2005). In healthcare vis-a-vis other sectors, supply chain management is more complicated because the effect on people's health demands sufficient and reliable medical supply according to the needs of the patient (Beier, 1995). Nevertheless, it is still felt that there is ample potential for enhancing the overall efficiency of the supply chain (McKone-Sweet *et al.,* 2005). In recent years, a variety of different methods for supply chain management have been implemented, but obstacles to their widespread use continue to exist. Many of these applications have arisen in the developed world, with only a very small number of examples available in the literature from the developing world.

The Council of Supply Chain Management Professionals (CSCMP, p.187) not only defined SCM as the "planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities," but also emphasizes its role in the integration between players involved in the entire supply chain (CSCMP, 1963). Stadtler (2005) defines supply chain management as "the process of integrating organizational sections along a supply chain and coordinating materials, information, and financial flows to satisfy (ultimate) customer demands to improve the competitiveness of the supply chain as a whole." According to Lambert *et al*. (2006, p. 2) supply chain is defined as, "the integration of key business processes from end-user through original suppliers, that provides products, services, and information that add value for customers and other stakeholders." According to Carter and Rogers (2008), the term supply chain management has been defined by Mentzer *et al*. (2002, p. 18) as "the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, to improve the long-term performance of the individual companies and the supply chain as a whole". A supply chain is the set of value-adding activities connecting the enterprise's suppliers and its customers. The principle of supply chain activity is receiving input from a firm's suppliers – adding value – and delivering to customers (Levi *et al*., 2004). A supply chain encompasses all the parties involved, directly or indirectly, in fulfilling a customer request. In a manufacturing organization, the supply chain includes all functions involved in receiving and filling a customer request. These functions include new product creation, marketing, operation, distribution, finance, customer service, and other functions related to serving customer requests (Chopra and Meindl, 2007). Supply chain management (SCM) can be defined as a set of approaches and practices for managing and achieving effective coordination within organizations (cross-functional) and between organizations (cross-organizational) in a supply chain, to improve customer service, asset utilization, profit generation, and cost reduction (Croxton *et a*l., 2001). In a supply chain, multiple decision-makers are involved in managing processes, resources, and information that may not necessarily be totally under their direct control (Hassini, Surti and Searcy, 2012). In other words, organizations along the supply chain must integrate their operations and work together to make their supply chain operations sustainable (Luthra and Kumar Mangla, 2018; Mathivathanan *et al*., 2017).

Supply chain management techniques include a range of methods and practices that integrate successfully with manufacturers, vendors, and consumers to maximize long-term business success (Chopra and Meindl, 2007; Tseng 2010). The term "supply chain" is defined in numerous ways to envision all steps needed from beginning to end to deliver products or services to the customer. According to Christopher (1992), supply chain management is defined as "The management of upstream and downstream interactions between suppliers and customers to create superior customer value. A supply chain encompasses all the parties involved directly or indirectly, in fulfilling a customer request (Sukati *et al*., 2012). Meijboom, Schmidt-Bakx and Westert (2011) argue that despite a broad variety of scholars' definitions of a supply chain, their definitions usually have many similar characteristics. Firstly, it involves all operations from the processing of raw materials to the distribution of goods to final consumers. Second, an institution can be a part of more than one supply chain. Third, for final clients, all functions can produce values. Fourth, between organizations, information should flow smoothly and timely. With increasing globalization and advanced information technologies, SCM has gained prominence in business management and become feasible (Shan and Wang, 2018). Silvestre (2015) argues that supply chains in emerging economies face more sustainability obstacles than those in developed countries. Indeed, the supply chain achieves intended outcomes, unmatched by other management tools.

Supply chain management, however, should be firmly rooted in three principles: sharing knowledge, sharing costs and rewards, whether it is a long-term strategic instrument or an operational as well as a tactical instrument (Kwon, Kim and Martin, 2016). The absence of any one of these principles may result in suboptimal performance. Nachtmann and Pohl (2009) report that lack of confidence is a major obstacle to achieving an acceptable level of collaboration among healthcare supply chain organizations according to 60% of survey respondents. The principle of supply chain activity is receiving input from a firm’s suppliers, adding value and delivering to customers (Levi *et al.*, 2004). Scholarly work interview findings report the need for further investigation into the following propositions: Hospitals that use consistent metrics and have a structured supply chain management evaluation process have better success in the supply chain than those that do not. Supply chain management practices are described as many management functions aimed at improving the performance of the supply chain. (Li *et al.,* 2006; Wong *et al*., 2005; Zhou and Benton, 2007; Koh *et al.,* 2007; Sufian, 2010). Strategic supplier relationships require greater communication between the company and its suppliers; businesses tend to have long-term relationships with long-term suppliers. This long-term relationship between the company and its suppliers is characterized as a strategic supplier partnership that affects the strategic and operational capabilities of individual participating companies to help them achieve significant continuous benefits (Li *et al*., 2005; Li *et al*., 2006; Monczka *et al*., 1998). A strategic supplier relationship involves purchasing suppliers' products and services, influencing the supplier framework and operating resources, adding value and enhancing the efficiency of the supply chain. (Monczka *et al.,* 1998; Sufian, 2010). Li *et al*. (2006) argue that the customer relationship is the entire set of strategies used to handle customer grievances, create long-term customer relationships and increase customer satisfaction.

The supply chain associated with pharmaceutical products within the healthcare industry is important in maintaining a high quality of patient care and supplying pharmacies with sufficient supplies of required medication. In terms of cost, supply is projected to account for 25-30% of hospital operating costs (Roark, 2005). It is also crucial that this is effectively handled to ensure that all service and cost targets are met. Primary processing includes the production of the active ingredient found in the drug. There are long downtimes in production to allow for cleaning due to the need to prevent contamination between products, contributing to batch production (Shah, 2004a). This reflects, in essence, mass production. Secondary manufacturing sees the active ingredient converted into useable goods (such as tablets, capsules, etc.). This can potentially contribute to a substantial increase in the number of product lines, particularly if the packaging is not considered. With growing globalization in the pharmaceutical industry, factors such as tax advantages also affect the location of manufacturing plants (Papageorgiou *et al*., 2001). Secondary production may, therefore, be geographically distinct from primary production and serve local or regional markets (Shah, 2004). There are a variety of outlets on the market when it comes to the sale of finished goods. The dominant intermediary is the wholesaler (in terms of volume at least). Around 80% of the volume flows through this channel in the UK. (Shah, 2004). Hospitals and distributors with broad demand requirements obtain shipments directly from the fulfilment centre of the suppliers. Hospitals may also maximize economies of scale by strengthening their purchasing power by, for instance, group buying organizations (Roark, 2011). Recent developments in healthcare supply chain management have seen a shift towards pull-based structures for the final part of the distribution channel, which will be addressed shortly, essentially adding a decoupling point at the wholesaler, where a stock repository is found (Arglo e*t al*., 1992).

In terms of the characteristics of these supply chains, Shah (2004) demonstrates concerning performance standards, it offers comprehensive information. There are long lead times, with the whole supply chain taking between 1,000 and 8,000 hours for goods to move through. Additionally, with stock turns taking between one and eight weeks, inventory levels seem very high. This is consistent with the findings of (Haavik, 2000) who reported that, in 1994, stock turns in hospital storerooms lasted four to five weeks. Another theme raised by several authors is demand development (Shah, 2004b; Correˆa, 2004). This should perhaps be anticipated, considering the number of intermediaries within the supply chain and the presence of batching within primary production. A vast amount of research has been performed on all aspects of the supply chain of health care (see Shah, 2004, for an overview).

2.3.1 Evolution of supply chain

Supply chain management, a term introduced by management consultants in 1982 (Oliver and Webber, 1982), began as a vague concept in business management and was synonymous with logistics (Cooper et al., 1997). After three decades of evolution, several studies have attempted to examine the nature and scope of SCM, the core concept of which is to add value to customer service and maintain or enhance competitive advantage by integrating and coordinating business processes within and among organizations. Cooper et al. (1997) proposed that the SCM framework consists of three closely related elements: business processes, management components, and supply chain structure. Lummus and Vokurka (1999) asserted that SCM is a seamless process of coordinating and integrating activities that create a product from raw material and deliver it to customers. Mentzer et al. (2001) hypothesized that the ultimate goal of SCM is to increase customer satisfaction and competitive advantage. Delbufalo (2012) investigated outcomes of inter-organizational trust in supply chain relationships. The term "supply chain management practices" refers to a set of management actions aimed at improving supply chain performance (Li *et al.,* 2006; Wong *et al.*, 2005; Zhou and Benton, 2007; Koh *et al.,* 2007; Sufian, 2010). A supply chain is a dynamic process that involves the continuous flow of information, materials, and finances between and within chain members across many functional domains (Jain, Wadhwa, and Deshmukh, 2009). Manufacturing organisations frequently demand that their supply chain partners, such as subcontractors or suppliers, apply similar processes, which often necessitate the sharing of information, in order to improve supply chain coordination and product quality (Cheng, 2013). Timely information sharing significantly helps to reduce supply chain costs and achieve a competitive advantage (Cheng, 2013, Jain, Wadhwa and Deshmukh, 2009).

Supply chain management (SCM) is a well-known management strategy that is employed to add value to customer service, enhancing competitive advantage by integrating the main business process into the supply chain. Three decades have passed since SCM was proposed in the 1980s (Oliver and Webber, 1982). SCM has gained importance and become feasible in business management because of increased globalization and advanced information technologies (Handfied, 2009; Cousins et al., 2006; Handfield and Nichols, 1999). Numerous researchers have claimed that individual organizations can compete longer when they belong to a supply chain (Drucker, 1998; Lambert and Cooper, 2000). SCM was recognized as an alternative to logistics. However, by the late 1990s, scholars had noticed that SCM had developed into its field. Therefore, studies about the domain and scope of SCM became crucial (Cooper *et al.*, 1997; Harland *et al*., 2006; Harland, 1996; Lummus and Vokurka, 1999; Mentzer *et al.,* 2001; Tan, 2001). In the twenty-first century, the focus of SCM has shifted from operation-oriented (sharing information) to strategy-oriented (business process integration) management (Lummus and Vokurka, 1999; Mentzer *et al*., 2001), and SCM has developed into a multivariate discipline (Cousins et al., 2006). Advanced by innovative information technology, SCM has become powerful and practicable (Cachon and Fisher, 2000), and the potential benefits of SCM are vital to an organization's competitiveness. Because a growing number of researchers and practitioners have investigated SCM, publications relevant to the field have increased dramatically (Charvet et al., 2007; Georgi et al., 2010; Lambert and Cooper, 2000). Although the nature of SCM research has been examined in numerous studies (Cooper *et al.,* 1997; Mentzer *et al*., 2001; Tan, 2001; Delbufalo, 2012; Wong *et al*., 2012), few researchers have explored the intellectual structure of SCM (Charvet et al., 2007; Georgi et al., 2010; Giannakis, 2012). The intellectual structure of SCM can be used to identify fundamental knowledge of SCM and provide an objective scope of structure and development (Culnan, 1987; Hsiao and Yang, 2011; Keen, 1980; Shiau and Dwivedi, 2013), and therefore has become a critical topic of research in recent years (Georgi and Dimitriou, 2010; Giannakis, 2012).

The scope of supply chain management has grown considerably over the last two decades. Early supply chain activities centred on suppliers' material and service inputs and their impact on the capacity of an enterprise to meet consumer needs. Most of the emphasis was focused on cost savings during those early attempts. Organizations have increasingly realized the value of looking at the whole supply chain, from raw materials to production to delivery to distributors and the final consumer, and its effect on the customer. By providing the right product at the right time and reducing costs through more effective content and knowledge flow, the emphasis has moved to the overall sustainability of the supply chain through -revenues (Handfield and Nichols, 1999; Simichi-Levi *et al.*, 2002). Nelson, Erika and Marsillac (2012) state that the characteristics of a good supply chain have been described: top management recognizes the value of supply chain management; benchmarking is used to analyse and guide; a common knowledge organizational culture prevails; the supply chain view of the participants encompasses the entire chain and institutionalization of best practices. Organizations have led their competition by implementing a system-wide strategy and show that ‘‘supply chain mastery is an efficient means of achieving market share gains, consumer intimacy and lasting advantage’’ (Copacino and Byrnes, 2001). Fine (1998) concluded that competitive advantage is lost or gained by how well an organisation handles complex relationships through its supplier, distributor, and alliance partner chain. These findings suggest that the lack of executive support, information technology, and misaligned incentives lead to poor work performance (McKone-Sweet, Hamilton and Willis, 2005).

Supply chain management strategy refers to wholesalers and retailers' attempts to successfully integrate purchasing and supply with other functions in the business, as well as manufacturers' efforts to effectively integrate purchasing and supply with other functions in the organization (Wisner and Choon, 2000). Supply chain management has four components: planning, sourcing, making and delivering (Youngdahl, 2000). About 78% of the businesses surveyed reported that they were conversant with the supply chain management concept. About 68% of the respondents (272 organizations) revealed that there was not an existing wholly integrated supply chain management program. The remaining 130 organizations reported the duration of their supply chain management programs to be “less than one year (130 firms),” “less than two years (50 firms),” and “three or more years (20 firms).” These organizations have adopted a supply chain management concept in part to include the areas of wholesaling, retailing, manufacturing, transportation, logistics, inventory, facilities, information systems, and outsourcing. An analysis showed top general reasons for undertaking supply chain projects identified by the survey results were to: reduce costs and inventory, improve the quality of customer services, improve delivery reliability, reduce cycle time, increase productivity and profitability, use resources not available internally, employ human resources efficiently, make capital funds available for more profitable operations, focus on core competencies of the corporation, and gain a competitive advantage over the competition. These findings complement the previous studies (Mentzer *et al*., 2000; Chopra and Meindle, 2001; Gardner, 2001; Beamon, 1999) and the findings show that supply chain management helps to achieve a big impact on the company's bottom line, even though more remote reasons like strategy, profitability, and competitive advantage may have been the driving force behind the more immediate ones.

2.3.2 Drivers of supply chain

Because of rapidly changing market situations and customer awareness regarding health issues and environmental and social concerns, the production of end goods and services without SSC is not feasible (Bag *et al*., 2020). The adoption of SSC may rely on many critical indicators (drivers) associated with the organizations. Such drivers can contribute significantly to the successful implementation of SSC and can even enhance efficiency and responsiveness. Awareness of drivers will also help industries determine their SSC initiatives for sustainable performance. Many companies have placed greater emphasis on the implementation of sustainability drivers because of multiple pressures and awareness (i.e., vendor collaboration and procurement tactics), changes in consumer preference and perception, improvement of regulations, and the principles and policies of organizations (Luthra *et al*., 2017; Zeng *et al.*, 2017; Matthews *et al.,* 2019). SSC drivers ensure efficient operation as well as economic performance, risk management, quick responses to uncertain environments, fulfilment of sustainability expectations, and achievement of sustainability practices (Tseng *et al.*, 2019; Sajjad *et al*., 2020). Nevertheless, in emerging economies, there has been insufficient attention on key sustainability drivers for the successful implementation of SSC (Munny *et al*., 2019). Therefore, it is significant to examine the drivers of sustainability, especially in tackling the effects of disasters or pandemics on supply chains. Such drivers help companies enhance sustainability initiatives and improve overall sustainability performance. Enable employees’ safety by providing personal protective equipment (PPE), building resilient transportation and logistics facilities, developing health protocols for stakeholders across the supply chain, policy development to recover the impact of COVID-19, financial support from supply chain partners, expanding the application of internet of things (IoT), application of automation and robotics in manufacturing and logistics service, use of 3D printing for rapid manufacturing and financial support from the government through the offering.

Other studies have found supply chain agility (SCAG) as one of the drivers of sustainable supply chain practices. SCAG is defined as "an organization's capacity to collaborate with channel partners on operational activities to quickly adjust or respond to market changes" (Liu *et al*., 2013, p. 1453). SCAG is now considered a critical enabler of supply chain success in a highly unstable and shifting economic environment (van Hoek *et al*., 2001; Sharifi et al., 2006, 2009; Najafi Tavani et al., 2013; Cerruti *et al*., 2016) that aims to add value to the organization and maintain a competitive advantage (Ngai et al., 2011). For example, Dwayne Whitten *et al*. (2012) argue that the success of supply chain practitioners depends on an agile supply chain environment (p. 30). As an operational (Liu *et al*., 2013; Yang, 2014) and relational capability (Yang, 2014), agility enables organizations not only to swiftly respond to customer demands and market dynamics (van Hoek *et al*., 2001) but also to face market uncertainty (Sharifi et al., 2006; Chiang et al., 2012), promote supply chain collaboration (Dwayne Whitten et al., 2012) and achieve time-to-market (Cerruti *et al*., 2016). It also improves product customization, delivery performance and product development time (Swafford *et al*., 2008), while speeding access to new business prospects (Sharifi *et al.,* 2006). Considering the significance of all these capabilities, some scholars have even advocated that SCAG could "act as a rare, valuable, and imperfectly imitable operational capability, which is critical to improving firm performance" (Liu *et al*., 2013, p. 1453). Agile practices: inventory in response to demand, excess buffer capacity, quick response to consumer needs, total marketplace visibility, dynamic alliances, supplier speed, flexibility and quality, and shorter lead times.

The concept of agility has experienced increasing attention in production and supply chain management research due to its importance in managerial practice. The context in which the idea has received the most consideration to date is that of manufacturing, in which agility was seen as an emerging competitive weapon (Kasarda and Rondinelli, 1998), a requirement for world-class manufacturing performance (Nagel and Bhargava, 1994), and as a new paradigm in manufacturing (Sharifi and Zhang, 2001). For example, Narasimhan et al. (2006) combine agility with leanness, Ismail *et al.* (2007) consider agility as a building block for mass customization, and Ismail *et al*. (2011) investigated the role of agile strategic capabilities in achieving resilience in manufacturing-based small companies. One of the first scholars to consider agility within the supply chain management context was Fisher (1997), with subsequent works further stressing supply chain agility as a business-wide capability, enabling the firm to respond to changing market environments (Lee, 2004, Swafford *et al*., 2006, Braunscheidel and Suresh, 2009). Supply chain agility thus extends beyond a single firm and involves alignment with major customers and suppliers (Braunscheidel and Suresh, 2009). Stimson (2002) offered a profile of procurement performance leader skills, which includes: consistent application of performance metrics; aptitude for leadership; ability to apply strategic and governance principles; understanding of and ability to navigate organizational structure; capability to integrate across the enterprise; commitment to procurement resource management and development; and the potential to analyse and influence stakeholder relationships. As Fawcett and Magnan (2001) highlighted, "supply chain education and training are one of the singular requirements for implementation success."

2.3.3 Supply chain management practices

Supply chain management paradigms or strategies, according to Morash (2001), should be based on appropriate supply chain management practices. Supply chain management practices, according to Li *et al.* (2005), are the collection of activities that a business engages in to support effective supply chain management. Some authors use supply chain management practices as a collection of sub-practices, activities, and even technologies. Nugraha and Hakimah (2019) argue that SC performance must be a combination of intra- and inter-organisational outputs. A study reported that the competition in the global market environment has transformed from competition between firms to competition between SCs associated with competing firms. Therefore, SC performance has become the centre of each SC entity in a competitive environment. Jin et al. (2014) discussed that SC performance relies on the performance of each SC entity and the efficacy of the relationships between them. The higher the supplier-manufacturer synergy, the more frequent information sharing is possible, and thus leads to a decrease in the bullwhip effect and an increase in SC performance (Bidar et al., 2010; Zhang et al., 2018). Barratt (2016) proposed that, if SC to be well-coordinated, firms must emphasise sustaining healthier associations with their suppliers and customers. The relationship among the members must lead to mutual dependence. The dynamic market environment forces organisations to make new associations and sustain the relationships to gain a competitive advantage. Organizations prefer to have long-term relationships with value-adding providers, which necessitates tighter coordination between the business and its suppliers. A strategic supplier partnership is described in this study as a long-term relationship between an organisation and its suppliers that influence the strategic and operational capacities of individual participants to assist them in achieving significant long-term benefits (Li *et al.*, 2005; Li *et al.*, 2006; Monczka *et al.,* 1998). Procuring goods and services from suppliers influencing their system and operational capabilities, creating value and increasing supply chain performance are all elements of a strategic supplier alliance (Monczka *et al.*, 1998; Sufian, 2010). It appears that how suppliers are managed has a direct impact on organisational success

(Salam and Khan, 2018; Forslund, 2014). Supplier rationalisation is frequently recommended in the reviewed literature since it allows for not only higher volume orders, which saves money but also the development of long-term relationships, which improve trust and enable the implementation of collaborative initiatives (Landry *et al.*, 2000; Oruezabala and Rico, 2012; Brennan, 1998). For example, Brennan (1998) suggests that after reducing the supplier base, implementing vendor-managed inventory arrangements is easier. Rakovska and Stratieva (2018) examined that, in addition to having high levels of cross-departmental interaction, leading hospitals engage in joint initiatives with their suppliers to improve product availability and reduce costs, as well as extensively share a lot of information and knowledge with them about forecasts, consumption plans, inventory levels, costs, joint efforts, technical information, good material flow management practises, and new products and services. Leading hospitals tend to keep payments under control to avoid delays when it comes to financial flow management. As a result, many hospitals place high importance on the benefits of external integration. Given that difficulties with acquired products can jeopardise patient care, health, and hospital reputation. The long-term viability of a hospital entails the long-term viability of its suppliers. In the manufacturing context, a classic example is when toxic materials are procured, which can result in unpleasant events and product recalls, as well as other effects such as criticism, damage to the hospital's reputation, and financial losses (Gimenez and Tachizawa, 2012). Therefore, the selection of certified suppliers (HCWH - Health Care Without Harm, 2019; WHO - World Health Organization; HCWH. Health Care Without Harm Healthy Hospitals, 2019; Oruezabala and Rico, 2012), supplier sustainability reporting (Schieble, 2008), supplier audit programs (Kritchanchai, Hoeur and Engelset, 2018), and assessment of suppliers´environmental and ethical practices (HCWH - Health Care Without Harm, 2019; WHO - World Health Organization; HCWH. Health Care Without Harm Healthy Hospitals, 2019; Schieble, 2008) emerge as important practices in the arena of supplier management, to ensure compliance with economic, environmental, and social standards. Furthermore, suppliers are uniquely poised to contribute to sustainability, as the development of more innovative and sustainable products largely depends on their capacity, readiness, and time invested therein (Oruezabala and Rico, 2012).

It's helpful to look at measures for developed countries to get a sense of supply chain performance. Order fill rate - the proportion of orders filled within a specified time frame - is a popular statistic of supply chain performance in developed countries. In the United States, the average order fill rate from distributor to pharmacy is 95% within 24 hours after placing an order. More than 99% of orders are filled from store to client (higher because the retailer also has stock) (Healthcare Distribution Management Association, 2004). According to a poll of European Union countries, 96% of orders were fulfilled within 45 minutes of being placed. (Clement, Tuma, and Walter, 2005). Because of the vast number of things carried - 45,000 stock-keeping units in a typical outlet - and their high cost, stores in the United States have low inventory levels, and orders are placed regularly, often several times a day. Stock levels in developed countries are measured in months due to few order cycles and large lead periods, whereas stock levels in underdeveloped countries are measured in days. For medicines supply chains in wealthy countries, availability is almost a given; performance is measured in terms of efficiency and quality. Wholesale distributors in the United States report that their net cost accounts for less than 2% of the total value given (Healthcare Distribution Management Association, 2004).

Several difficulties limit the assessment of the performance of LMIC supply chains, including (1) a lack of performance data and (2) the presence of several confounding factors that affect pharmaceutical availability, particularly financing. Performance data: Several domestic supply chains do not track and report on their performance regularly. This is a strong predictor of subpar performance in and of itself. If monitoring is done, it is frequently based on data from periodic surveys for a small number of indicators. Confounding factors: It's often difficult to tell whether poor performance (medicine availability) is related to supply chain issues or other variables, such as a lack of supply financing. For LMICs, order fill rates are rarely available. Over six months, order fill rates for the CMS in Cameroon were 69.5 percent, whereas in Senegal they were 65 percent in 2005 and 49 percent in 1995 (Govindraj and Herbst, 2010). The most common metric of supply chain performance in developing countries is the stockout rate: The percentage of stores that were out of a particular item on the day the survey was conducted. A stockout can have serious health repercussions when facilities are resupplied infrequently (sometimes months between deliveries) and patients' alternatives are limited. Stockouts are often assessed using a small number of goods (dubbed tracers) chosen for their value to human health. The World Health Organization (WHO) and Health Action International (HAI) have created a standardised technique for evaluating drug access based on price, availability, and affordability surveys. A standard list of core medicines is selected to reflect treatments for frequent acute and chronic illnesses that significantly contribute to morbidity and death in a country. Surveys are conducted in a diverse range of public and private institutions. Using this methodology, a secondary analysis of 45 surveys was conducted (Cameron et al, 2008). The availability of a basket of essential medicines in the public sector ranged from 38.2% in Sub-Saharan Africa to 57.7% in Latin America and the Caribbean. The average availability in the private sector varied from 44.5% in East, Southeast, and South Asia to 79.4% in Central Asia. The private sector had a greater overall availability rate of 63.2% than the governmental sector (34.9%).

2.3.4 Sustainable supply chain management

SSCM is the strategic and consistent alignment and achievement of the social, environmental, and economic goals of an organization through the systematic coordination of key inter-organizational business processes to enhance the long-term economic, social and environmental efficiency of the organization and its supply chains (Carter and Rogers, 2008). Sustainable supply chain management (SSCM) can be described as managing the supply chain activities, operations, resources, information, and funds, to maximize the profitability of the supply chain, as well as social well-being (e.g. the impact of the supply chains on its employees, customers, and society), and at the same time minimize any negative environmental effects (Hassini et al., 2012; Shi et al., 2017; Zhang *et al*., 2016). There are several aspects to SSCM and it requires multi-operational functions to attain a competitive advantage (Su et al., 2015); Ahmad *et al*., 2016a). In short, SSCM focuses on preserving the environment and improving socio-economic dimensions for long-term sustainable development (Ahi and Searcy, 2013; Formentini and Taticchi, 2016; Fahimnia *et al*., 2017; Linton *et al.*, 2007; Leppelt *et al*., 2013). SSCM is driving corporations to improve their social, economic, and environmental performance across their supply chains (Lin and Tseng, 2014; Genovese *et al*., 2017). The potential environmental and societal effects of an organization's supply chain operations are both huge and difficult to manage (Kusi-Sarpong, Sarkis and Wang, 2016; Bai *et al*., 2017). As such, SSCM minimizes the negative impacts of operations and improves firm value/efficiency concerning environmental, economic, and social dimensions towards sustainable development, which is seen as a way to improve supply chain management, with a significant impact on the company's competitiveness and supply chain operations, the aim being to build the necessary capabilities to compete and strengthen the company's sustainable competitive and collaborative advantage (Tseng *et al.*, 2008; Wong *et al*., 2014).

According to Chardine-Baumann and Botta-Genoulaz (2014), one of the approaches to improving organizational performance is through supply chain sustainability. This has an impact on a company's competitiveness and supply chain performance. Managing these initiatives and programs involves multi-dimensional issues, such as supplier selection, and using green technology to increase sustainable collaborative competitive advantage (Seuring *et al*., 2008). In SSCM literature, it is obvious that implementing sustainable initiatives and programs reinforces proficiency and cooperation among partners and stakeholders by improving their environmental performance, minimizing waste, and saving costs (Linton *et al.*, 2007). This reaffirms the need for the combination of the economic, environmental, and social aspects of business theory and practices towards achieving sustainable supply chain management. As such, for organizations to enhance their sustainability, business operations must control their operations, with the long-term objective of maintaining the well-being of society, the economy, and the environment (Hassini *et al*., 2012). It is for this reason that many companies are beginning to use sustainability indicators to evaluate their level of sustainability, albeit with a predominant on environmental sustainability (Tseng, 2013; Tseng *et al.,* 2008; Seuring and Müller, 2008).

Srivastava (2007) demonstrated that the SSCM decision-making framework focuses on five key strategic areas, including product design, material selection, the production process, finished product delivery to the customer, and the management of end-of-life products at the end of their life cycle. Although Srivastava (2007) developed a sustainability framework, the operational criteria did not include clear criteria covering the social dimension and, without that social dimension, any sustainability initiative is bound to be deficient and incapable of dealing with the social impact. Carter and Rogers (2008) integrated resource dependence theory, population ecology and the corporation resource-based view to developing an SSCM framework, considering basic supporting facts which are required in the implementation of SSCM practices. The authors examined the relationships between social, environmental, and economic performance concerning obtaining long-term economic viability within an SCM context. However, the focus on social sustainability criteria was limited when the framework was being developed, which meant that the social sustainability issues were addressed to a lesser extent.

Liu *et al*. (2012) conceptualized a new hub-and-spoke framework comprising six dimensions (people, product, process, project, planning, and promotion). In their study, green marketing and SSCM were integrated to build supply chain capabilities more effectively to meet the needs of green customers. However, they did not focus much on social sustainability and its impact on the case companies. Manzini and Accorsi (2013) developed a framework for managing sustainability, safety, and quality in food supply chains, but their framework did not include the social sustainability dimension. The SSCM practice framework was developed by Esfahbodi *et al*. (2016) based on environmental and cost performance practice sets, that did not discuss or consider the supply chain social sustainability dimension to help build the capabilities needed to deal with social issues in emerging economies. A review of existing literature indicates that, although there are significant attempts in the existing literature to address the issue of organizational and corporate sustainability, few studies have focused extensively and specifically on the social dimension of sustainability (see also Kleindorfer *et al*., 2005; Seuring and Müller, 2008; Seuring, 2013). According to Mani *et al.* (2016), more study is required to examine the social sustainability dimension in developing nations. It is against this backdrop that this paper attempts to investigate organizational sustainability with a specific focus on the social sustainability of the supply chain.

This aim can be accomplished through the creation of coercive relational skills that enable the focal organization to develop incentive structures and improve upstream social and environmental conditions (Corbett and Klassen, 2006; Parmigiani *et al*., 2011). For organizations vulnerable to pressure from stakeholder groups, SSCM becomes crucial. Stakeholder pressure defines the situation in which a company is kept responsible to stakeholders for its actions and decisions on product design, procurement, manufacturing, or distribution (Parmigiani et al., 2011). Through SSCM, organizations seek to improve the environmental, social, and economic conditions within their supply chains to ameliorate stakeholder pressure. In the following, we will draw on Exploratory factory Analysis (EFA) to further elaborate on the potential relationships between supply chain components, supply chain practice, and sustainable performance. Brockhaus, Kersten and Knemeyer (2013) argue that sustainability has moved from a peripheral topic to an important research agenda in supply chain management (SCM). Carter and Washispack (2018, p. 242), demonstrate in a review that, with sustainability gaining much interest “we have reached a point of saturation” with regards to evaluating the framework of SSCM literature and its core themes. SSCM according to Hong, Zhang and Ding (2018) is based on the combination of sustainable theory and SCM.

The application of sustainability to the supply chain has caught the attention of many researchers (Scavarda *et al*., 2018) in unindustrialized countries. The contribution made by the researchers facilitates the proposal development for several segments, such as the industry (Ahmadi, Kusi-Sarpong and Rezaei, 2017; Koksal et al., 2017; Oelze, 2017) and the healthcare institutions (De Vries and Huijsman, 2011). Mustaffa and Potter (2009) demonstrate that there is a parallel relationship between the healthcare supply chain and the industrial supply chain. They stress that the first is more complicated than the latter to include the generation of treatment following the needs posed by each patient. Despite the authors' suggestion of this uncertainty, it is important to emphasize that the sectors developed in emerging countries are seeking proposals and programmes for the supply chain aimed at environmental sustainability. Another aspect involving the sustainable supply chain concept is the circular economy (Hong, Xiong and Bai, 2017). The circular economy guides towards sustainable growth and it provides the Triple Bottom Line (TBL) contribution of adding value to where it is established (Hong, Xiong and Bai, 2017; Seuring and Miller, 2008; Zeng *et al.*, 2017). The Global Supply Chain Forum discovered eight crucial processes that make up the core of supply chain management (Cooper et al., 1997, pp. 1-14): Customer Relationship Management; Customer Service Management; Demand Management; Order Fulfilment; Manufacturing Flow Management; Procurement; Product Development Commercialization; Returns. The eight key business processes run the length of the supply chain and cut across firms and functional silos within each firm. Functional silos include marketing, research and development, finance, production, purchasing and logistics. Activities in these processes reside inside a functional silo, but an entire process will not be contained within one function.

2.4 Healthcare supply chain

Healthcare supply chain management refers to the integrated management of material flow, monetary flow, and the distribution of human resources among all activities to provide optimal services at a proper time to patients as final clients (Parker and DeLay, 2008). Healthcare supply chain is the combination of a wide range of supplies (pharmaceutical products, medical supplies, office supplies, cleaning products, linen, etc.) with, in some instances, a high turnover of products driven by technological development (Baker *et al*., 2010; Germain *et al*., 2011). The inventories must pass through the internal supply chain of the organization, which originates in the central storeroom and ends with the end-user (i.e. doctors, nurses, orderlies, or patients) (Abdulsalim *et al*., 2015; Landry and Beaulieu, 2013). Scholarly works examine that the healthcare supply chain keeps lagging behind the supply chain in the commercial sector and other sectors (see Schneller and Smeltzer, 2006; Burns, 2002; Dacosta-Claro, 2002; Oliveira and Pinto, 2005).

McKone-Sweet, Hamilton, and Willis (2005) investigated the healthcare supply chain and reported that the most mentioned barriers were: lack of executive support; misaligned incentives within the organization and throughout the supply chain; lack of education, both at the materials management and executive levels; and data collection and measurement. Hospital supply chains are often confronted by several economic, environmental, and social problems. From an economic point of view, increasing healthcare expenditures demand greater efficiency in the delivery of services (Kumar and Blair, 2013). An investigation of the case histories of 10 high-performance supply chains led Nelson *et al*. (2001) to conclude that “training, education and persistence and occasionally luck are the capacities that made all the difference.” The study participants also focused on the need for materials managers and supply chain managers to gain more knowledge of supply chain management and other business processes. Barrow (2011) revealed that clinicians spend much of their time to the detriment of patients, often actively involved in the supply chain process. In addition, all supply chain stakeholders prefer to overstock these supplies to avoid inventory shortages; hence, they raise both costs and the risk of obsolescence. Logistics managers appear to occupy lower levels in the hospital management hierarchy, considering the complexity of these problems, which makes it difficult for them to sell their ideas to the rest of the facilities. One industry expert (1/14/03) underscored the importance of executive involvement beyond the selection of a GPO, stating “they (hospital executives) can’t remove themselves from responsibility for supply chain management and defer to the GPO.” To drive changes in the hospital, “there has to be a top-down philosophy with a CEO interested in tackling the supply chain issues" and metrics put in place to measure and evaluate supply chain costs and overall performance (McKone-Sweet, Hamilton and Willis, 2005).

Other scholarly works demonstrate that process enhancement management can lead not only to improved quality but also to innovative business creation and new market opportunities (Robinson and Malhorta, 2005). According to Kavilanz (2009) out of $2.2 trillion in healthcare spending, $1.2 trillion was wasted. Lack of standardized process is one of the areas that can be easily corrected and save resources, among many areas cited as sources of waste in the study. Lacy (2001) reports that improving the process could save approximately $16.5 billion in healthcare spending as early as 2000**.** Landry and Beaulieu (2013) report that this sector's logistics costs can account for 30% to 40% of the budget of a hospital, and poor practices in this field divert health resources from their core care provision mission. To buttress the shreds of evidence, Marino and Edwards (1999) argued that savings of 5% to 7% with an average process of standardization and additional savings of 5 to 7% with substitution programmes. Lin *et al.* (2012) simply defined best practices as those that demonstrate their superiority and that are generally recognized by many businesses in their sector. Szulanski (1996) stated that these practices often take the form of an amalgamation of resources (human, technological, procedural) and constitute organizational routines. Wong *et al.* (2005, p. 368) define logistics practices as "approaches applied in managing integration and coordination of supply, demand, and relationships to satisfy consumers in effective and profitable manners."

In healthcare provider organizations, process enhancement and standardization are not considered too challenging. In pandemic situations, such as the ongoing COVID-19 pandemic, hospital resources are often extended beyond capacity. Standardization certainly decreases and, in many instances, eliminates duplicate processes within and across the system (Derraik *et al*., 2020). In a total ownership cost framework, U.S. hospitals and clinics can use supply chain strategies to reduce healthcare costs while maintaining the quality of patient care. Resource pooling, mass customization, centralized logistics, specialization, postponement, and continuous improvement supply chain strategies that have been used successfully in the U.S. food industry should be applied more widely to the U.S. healthcare industry. In the supply chain analysis of U.S. healthcare, new and growing areas of telemedicine and medical tourism should be incorporated (Kumar and Blair, 2013). Developing low-resource countries have endured serious COVID-19 consequences compounding the already existing healthcare challenges across the African continent that are also faced with acquired immunodeficiency syndrome (AIDS) and Mycobacterium tuberculosis as co-morbidities (African Centre for Disease Control and Prevention, 2020).

2.4.1 Healthcare supply chain challenges

Challenges to developing an effective hospital SCM strategy. While literature validating the importance of strategic SCM is plentiful, there is limited academic literature that addresses the challenges unique to the healthcare industry. Burns (2001), however, provided an excellent description of the challenges inherent in the healthcare industry. A variety of obstacles to effective supply chain management exist, including:

- Constantly evolving technology results in short product life cycles and high costs for physician-preference items.
- Difficulty in predicting frequency, duration, and primary diagnoses for patient visits and the associated product requirements.
- Lack of standardized nomenclature/coding for healthcare products and commodities.
- Lack of capital to build a sophisticated information technology infrastructure to support supply chain management efforts.
- Inadequate business education and SCM capabilities among hospital-based buyers.

Swaminathan et al. (2007) argue that if hospitals are to continue to function adequately, reliable access to effective personal protective equipment (PPE; gowns, N95 masks, gloves, and eye protection) and antiviral drug therapy will be necessary for an unpredictable period. PPE used in healthcare includes gloves, aprons, long-sleeved gowns, goggles, fluid-repellent surgical masks, eye, nose, and mouth protection, face visors, and respirator masks. Healthcare workers (HCWs) should wear protective clothing when there is a risk of contact with blood, body fluids, secretions, and excretions. HCWs should select the appropriate PPE based on a risk assessment of the task to be carried out (Swaminathan *et al*., 2007). There are focus airborne droplets (splatter) released through breathing or expelled through sneezing of infected COVID-19 patients may travel several meters and remain suspended for 30 min and survive on surfaces for potentially several days. Disinfection or sterilization of PPE on the surface or touched surface, as coronavirus does not penetrate materials. However, maintaining materials functionality after efficient treatment is the greatest challenge for reprocessing on one-time-use PPE. These essential materials cannot be available at the hospital without an efficient and effective supply chain management system. Based on World Health Organization definitions and guidelines, the mean number of “close contacts” of the patient was 12.3 (range 6 -17; 85% HCWs); mean “exposures” were 19.3 (range 15 - 26). Overall, 20 - 25 PPE sets were required per patient, with variable HCW compliance for wearing these items (93% N95 masks, 77% gowns, 83%

gloves, and 73% eye protection). These data show that many current national stockpiles of PPE and antiviral medication are likely inadequate for a pandemic (Swaminathan, 2007).

Although a new influenza pandemic may appear inevitable, critical parameters of transmissibility and attack rate are uncertain. Estimates based on extrapolations from the 3 influenza pandemics of the 20th century suggest that healthcare facilities in the United States alone may be required to cope with 314,000-734,000 additional hospitalizations and 18 - 42 million outpatient visits (Meltzer, Cox and Fukuda, 1999). During the early containment phase of a pandemic, patients with suspected infection are likely to be referred to hospitals for isolation, diagnosis, and treatment until the transmissibility and virulence of the pandemic strain are known. Although social distancing and school closures may reduce risk in the wider community (2), healthcare workers (HCWs) are likely to encounter repeated close exposures. With awareness of the recent severe acute respiratory syndrome (SARS) outbreak and growing concern about human deaths from avian influenza (H5N1), governments worldwide have begun to stockpile PPE and antiviral medication. Key strategies to control the speed and extent of viral spread within the healthcare sector have been advocated by national government guidelines (WHO, 2011) and the World Health Organization (WHO). These include rigorous infection control practices, prescriptive instructions for the use of PPE, and dissemination of antiviral medication (WHO/CDS/CSR/EDC/99.1, available at http://www.who.int/csr/resources/publications/influenza/en/whocdscsredc991.pdf). HCW was defined as any person working within the healthcare facility (WHO, Avian Influenza: guidelines, 2011). We used the WHO definition of "close contact" as any person (including non-HCWs) coming within 1m of an API patient within or outside of an isolation room or area (WHO, Avian Influenza: guidelines, 2011). Close contacts were counted only once. An "exposure" was counted each time a close contact came within 1 metre of the API patient. A "PPE item" included a disposable gown, pair of gloves, pair of protective eyewear, or N95 mask (or equivalent particulate respirator). A "PPE set" was defined as the appropriate combination of PPE items recommended for HCW use in a particular clinical setting (WHO, Avian Influenza: guidelines, 2011). "Opportunity for PPE item use" was defined as any instance of actual use of a PPE item during the study as well as any instance where the wearing of a PPE item was recommended by WHO guidelines (WHO, 2011), as objectively noted by accompanying study observers. These items included PPE worn by HCWs involved in direct patient care (HCW close contacts) and ancillary HCWs who performed indirect clinical tasks associated with the API case-patient such as cleaning, ward support, and specimen transportation and processing. Environmental decontamination of clinical areas after use was considered adequate if cleaning and disinfection procedures were undertaken in a manner consistent with WHO recommendations (www.who.int/csr/disease/avian_influenza/guidelines/infection control1/en). Finally, Everard (2001) attributed the lack of progress in SCM to the fact that each link in the healthcare supply chain operates solely in its own best interests. Although most healthcare professionals generally agree that change is necessary, fear of making the first move limits progress. Chopra and Sodhi (2004), and the Institute for Supply Management, argue that the number of enterprises reporting supply chain impact increased from 80% to 95% between early March and late March (Christopher and Peck, 2004). However, currently, the COVID-19 epidemic has damaged 86% of supply chains, according to a report released on March 28, 2021, reported by the Chartered Institute of Procurement and Supply).

2.4.2 Sustainable healthcare supply chain

During the last decade, the healthcare sector has changed enormously in response to the increased competition, the growing influence of patients, and the necessity to deliver health services more efficiently and effectively (de Vries and Huijsman, 2011; Aptel and Pourjalali, 2001). While Banks *et al*. (2015) show that healthcare markets are growing under demographic and economic pressures, Pencheon (2015) argues that new circumstances with environmentally generated risk and a shifting disease reality challenge the current healthcare sustainability model. Zadeh, Xuan, and Shepley (2016) disclose that after focusing on health, safety, and quality, queries have risen concerning the functional application of sustainability concepts in healthcare services and whether such notions can be well-matched with healthcare outcomes. According to Hong, Zhang and Ding (2018), research focusing on developing countries is still limited as SSCM practices in these countries are relatively underdeveloped. Improving the sustainability of supply chains in developed countries holds important worldwide value, as more developing countries are. The cost of logistics in healthcare is 38% of the overall cost, according to one report, while the same is 5% for the retail sector and 2% for the electronic industry (Johnson, 2015). Specific distribution networks used by the healthcare supply chain attributable to group purchasing organizations (GPOs) and independent delivery networks (IDN) activities could be a potential explanation for such a wide gap (Kwon and Hong, 2011). A study reveals that healthcare cost in this country is the biggest barrier to entrepreneurship investment (O'Marah, 2015). An outstanding overview of the challenges inherent in the healthcare industry was analysed by Burns (2001). There are several barriers to successful supply chain management:

I. Continuously changing technology results in short product life cycles and high costs for physicians' favourite products.
II. Difficulty in forecasting patient visits frequency, period and primary diagnoses and the related product requirement.
III. Lack of standardized vocabulary/coding for healthcare products and commodities.

IV. Lack of capital to develop a sophisticated infrastructure for information technology to sustain initiatives in supply chain management.

Subsequently, with an increasingly significant portion of the economy of many developed countries serving the healthcare sector and with more and more decision-makers searching for ways to minimize healthcare costs (Chen *et al*., 2013; Dobrzykowsi *et al*., 2014), not implementing strategic factors in the logistics operations of an organization is becoming unsustainable. Health studies have demonstrated the ability of logistics to make substantial improvements over time (Aziz *et al*., 2013; Beier, 1995, CSC Consulting, 1996). However, relevant relationships between components remain unexplored. Again, the studies show that numerous obstacles remain in implementing practices that would strengthen logistics management in this field, despite solutions that have been established for years (Aziz *et al*., 2013; Nachtmann and Pohl, 2009).

2.4.3 Evolution of sustainability

Sustainability is defined as the ability to continue, support or maintain an activity for a prolonged period approaching perpetuity. It means meeting the needs of today without compromising the ability of future generations to meet their needs (WCED 1987). The best-adopted and most frequently cited definition of sustainability is that of the Brundtland Commission: “development that meets the needs of the present without compromising the ability of future generations to meet their needs.” (Commission on Environment, 1987, p. 8). Shrivastava (1995a, p. 955) describes sustainability as an offering “the potential for reducing long-term risks associated with resource depletion, fluctuations in energy costs, product liabilities, and pollution and waste management.” In the engineering literature, sustainability is defined as “a wise balance among economic development, environmental stewardship, and social equity,” (Sikdar, 2003, p. 1928) and as including “equal weightings for economic stability, ecological compatibility and social equilibrium,” (Go´ncz *et al*., 2007, p. 4). Sustainability from a corporate perspective is defined as the right combination of economic, environmental, and social aspects (Elkington, 1994). An increasing number of businesses are adopting green initiatives to achieve sustainability (Teixeira, Jabbour and de Sousa, 2012). The concepts "sustainable development", "sustainability" and "sustainable" are used in many ways, sometimes with different connotations, as previously noted. As understood in academic literature, the following section explains the words. Second, along with the term "development", the term "sustainable" is also used. In this instance, both concepts comprise an entire concept - "sustainable development" - which should be taken together to represent a specific concept based on specialized definitions and guiding principles (Zaccai, 2002). Secondly, the word 'sustainable' can also be used differently from the term 'development,' such as 'sustainable agriculture,' 'sustainable education,' 'sustainable forestry,' 'sustainable fisheries,' 'sustainable entrepreneurship,' etc. In this circumstance, the adjective generally applies to "sustainable development" and provides the ability to incorporate the basic concepts of the definition into many application fields. (Zaccai, 2002). Thirdly, as a synonym of "sustainable development," the word "sustainability" is also used. A distinction between "sustainable development" and "sustainability" is often made, however. Some scholars claim that "sustainable development" is mainly about economic growth/development, while "sustainability" prioritizes the environment. The unifying factor is that environmental issues are considered by both terms. The distinction is that taking the climate into account, the former applies to "improving" economic development, while the latter is about "challenging" economic growth, reflecting on humanity's ability to survive within the planet's environmental limits (Robinson, 2004; Waas *et al*., 2011).

For more than half a century, sustainable development advanced from an alternative view of development towards a broadly acknowledged and formally politically endorsed development model. Throughout this process, political efforts vary and four periods can be distinguished: (1) the starting up period (until the end of the 1970s), (2) the stagnation period (1980-1986), a period with major achievements (1987–1995), and (3) a period of decline (1996 - onwards). The following milestones were key:

I. United Nations Conference on the Human Environment (UNCHE; 1972)
II. World Conservation Strategy (WCS; 1980)
III. Our Common Future (1987)
IV. United Nations Conference on Environment and Development (UNCED; 1992)
V. United Nations Millennium Summit (2000)
VI. Earth Charter (2000)
VII. United Nations World Summit on Sustainable Development (WSSD; 2002)
VIII. Rio + 20 United Nations Conference on Sustainable development (UNCSD; planned in 2012).

Regardless of the period, peaks in political activity coincide with the decennial conference organized by the United Nations (UN) (UNCHE, UNCED, Millennium Summit, and WSSD) which is suggestive of their influence as catalysts of more reflective societal and political action and underline their importance (Quental, Lourenço and Da Silva, 2011). The idea of sustainable development (SD) has been used for the last 45 years as an alternative to traditional economic development focused on the growth of gross domestic product (GDP). Rallying around this paradigm is a reaction to the dominant model's shortcomings, including its inability to allocate resources equally and its effects on the local and global climate, cultural diversity, and social diversity. While its origins can be traced to human history millennia ago, (Waas et al., 2011). Sustainability development has profoundly thrived in the late 20th century (Pintér *et al*. 2012). In the political environment, corporate sectors as well as at the community level, in non-governmental organizations, and in the academic world, sustainability is addressed but attempts to implement it are rewarded by varying degrees of success. So far as the definition is based on virtuous ideals, "things" continue to proceed much as normal and no real improvements are made in detail. Sustainability did not reach the domain of decision-makers sufficiently to prevent multiple crises (food, environment, water, poverty, etc.) which coincided with the financial crisis of 2008, despite abundant literature on SD and another World UN Summit held in Johannesburg (2002). The financial crisis eventually called for a real move toward conversion in the measure of success from GDP growth to well-being and sustainability, as both would have been impossible in an SD-ruled environment (Barbier, 2009; Pintér *et al*., 2012; Villeneuve *et al.*, 2017). Since decisions are usually based on short-term perceived problems to fulfil political goals or quarterly outcomes, long-term problems and uncertainty have a minimal effect on daily management. We can therefore accept SD as a hypothesis on the evolution of various indicators for the welfare of human beings that increase the quality of their local and global environment over a long period (Villeneuve, 2000 (p. 53) cited in Villeneuve, 2017). In terms of its planning, execution, tracking and assessment, however, SD still poses challenges (Sala, Ciuffo and Nijkamp, 2015). As ecosystems are continually placed under threat around the world, demands for ecosystem conservation and management have been growing (Meadow, 1972a; Brundtland, 1987, IUCN, 1991). The need to achieve a sustainable level of human contact with a given environment is widely recognized (Brundtland, 1987; IUCN, 1991). The difficulty faced by environmental managers and ecologists is precisely how these systems should be managed and made sustainable. Some early answers to such questions are that ecosystems should be managed for "naturalness", "health", or even "wilderness."

Initially, growing concern about environmental issues in developing countries and the inability to link these problems to development issues led to the creation of November 1983 of the United Nations Commission on Environment and Development. This Commission was composed of twenty-two people from both developed and developing countries, under the dynamic leadership of Norway's prime minister, Mrs Brundtland. The main objective was to hold public hearings in several countries in which members of the public and community representatives could provide proof of the development of the environmental relationship (Woodley, 1991). Sustainability according to the World World Commission on Environment and Development (WCED) is the development that meets the present needs without sacrificing future generations' ability to meet their own needs (Ekins, 1993). Issues such as recognizing the environmental effects of economic activity in both developing and developed economies are included under this large sustainability rubric (Erlich and Erlich, 1991; Choong and McKay, 2014); ensuring worldwide food security

(Lal, 2004); ensuring that basic human needs are met (Savitz and Weber, 2006); and ensuring non-renewable resource management (Whiteman and Cooper, 2000).

It was not until 1998, that triple bottom line (TBL) a concept was introduced by Elkington (Onsager, 2004), which considers and balances at the same time economic, environmental, and social objectives from a microeconomic point of view. Therefore, the triple bottom line suggests that there are activities that organizations can engage in at the intersection of social, environmental, and economic performance that not only positively affect the natural environment and society but also result in long-term economic benefits and competitive advantage for the firm. According to Dey and Cheffi (2013), the US Environmental Protection Agency (EPA) reports that effective management of the environmental performance of suppliers as practised by Hewlett-Packard can lead to simplification of goods and processes, more productive use of resources, better product quality, avoidance of liability and enhanced reputation of leadership. Aras and Crowther (2008) report that sustainability focuses on transformation, efficiency, and distribution. Sustainability performance management requires a sound management system that firstly links environmental and social data with industry, strategic strategy, and management, and secondly integrates environmental and social information with business information and sustainability reporting (Schaltegger *et al.,* 2003). Many different stakeholders are involved in healthcare chain practices. Therefore, the application of supply chain management practices in a healthcare setting is related to organizational aspects such as building relationships, allocating authorities and responsibilities, and organizing interface processes (de Vries and Huijsman, 2011). Supply chain management in healthcare includes the internal chain (e.g. patient care unit, hospital storage, and patient) and the external chain (e.g. vendors, manufacturers, and distributors; Rivard-Royer et al., 2002; Schneller and Smeltzer, 2006). It incorporates business activities and operations that integrate a smooth, continuous flow of materials and services for healthcare (Rivard-Royer *et al*., 2002; Shih *et al.,* 2009).

Sustainability challenges cut across organizational settings and therefore are not restricted to the health sector alone. For instance, findings of a scholarly work by Dey *et al.* (2020) report that while 88% of respondents claimed to value sustainability, 70% had struggled to attach practices and strategies (Mace, 2019). Although 8 out of 10 SMEs plan to introduce more ethical and sustainable practices, 40% thought that sustainable practices were too costly to implement, while 42% claimed that the UK government wasn't doing enough to encourage sustainable business practices (Mace, 2019). When chief executives were consulted on ethical business practices, 75% responded 'treating people fairly', 58% responded 'sourcing manufacturing materials responsibly', 51% responded 'maintaining energy efficacy' and 33% responded 'stakeholder engagement outside the financial backers' (Newsroom, 2018). Sustainability can be assessed but it allows different views to coexist. According to Carley and Christie (2000), it must abide by four principles: (1) normativity; (2) equity; (3) integration; and (4) dynamic principle. The normativity principle supposes that sustainability is a matter of social definition and can change with time and values. It is a temporary representation of the kind of world we want to live in and want to leave as a legacy for future generations. The equity principle is central to sustainability and can be divided into inter-generational, intra-generational, geographical, procedural, and inter-species equity. The integration principle implies that all sustainability principles should be considered together in a holistic perspective and that mutually supportive benefits must always be sought. The dynamic principle refers to SD as a process of directed change that is not defined by an end-state: SD is therefore cybernetic by essence (Villeneuve, 2011). A study highlighted the need for sustainability impact assessment which refers to the process of determining the likely effects of a project or plan on the social, environmental, and economic foundations of sustainability. This information is often used to create integrated strategies that "take full account of the three dimensions of sustainable growth" and include "cross-cutting, intangible, and long-term considerations" (Organization of Economic Cooperation Development, 2010). Many European countries and Canada use sustainability impact assessments, but they are not widely used in the United States (Zerbe and Dedeurwaerdere, 2003).

2.4.2 Determinants of Sustainability

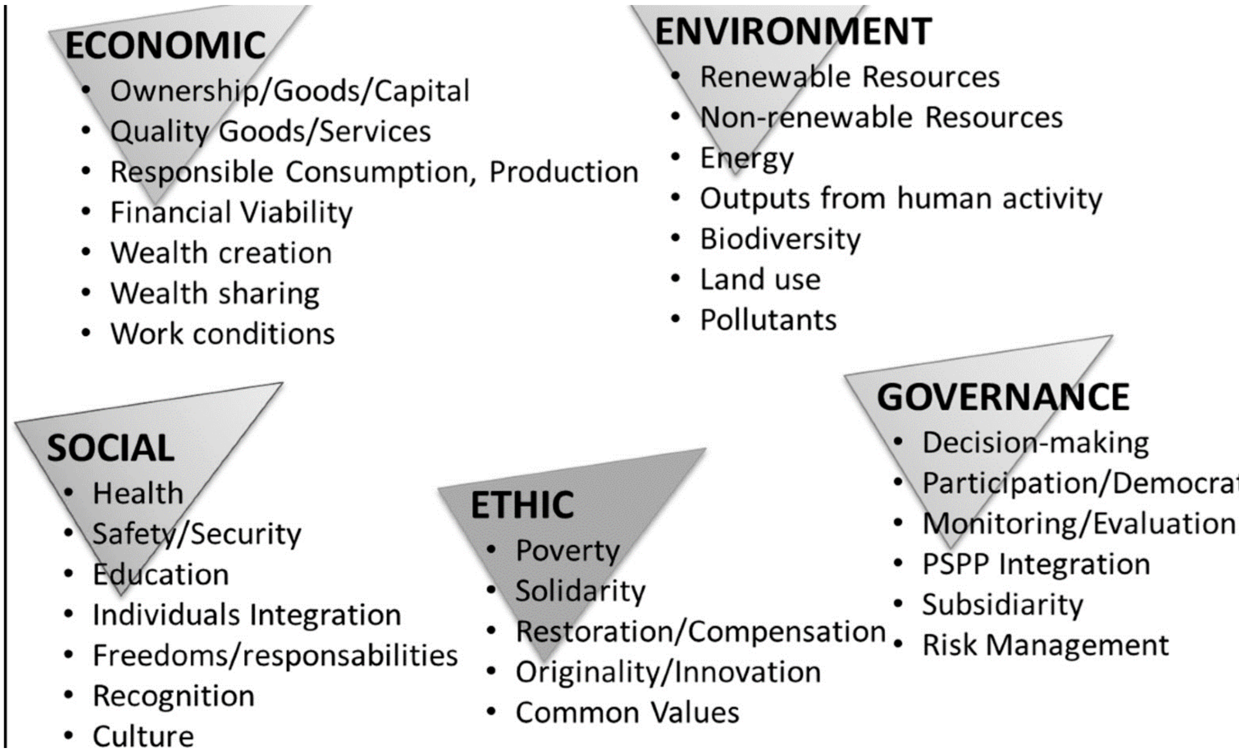

Figure 2.1 Dimensions and Themes of the SDAG 2011

(Adapted from: Villeneuve et al. 2017)

2.4.4 Sustainable development goals (SDGs)

At the beginning of the new millennium, world leaders congregated at the United Nations to shape a wide vision to resolve poverty in its many dimensions. This vision, which has been translated into eight Millennium Development Goals over the past 15 years (MDGs) which are Goal 1: eradicate extreme poverty and hunger; Goal 2: achieve universal primary education; Goal 3: promote gender equality and empower women; Goal 4: reduce child mortality; Goal 5: improve maternal health; Goal 6: combat HIV/AIDS; malaria and other diseases; Goal 7: ensure environmental sustainability; Goal 8: Develop a global partnership for development have remained the overall development paradigm for the world (SDG Report, 2019). As we near the end of the MDG era, the global community has reason to rejoice. Thanks to concerted global, international, national, and local efforts, the MDGs have saved the lives of millions and improved conditions for many more. The data and analysis presented in this report show that even the poorest countries, with oriented initiatives, sound policies, adequate resources, and political will, can make a dramatic and unprecedented change. The analysis also recognizes contradictory achievements and shortcomings in many respects. In the new era of growth, the job is not finished and must continue (United Nations, 2015).

2.4.5 Economic sustainability

The concept of circular economy (CE) is hastily gathering momentum in industry, policymaking, and academia to improve economic performance without utilizing resources at a rate that exceeds the Earth's capacity (European Commission, 2020a, 2020b; Stahel, 2010). The CE accomplishes this decoupling of creating value from the consumption of finite resources by leveraging a range of efficiency, productivity, and restorative-oriented strategies (known as circular strategies) to maintain products, components, and materials in use for longer (EMF, 2015a; 2015b). Therefore, the CE holds great promise as a contributor to sustainability (Geissdoerfer et al., 2017; Ghisellini et al., 2016) and directly impacts multiple United Nations' Sustainable Development Goals (Schroeder et al., 2019). However, the adoption of CE and sustainable strategies by industry has so far been modest (Circle Economy, 2020; Haas et al., 2015; Planing, 2015; Sousa-Zomer et al., 2018), and scant progress is observed in the decoupling from linear resource consumption. Economic performance, measured by efficiency, cost reduction, sales, benefits, cash flow, and business development, is one of the fundamentals of sustainability performance and business performance *(Dey et al.,* 2020). Effective supply chain management is important to build and sustain a competitive advantage in the products and services of the firms. Gunasekaran and Ngai (2004); Sufian (2010) stated that the performance of the supply chain was influenced by managing and integrating key elements of information into their supply chain. To achieve effective supply chain integration, the firms need to implement information technology (Handfield and Nicholas, 1999); Sufian (2010). (Brandyberry, Rai and White, 1999) contend that by using information technology, firms could manage well the flow and impact of numerous supply chain dimensions, such as quality, cost, flexibility, delivery, and profit. In addition to the economic focus, a recent trend in the SCM study points to its link to sustainability, which incorporates the environmental and social dimensions (Winter and Knemeyer, 2015).

Since the UN General Assembly adopted the sustainable development agenda (Agenda 2030) in September 2015, which is made up of 17 goals and builds on the principle of 'leaving no one behind' a systemic strategy for achieving sustainable prosperity for everyone has been developed (Weber, 2017). Sustainability, widely accepted as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development, 1987, p. 41), is a long-term dynamic process and poses several challenges for supply chain managers. To achieve sustainability, they need to address interconnected social, environmental, and economic objectives in the supply chain (Mitchell and Walinga, 2017; Raut *et al*., 2017). The sustainability of the supply chain depends on individual companies, and a supply chain which often has multiple partner companies, including manufacturers and suppliers (Ashby *et al.,* 2012). The United Nations periodically assesses the human development index of industrialized and developing countries and sets the benchmark for social sustainability measures. The index and benchmarks act as a driving force that will improve the social aspects of sustainable development (UNCTAD, 2013).

However, the problem in developing countries is to identify the most pivotal enablers that lead to social sustainability in the supply chain. A scholarly study reports that from a strategic management perspective, 88% of reviewed sources find that companies with robust sustainability practices demonstrate better operational performance, which ultimately translates into cash flows. The report further shows that 80% of the reviewed studies demonstrate that prudent sustainability practices have a positive influence on investment performance and ultimately demonstrate that responsibility and profitability are not incompatible, but wholly complementary. It argues that when investors and asset owners replace the question “How much return?” with “How much sustainable return?”, then they have evolved from stockholders to stakeholders (Clark, Feiner and Viehs, 2014). Many medications and doses that are excessively or imprudently high are administered to parts of the population. Imprudent prescribing and ultimate use of medications are the main aspects of rising healthcare expenses, which make up an unsustainable 17.6% of GDP in total (Curfman, Morrissey and Drazen, 2013). In addition, a corresponding reduction may lead to drug diversion, misuse, and accidental poisoning by reducing the incidence of leftovers through lower doses (Daughton and Ruhoy, 2012). These are all major challenges in the U.S. and a primary concern for the White House Office of National Drug Control Policy (ONDCP, 2013).

2.4.6 Environmental sustainability

According to Daughton (2014), the practice of healthcare requires the widespread use in the US of approximately 2500 separate active pharmaceutical ingredients (APIs) formulated into tens of thousands of commercial pharmaceutical preparations (approximately 4000 worldwide). Excreted APIs reach the aquatic ecosystem through both treated and untreated (raw) sewage; APIs in raw sewage enter unabated not only through wet-weather runoff and illegal discharges into surface and ground waters but also through contributions from various point sources from faulty sewer connections (Baum *et al.,* 2013). Leftover discarded drugs are frequently disposed of in sewers as well. Some APIs (high-content topical drugs) are designed for external use; some of these APIs have exclusive topical use (they are not administered systemically). Bathing is a big route for these APIs to reach the world (Daughton and Ruhoy, 2009). Both excretion and the need for disposal are motivated in part by imprudent, inappropriate or excessive prescribing, misuse and over-consumption, both major healthcare issues and others with several complicated causes (Daughton and Ruhoy, 2011). Substantially, current approaches aimed at reducing environmental API levels have concentrated solely on pollution control, especially improving the treatment of wastewater and the collection of unused consumer medicines. These are end-of-pipe methods, which have been the hallmarks of environmental chemical pollution management for decades. However, these are not methods that can be counted on to promote the sustainable use of drugs. On the contrary, there could be a claim that pollution control measures may work against sustainability by deflecting the ongoing dialogue on drug residues in the atmosphere from potentially more efficient pollution reduction measures. The absence of an emphasis on the prevention of pollution encourages the continued, unregulated prescription and use of unnecessary medicines for prolonged periods and sometimes in excessive doses. However, in recent times, dose reduction has been the only method suggested to specifically reduce the primary pathway (excretion) for the environmental release of APIs, as well as to reduce the occurrence of leftovers and the consequent need for their disposal. This proposed technique also indicates that more cautious drugs and regimens should be taken into consideration by patients and prescribers; minimizing the overuse and imprudent use of antibiotics is one example (Daughton, 2010a; Daughton and Ruhoy, 2013).

Environmental performance is very reliant on energy usage, optimizing resources, and reducing waste, which has a direct relationship with Co2 emissions (Yusuf *et al.*, 2013). Dey and Cheffi (2013) demonstrate that according to the US Environmental Protection Agency (EPA) effective management of the environmental performance of suppliers as practised by Hewlett-Packard, can lead to simplification of goods and processes, more productive use of resources, better product quality, avoidance of liability and enhanced reputation of leadership. Aras and Crowther (2008) report that sustainability focuses on transformation, efficiency, and distribution. Sustainability performance management requires a sound management system that firstly links environmental and social data with industry, strategic strategy, and management, and secondly integrates environmental and social information with business information and sustainability reporting (Schaltegger *et al.,* 2003). Pollution is a major cause of morbidity and mortality, accounting for 9 million premature deaths worldwide in 2015, or 16% of all fatalities (Landrigen *et al*., 2018). Many of these environmental deaths are currently associated with air pollution, which is responsible for 1 in 8 deaths worldwide (Cohen *et al.,* 2017). Climate change from greenhouse gas emissions has been called the 21st century's number one public health issue which like air pollution, is largely due to the burning of fossil fuels (Costello *et al*., 2009). Due to climate change-mediated health threats such as severe weather events, deteriorating air quality, food and water-borne illnesses, water-borne diseases, food and water shortages, and social unrest, an estimated 150,000 deaths occur annually worldwide. The loss of an extra 250,000 lives each year from climate change is expected to occur between 2030 and 2050 (World Health Organization, 2009), in future decades, vital earth systems will be further damaged unless drastic pollution mitigation measures are taken urgently (Steffen *et al*., 2015).

While health professionals find ways to help patients deal with the adverse health effects of pollution, leadership from health professionals is important to draw attention to these effects and to help recognize and prioritize mitigation strategies (Costello *et al*., 2009; Costello *et al*., 2013). Ironically, modern healthcare itself is a major emitter of environmental pollutants that adversely affect human health (Eckeman and Sherman, 2016; Eckelman *et al*., 2018; Malik et al., 2018; National Health Service Sustainable Development Unit, 2016). To increase efficiency, prevention, and benefit, healthcare sustainability research investigated the dimensions of resource use and environmental pollution associated with healthcare activities. The framework for industrial ecology aims to establish solutions and methods to eradicate waste and contamination from human environments, sustain the use of goods and resources, and restore or renew natural systems. The key analytical method used to evaluate healthcare sustainability is LCA (Sustainable Development Unit. Coalition for Sustainable Pharmaceuticals and Medical Devices, 2019; Sustainable Development Unit, 2012). LCA is an internationally standardized scientific approach (ISO 14040 (International Organization for Standardization. ISO 14040 1997) Used for quantifying emissions of a product or process across its entire life cycle in many industries. The complete life cycle should account for 'cradle-to-grave' inputs, pollution, and associated health effects, including natural resource production, processing, transport, use/re-use, and disposal or end of life. LCA thus contains direct emissions from product use as well as indirect emissions from upstream (i.e. supply chain processing and transport) and downstream operations (i.e. waste disposal management). LCA makes comparisons between alternative products and processes possible and can thus be used to inform decision-making in healthcare. Dey et al. (2020) demonstrated that SMEs contribute up to 70% of global pollution collectively. Especially manufacturing SMEs are reported to account for 64% of air pollution, whereas only a small portion (0.4%) of these SMEs comply with an environmental management system (Bonner, 2019). A study revealed that SMEs consume more than 13% of total global energy demand [around 74 exajoules (EJ)]. Cost-effective energy efficiency measures could shave off as much as 30% of their consumption, namely 22 EJ, which is more energy than Japan and Korea combined consume per year (IEA, 2015).

2.4.7 Social sustainability

The United Nations Sustainable Development Goals for defining targets and indicators for the UN 2030 Agenda, attracted global attention (Monteiro, da Silva and Neto, 2019). A major critique, however, was the lack of acceptable metrics, as well as a model for assessing sustainability (Kapera, 2018). The concept of sustainable development addresses old theories and introduces new approaches for assessing the interdependence between economic and social development to understand the environment (Everard and Longhurst, 2018). This concentrates on social interactions that include inequality, gender discrimination, poverty, diversity, wages, and education that vary from one country to another. Social performance refers to enhancing the quality of life of all the concerned stakeholders (Yusuf, Sumner and Rum, 2014). This is measured through CSR project investments, employee wellbeing initiatives, reduction of accidents, and so on. Social sustainability not only ensures that the industry makes profits but also ensures that industrial activities do not cause social degradation (Tsai and Chou, 2009). It has become necessary for everyone, either as a business owner, Government and/or major stakeholders to ensure improvement in all facets. A study conducted by Amindoust et al. (2012), examined that organizations should consider the health and safety standards of their workers, as well as other important social requirements, in a socially responsible supply chain. Bai and Sarkis (2009) argue that social sustainability criteria could be divided into internal and external social criteria. Internal social sustainability criteria include factors such as health and safety and job practices, while external social sustainability criteria include the role of local communities, contractual stakeholders, and other stakeholders. Azadnia, Saman and Wong, (2015) used occupational health and safety management systems, training, education, and community development as social sustainability criteria, while Ahmadi *et al.* (2017) used the influence of contractual stakeholders, to create a sustainable supplier selection process, health and safety as social sustainability requirements, as well as other environmental and economic criteria, must be considered. As social sustainability criteria, Govindan, Khodaverdi and Jafarian (2013) used the influence of the local community, health and safety policies, job practices, and the influence of contractual stakeholders.

A scholarly work by Labuschagne, Brent and Van Erck (2005) assessed an organization's and its organizational activities' social sustainability efficiency, focusing on stakeholder engagement, external population, internal human capital and macro-social performance. They discovered that current performance assessment mechanisms for assessing overall organizational sustainability do not sufficiently tackle all sustainability elements at the operational level (Rajak and Vinodh, 2015). Ciliberti, Pontrandolfo and Scozzi (2008) demonstrated the problems faced by small and medium-sized enterprises (SMEs) to broaden socially responsible behaviour to suppliers operating in emerging economies, while Hutchins, Robinson and Dornfeld (2013) developed a framework for identifying the social impact of production along a product or process life-cycle, including the social dimension of sustainability (Rajak and Vinodh, 2015). Some scholars refer to social sustainability as an ethical code of conduct for human survival and growth that should be achieved in an inclusive, connected, equitable and prudent manner (Sharma and Ruud, 2003). Some researchers connect social sustainability with the management of social resources which include people skills and abilities, relationships, and social values (Sarkis, Gonzalez-Torre and Adenso-Diaz, 2010). The Bruntland Commission (1987) indicated that until the basic needs of society are met, it is unlikely that companies and governments will adequately address the problem of environmental sustainability. This means that social sustainability will not be achieved until a country meets the basic needs of its citizens. Whooley (2004) pointed out that employee satisfaction is a key driver of sustainability in the supply chains. Workplace benefits, health and safety measures, compensation, benefits, organizational commitment, retirement funds, equality and diversity among workers, training and development and work-life balance improve morale and company culture.

According to the Mani, Agrawal, and Sharma (2015) studies, it could be said that the laidback attitude of developing countries towards social sustainability in healthcare is responsible for the high rate of maternal mortality, gender inequality, and general health problems that have devastated the quality of healthcare delivery in those countries. Most of these issues are attributable to the unawareness and lip service paid to the concerns of social sustainability in the pharmaceutical supply chain and other fields of logistics. The theory of stakeholders, therefore, found its way among many researchers' prominent and commonly used theoretical techniques, and this theory led to significant hedges in the dimensioning of sustainability (see Clark, Feiner and Viehs, 2014; Baric, 2017; Alves, do, and Rodrigues, 2018; Carroll and Brown, 2018). Further studies on the interactions between the environment and the human factor have a lot of potential in the field of health care services. The need to pay attention to this vital link has been of interest to scientists and researchers for this reason (Daughton, 2014). Carter and Jennings (2004) investigated purchasing social responsibility which involves community, workplace, safety, and human rights. However, the study did not establish a direct relationship between supply chain performance and the financial performance of an organization due to mediating variables such as supplier performance and organizational learning that invariably reduce cost. Previous work on sustainable supply chains has also been presented with an instrumental debate asking if a supply chain will benefit from addressing environmental or social issues (Montabon, Pagell, and Wu, 2016). Concerning how a supply chain may become sustainable, Hong, Zhang and Ding (2018) investigation conducted on the sustainability of supply chains in developed countries has further developed the field. However, Hong, Zhang and Ding (2018) argue that some empirical studies indicate that SSCM activities and sustainable performance frameworks were not established clearly or consistently.

A study conducted in Iranian healthcare situated in Tehran demonstrates the applicability of a proposed framework and results showed that the sustainability index for Suppliers, Patients, Patient relatives, Employees, and Government and Decision-makers are 47%, 60%, 59%, 75%, and 56% respectively (Khosravi and Izbirak, 2019). While the majority of research questions have been linked to organizations' financial targets, studies conducted by Carroll and Shabana (2010), Epstein and Roy (2014), Salzmann, Ionescusomers, and Steger (2005), Schaltegger and Burritt (2018), to determine how a company could create links that facilitate corporate economic effectiveness throughout environmental management and social characteristics. Faruk (2020) argues that social sustainability is the ability to assign reasons to create and experience the value of intellectual, emotional, spiritual, and physical presence. If done, this will be a true reflection of how people are sensitive to business-wise societies or other parts of society (Monteiro, da Silva and Moita Neto, 2019). It is completely necessary, inevitably, to follow the theory discussed by (Villeneuve *et al.*, 2017), The only instrument for determining the quality of life is social sustainability which could aid in decision-making. Few studies have concentrated extensively and explicitly on the social dimension of sustainability to address the topic of organizational and corporate sustainability (see also Kleindorfer *et al.*, 2005; Seuring and Müller, 2008; Seuring, 2013). More research is needed to explore the social sustainability factor in developing countries, according to Mani *et al.* (2016).

2.5 Theoretical background

The Council of Supply Chain Management Professionals (CSCMP, p.187) not only defines SCM as the "planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities," but also emphasizes its role in the integration between players involved in the entire supply chain (Piboonrungroj, 2012). According to Carter and Rogers (2008) the term supply chain management has been defined by Mentzer *et al.* (2001, p. 18) as "the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, to improve the long-term performance of the individual companies and the supply chain as a whole" and by Lambert *et al*. (2006, p.2) as "the integration of key business processes from end-user through original suppliers, that provides products, services, and information that add value for customers and other stakeholders." SCM has proven to be crucial for businesses to reduce costs and boost economic efficiency these days when faced with a more and more dynamic market (Gripsrud, Jahre, and Persson, 2006). Supply chain as posited by Duby and Kumar (2007) is “the network of organizations that are involved, through upstream and downstream linkages, in the different process and activities that produce value in the form of products and services delivered to the ultimate consumer.” According to Chopra and Miendel (2005), supply chain management “is the management of a network of retailers, distributors, transporters, storage facilities and suppliers that participate in the sale, delivery and production of a particular product.” A supply chain is essentially a network of independent organizations connected by the goods and services to which they attach value separately and/or jointly to deliver them to the end-user (Lu, 2011). Seuring and Gold (2013) generalize that supply chain management (SCM) is a field of increasing academic interest and is reflected in the growth of related literature. Effective and efficient SCM by following exemplary practices is argued to achieve superior results (Duque-Uribe, Sarache, and Gutiérrez, 2019).

2.5.1 Sustainability-oriented leadership (SOL)

Sustainability-oriented leadership refers to leadership that prioritizes and actively promotes sustainable practices within an organization. In the supply chain discipline, there is growing research on the roles of leadership in sustainability practices (Wang and Feng, 2022; Mokhtar et al., 2019; Jia et al., 2019; Feng et al., 2022). Calls for empirical research in this discipline have concentrated on the impact of supply chain leadership on green supply chain integration (Wang and Feng, 2022; Wang et al., 2022), supply chain learning and multi-tier supply chain structure (Jia et al., 2019), reverse supply chain performance (Mokhtar et al., 2019) and sustainability performance (Burawat, 2019). Leaders who are sustainability-inclined are influential in championing sustainability into the organizational culture and driving strategic initiatives that align with sustainable goals. Leaders influence organizational processes and development and also have an influence on employees (Stempel et al., 2023; Šimanskienė & Župerkienė 2014). Furthermore, the level of sustainable development awareness of leaders also plays a significant role in helping them cope with complex economic, social and environmental circumstances, and make changes when necessary, to promote the sustainable innovation of organizations (Macke and Genari, 2019). Sustainable leadership among its objectives is to create a corporate climate of psychological safety. Employees can express their diverse and conflicting views without fear of repercussions by creating a positive work environment (Iqbal et al., 2020). Leadership is critical in directing an organization toward sustainable supply chain (SSC) practices. Influential leaders set strategic goals that embed sustainability into the core mission of their organizations, as emphasized by Wang and Feng (2023) and Pham et al. (2023). The role of leadership is of greatest significance in developing, optimizing, and maintaining SCC. Leadership entails the provision of a reasoned and concise vision that outlines the direction in which the company is advancing (Wang and

Feng, 2023; Pham et al., 2023; Cetinkaya, 2011). Günzel-Jensen et al. (2020) emphasize that sustainability-oriented leadership is vital for encouraging an organizational culture that values sustainability, which in turn influences the adoption of sustainable practices across the organization. Leaders play a crucial role in setting the vision and strategic direction for sustainability, motivating employees, and ensuring that sustainability is integrated into all facets of operations. Moreover, Strand (2021) found that leadership commitment to sustainability is a significant predictor of an organization's overall sustainable performance, as it drives the implementation of sustainable supply chain practices and enhances supply chain capabilities.

Leadership for sustainability is anchored on a living processes paradigm and not a mechanistic paradigm based on Newtonian science. This is because complex living processes demonstrate sustainable properties and patterns and can suggest crucial strategies for leadership (Barlow and Stone, 2011). Leadership is a critical factor influencing employees' attitudes and behaviours. Scholars have recounted how different leadership styles affect employee organizational citizenship behaviour for the environment (OCBE). For instance, a scholarly work by Zhang et al. (2016) revealed that supervisors' ethical leadership have a positive relationship with organizational environmental citizenship behaviour, this study was supported by follow-up research by Khan et al. (2019) and Saleem et al. (2020); Furthermore, Luu (2019, 2020) identified environmentally specific charismatic leadership and environmentally specific servant leadership demonstrated a role in shaping employee OCBE. Nurwahdah and Muafi (2022) examined that green transformational leadership has a significant impact on employee green organizational citizenship behaviour. Some researchers highlighted that transformational leadership could promote employee OCB better than transactional leadership or other leadership styles (Podsakoff et al., 1990, 2003). Likewise, the advantages of environmental transformational leadership are reflected in the green leadership literature (Egri and Herman, 2000; Robertson and Barling, 2017). A study by Everard (2001) suggested that the lack of change in the supply chain could be attributed to the lack of strong managers. He offered the following characteristics of the successful supply chain manager: the ability to learn from best practices in other sectors, a broad business education, an understanding of the supply chain drivers and influencers, and the capability to engage in strategic thinking and influence the organization. This further supports the role of leadership in supply chain management.

Green transformational leadership refers to the extension of transformational leadership style to the field of environmental protection, which can motivate subordinates to exceed the expected environmental goals (Chen and Chang, 2013). This leadership style is vital to employees' pro-environment behaviours in the workplace (Robertson and Barling, 2013). When leaders adopt democratic and open communication on matters related to the environment, employees are more willing to take environmental measures (Ramus and Steger, 2000; Ramus, 2001). Therefore, green transformational leaders' inspiration and support of environmental protection initiatives can motivate employees to engage in green behaviours actively (Chen and Chang, 2013; Robertson and Barling, 2013). However, these studies have not been able to discover enough about the potential mechanisms that affect employee OCBE, there is a lack of in-depth discussion on the process and limited conditions even though existing studies have provided a preliminary awareness of the role of leaders in predicting OCBE. Leaders in a team working on a new product are essential because they may utilise their expertise, empathy, and leadership skills to motivate others to accomplish tasks (Hart, 2019). Other studies have dealt with circular supply chains and reported that it becomes more challenging for SMEs because of resource sparsity, lack of requisite expertise and dedication to circular issues and absence of visionary leadership (Khan et al., 2022). Ethical leadership supports SMEs' circular economy practices (Saha et al., 2020; Cheffi et al., 2023) and drives sustainability practices across supply chains (Mokhtar et al., 2019). Pintro *et al*. (1993) suggested that cross-functional teams are vital to the successful implementation of projects and the effective performance of an entire organisation. According to McKone-Sweet, Hamilton and Willis (2005) supply chain efforts driven only by mid-level materials managers are unlikely to lead to organizational change. To address these issues, a study in a hospital took a collaborative approach to improve the supply chain. With executive support, the role of supply chain management, typically the responsibility of the purchasing department, became the responsibility of the entire organization. The hospital found that when people worked outside their areas, they asked basic questions that challenged the way things were done. This led to radical changes within the organization and eventually helped to eliminate the barriers between departments. Another hospital recognized that clinicians' scheduling demands did not allow time for cost-cutting activities. These two steps have provided the time, resources and incentive for clinicians to participate in supply chain cost reduction efforts.

Other studies in the green leadership literature have concentrated on the perspective of normative behaviour theory (Norton et al., 2014; Robertson and Carleton, 2017), the theory of planned behaviour (Omarova and Jo, 2022); the social exchange perspective (Daily et al., 2009; Paille and Boiral, 2013) and sociological learning theories (Khan et al., 2019; Saleem et al., 2020). These views provide a valid explanation for understanding how leadership style affects employees' positive environmental behaviours but ignore the role of social information processing theory. The existing study on sustainable leadership has made progress, and some scholars have demonstrated that sustainable leadership has a positive impact on employees' organizational commitment, employees' job satisfaction (Suriyankietkaew and Avery, 2014), employees' organizational trust (Dalati et al., 2017), organizational sustainable performance (Burawat, 2019; Iqbal et al., 2020a,b), organizational financial performance (Kantabutra and Thepha-

Aphiraks, 2016; Suriyankietkaew and Avery, 2016) and organizational resilience (Avery and Bergsteiner, 2011b). To address this challenge, scholars are actively seeking solutions, and find that introducing the concept of sustainable development into leadership is the key to changing the situation and building a sustainable organization (Gerard et al., 2017). Based on this, sustainable leadership, which promotes enterprises to advance toward sustainable development, has attracted increasing attention (Dalati et al., 2017; Piwowar-Sulej et al., 2021). Sustainable leadership is the product of the integration of sustainable development and leadership, which is a kind of leadership and management behaviour that aims to meet the needs of stakeholders and develop the core business of the enterprise to create long-term value for all stakeholders. It goes beyond green transformational leadership and responsible leadership and emphasizes the balanced development of the economy, society, and environment. Besides, it encourages organizations to achieve profitable growth and sustainability and therefore has become a key focus of current leadership research (Avery and Bergsteiner, 2011a, b).

Integrating sustainable practices into organisation's operations is a top priority for leaders who are focused on sustainability. This could apply to the healthcare industry and entail putting a strong emphasis on energy efficiency, waste reduction, and green measures that lessen the environmental impact of healthcare facilities. Leaders who support these initiatives inspire staff members to embrace comparable principles, which improves sustainability performance as a whole. According to a recent study by Li and Jia (2022), leadership that is driven by sustainability has a direct impact on employees' sustainable behaviours, which in turn fosters an environmentally friendly corporate culture. It has been demonstrated that leadership with a focus on sustainability improves organisational performance, even in the healthcare industry. Leaders who prioritise sustainability not only yield better environmental results but also increase operational and financial efficiencies. By encouraging a culture of innovation, sustainable leadership encourages healthcare professionals to look for economical and environmentally friendly solutions, such as using telemedicine or energy-saving technologies. Wu and Wang (2021) provided evidence that healthcare organisations with a leadership focus on sustainability see increases in overall performance as well as lower costs as a result of their proactive resource management strategies. Leadership that is focused on sustainability can raise employee engagement, which is important in healthcare environments. Healthcare professionals have a feeling of purpose and dedication when their leaders support sustainable practices. Because they feel more in line with the organization's ethical and sustainable values, more engaged employees provide better patient care and outcomes. Organisations with sustainability-oriented leadership had higher staff satisfaction, according to Schilling and Brunner (2021). This is directly related to better patient satisfaction and healthcare quality. Healthcare organisations may better manage risks and develop resilience with sustainability-oriented leadership, particularly in a world that is changing quickly and where social and environmental concerns are having an increasing impact on business outcomes. Sustainability-minded leaders in healthcare are better equipped to handle issues like limited resources, shifting regulations, and disruptions brought on by climate change. For example, Hussen and Rashid's study from 2023 showed how sustainability-minded healthcare executives were able to build more flexible and robust systems that were better equipped to handle emergencies like the COVID-19 pandemic. Sustainability-oriented leaders in the healthcare industry frequently offer metrics and key performance indicators (KPIs) that capture the special difficulties faced by the industry, including energy use, medical waste management, and sustainable procurement. Healthcare organisations may systematically analyse and improve their performance thanks to this focus on customised sustainability indicators. The adoption of industry-specific sustainability criteria was facilitated by the leadership in sustainability, according to Vachon and Klassen (2022), and this greatly improved the social and environmental performance of healthcare organisations.

2.5.2 Supply chain capabilities (SCC)

Supply chain capabilities refer to an organization's ability to manage and optimize its supply chain operations effectively. These capabilities are critical for achieving sustainable performance as they enable organizations to respond to economic, social and environmental challenges, enhance efficiency, and improve collaboration across the supply chain. Supply chain capabilities ensure openness, transparency, neutrality, reliability, and security for all supply chain agents and stakeholders in this technological context (Bai & Sarkis, 2020; Kamble et al., 2020). Gold et al. (2020**)** argue that supply chain capabilities such as flexibility, integration, and collaboration are necessities for the successful implementation of sustainable supply chain practices. These capabilities allow organizations to adapt to changing environmental conditions, optimize resource use, and reduce waste. Again, Dubey et al. (2022) demonstrate that supply chain capabilities mediate the relationship between sustainability-oriented leadership and sustainable performance, revealing that strong capabilities improve the positive impact of leadership on sustainability outcomes. The large number of actors involved in a supply chain network results in a lack of transparency and accountability (Casey & Wong, 2017). Digitalizing the supply chain to combat the challenge led to the discovery of blockchain technology (BT) which enables safe transactions, improved transparency, and product traceability (Aste et al., 2017; Kshetri, 2018), resulting in reduced costs and improved SSCP (Queiroz and Wamba, 2019). BT also helps to increase accountability and auditability (Kshetri, 2018; Zou et al., 2018), fraud prevention (Lu & Xu, 2017), privacy, cyber-security, and protection (Kshetri, 2017), and enhanced financing processes (Ahluwalia et al., 2020). Smart decision-making facilitated by artificial intelligence-powered tools can strengthen SC capabilities to become resilient (Queiroz et al. 2021a, 2020).

Information is seen as the “glue" that binds the business structures that allow supply chains to be agile in responding to competitive challenges (Sanders and Premus, 2002). It is impossible to have a successful supply chain without the use of information technology. Because suppliers are located all over the world, it is critical to integrate both internal and external activity. This necessitates the development of an integrated information system for sharing data on various value-added activities throughout the supply chain. IT is like a nervous system for supply chain management (Gunasekaran and Ngai, 2004). Higher levels of supply chain efficiency could be achieved from the use of information systems for decision-making (McKone-Sweet, Hamilton and Willis, 2005). IT performs an essential role in enabling the sensing and response capabilities of an organization (Ngai, Chau and Chan, 2011). In this section, the extant literature on information sharing in collaborative supply chain management has been analysed. Byrd and Davidson (2003) examined that the effectiveness of the supply chain is influenced by information technology, according to the study. They claimed that information technology development and long-term use result in improved business performance in terms of return on investment (ROI), return on equity (ROE), and market share. Vickery *et al.* (2003) proved that employing integrated information technology facilitates supply chain coordination and integration, which has a direct impact on a company's financial success. According to Sufian (2010), a supply chain management plan must support the business strategy to gain a competitive advantage and improve performance. The contemporary market is dynamic and electronically connected. As a result, businesses are attempting to increase their agility to be more adaptable and responsive to changing market demands. To do this, several organisations have outsourced and developed virtual enterprises to decentralise their value-adding activities. All these highlight the importance of information technology in integrating suppliers/partner firms in virtual organizations and supply chains (Jain, Wadhwa and Deshmukh, 2009).

For instance, artificial intelligence-enabled solutions can help SC managers to objective make decisions based on the big data gathered from a multitude of sources and heterogeneous formats, which will help SCs become agile, lean, flexible, dynamically capable, and resilient, without undermining their productivity and sustainability (Baryannis et al. 2019b; Okabe and Otsuka 2021; Toorajipour et al. 2021). Several applications and benefits of AI have been reported in the SCM literature: for example, employing machine learning techniques for SC risk prediction (Baryannis et al. 2019b), data-driven objective decision-making capabilities to improve operational, resource, energy, and lean management efficiency and subsequently reduce production costs (Kohtamäki et al. 2019); forecasting consumer trends and demands (Chakraborty, Hoque, and Kabir 2020); predictive maintenance of machines by identifying faults before they would occur (Kohtamäki et al. 2019; Okabe and Otsuka 2021). AI has the potential to enhance visibility and transparency across the SC, which will facilitate SC coordination, planning, and responsiveness (Belhadi et al. 2021b; Pournader et al. 2021; Dora et al. 2021). Data-driven decision-making utilising AI-based predictive techniques can help organisations identify bottlenecks in SC operations, production, and planning. (Helo and Hao 2021; Wang, Skeete, and Owusu 2021). Similar analysis can facilitate optimising inventory to reduce waste and operating costs resulting in business productivity (Pillai et al. 2021).

According to Grover, Kar, and Dwivedi (2020), AI has significant potential to mitigate risks of actual disruption in a supply chain and to proactively avoid future issues because of predictive risk modeling, leveraging historical data. AI helps construct a risk profile of disruptions and supports its management to achieve resilience (Shah et al. 2021; Nayal et al. 2021). A bibliometric review on the evolution of AI research in the field of SCM reported by Sharma et al. (2022) found that Ai enabled decision-support systems will play a pivotal role in achieving SC sustainability and resilience through SC network design, reconfiguration, and low-carbon green practices by leveraging data collected from various operational and production systems. In a similar context, and further extending this narrative to new Industry 4.0 technologies, Dolgui and Ivanov (2022) discussed that 5G technology will strengthen the Internet of Things, processes, and services, which enhance the capabilities of digital SC including and not limited to, SC connectivity and real-time smart decision-making, visibility, and transparency in SC dynamic networks and SC innovation to cater for new business models and green goals, which will collectively enhance the productivity of SCs and its ability to be agile in a volatile and crisis-stricken business environment.

Supply chain capabilities, or distinctive competencies, were defined by Morash *et al.* (1996) as the attributes, abilities, organisational procedures, knowledge, and skills that enable a corporation to achieve superior performance and a persistent competitive advantage over competitors. As a result, supply chain practices have a direct impact on supply chain performance through the formation of capabilities. The term "supply chain attribute" is used in this chapter to identify various qualities or skills connected with supply chain management. These attributes are linked to supply chain characteristics that can be handled using supply chain management strategies. The attribute values may have nominal properties (for example, whether a product is reusable or not), ordinary properties (for example, whether the level of integration between two supply chain entities is higher or lower than the average), or cardinal properties (for example, whether the attribute can be calculated, like the production lead time). The supply chain attributes of "capacity surplus," "replenishment frequency," "information frequency," "integration level," "inventory level," "production lead time," and "transportation lead time" were considered in this chapter. The value of attributes can be changed by using various supply chain concepts. Supply chain characteristics are important elements of supply chain strategies because they determine the overall supply chain behaviour, allowing supply chain performance to be measured.

SC organizations cannot manage their circular economy (CE) operations effectively due to a lack of organized information systems and vibrant technology (Kumar, Raut, Nayal, *et al*., 2021). As a result, it's critical to integrate cutting-edge technology that can supply real-time data for predictive and cognitive learning, hence improving decision-making. Industry 4.0 (I4.0) technologies are seen as important drivers for developing a proactive, self-configuring, and automated manufacturing system to meet sustainability goals. Cyber-physical systems (CPS), the Internet of Things (IoT), big data (BD), cloud computing (CC), and artificial intelligence (AI) are all part of I4.0 (AI) (Ivanov et al., 2021; Luthra et al., 2020) that can provide real-time data and dynamic monitoring capabilities, to improve CE and sustainable production and consumption (Ma *et al*., 2019). I4.0 technologies have the potential to disrupt the status quo and assist efficient resource utilisation to improve long-term environmental performance (Li *et al*., 2020). The combination of CE and smart technologies associated with I4.0 can pave the path for resource-efficient business models that remanufacture, repurpose, and recycle trash. (Lopes de Sousa Jabbour *et al.,* 2018) and support sustainable production and consumption operations (Rajput and Singh, 2020).

Studies show that SSCM can inspire the sustainable development of supply chain in a certain period, which requires a certain level of rigid abilities in the supply chain (Diabat *et al*., 2013). However, due to the ever-dynamic environment, these abilities must be adjusted continuously. A supply chain can satisfy the market demand only if new abilities are created to improve long-term sustainable efficiency. The capability of creating new abilities is essentially the dynamic ability of the organisation. Teece *et al.* (1997) define dynamic capabilities as 'the ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments.' Sirmon *et al*. (2007) clarify that resources (tangible and intangible) are combined to create capabilities. Beske (2012) considers supply chain as a complex system. He initiated adopting dynamic capability into supply chain and proposed that supply chain dynamic capability was the desired ability of this complex system to deal with environmental change as well as internal complex relationships. Gimzauskiene *et al*. (2015) argue that supply chain dynamic capability makes organizations more flexible, and therefore can more easily and swiftly adapt to market trends and effectively tackle market volatility, and eventually enable an organisation to achieve sustainable competitive advantage in its industry. Supply chain dynamic capability is an abstract concept consisting of several sub-capabilities. For example, Beske (2012), Beske *et al.* (2014) break down into supply chain reconstruction, knowledge evaluation, co-evolvement, flexible supply chain control, and supply chain partner relationship development. Cheng (2011) categorizes this ability into integration and cooperation. The competitive advantage of an organisation is not from one particular sub-capability but comes from the combination of all sub-capabilities (Beske et al., 2014). Hall et al. (2012) also reveal that focusing on sustainable development elements independently is unlikely to find a satisfactory solution to sustainable supply chains. Another capability to discuss is big data analytics (BDA). BDA is defined as “a holistic process that involves 5V (volume, velocity, variety, value, and veracity) in terms of collection, analysis, use, and interpretation of data for various functional divisions, to gain actionable insights, create business value, and establishing competitive advantages” (Fosso Wamba *et al*., 2015, p. 235). BDA is considered as “an end-all solution to supply chain problems” (Lopez, 2017, p. 1) or “a revolution that will transform supply chain design and management” (Waller and Fawcett, 2013, p. 77), or even the “silver bullet for supply-chain forecasting” (Snapp, 2017, p. 10). The high potential of big data-driven supply chain analytics capability (SCAC) (Tiwari *et al*., 2018) for business value has positioned it as an important game-changer in the supply chain and one of the “hottest topics” among supply chain managers (Tay, 2016). The objective of using BDA across all supply chain processes is to improve SCAC. As such, SCAC is assumed to improve supply chain agility (SCAG) by synchronizing demand and supply (Niu and Zou, 2017) and by enhancing the overall business value and performance (Gunasekaran *et al*., 2017; Hofmann, 2017; Brinch, 2018). Recent industry literature shows that the market of supply chain analytics is expected to grow from about $4.8bn in 2019 (Newswire, 2015) to reach about $9.87bn by 2025 (Newswire, 2017a, b), thus growing potentially by 13.68% during the period 2017–2021 (Newswire, 2017a, b).

Healthcare organisations may manage resources more effectively with the help of supply chain capabilities, which is crucial for sustainability. Healthcare operations may minimise waste, cut expenses, and lessen their carbon footprint by using efficient inventory management, procurement, and logistics strategies. According to a study by Yadav and Desai (2023), improved supply chain capabilities in the healthcare industry can improve overall sustainability performance by reducing surplus inventory, streamlining operations, and reducing over-ordering of supplies. Adopting sustainable procurement methods, which are made possible by strong supply chain capabilities, is a crucial part of sustainable healthcare performance. Strong supply chain capabilities enable healthcare organisations to get products that are ethically and environmentally benign, reducing their negative effects on the environment and enhancing their social responsibility. According to Bansal and Kumar's research from 2022, healthcare institutions with sophisticated supply chain capabilities can improve environmental performance throughout the supply chain by influencing supplier selection based on sustainability factors. Healthcare organisations can also become more resilient to supply chain disruptions brought on by pandemics, natural catastrophes, or changes in regulations by establishing strong supply chain capabilities. These capabilities guarantee that healthcare establishments can sustain service standards and adjust to modifications while upholding sustainability objectives. In addition to lessening their negative effects on the environment and society, healthcare organisations that invested in creating strong and adaptable supply chains were better equipped to handle disruptions during the COVID-19 pandemic, according to Gupta and Shukla (2021). Reducing waste including packaging, medical waste, and energy use is a key objective of sustainable healthcare. Strong supply chain skills help businesses streamline operations, cut down on waste production, and enhance recycling and disposal procedures. Healthcare organisations with advanced supply chain systems can track and manage waste more efficiently, which reduces environmental impact significantly, as demonstrated by Ali and Qureshi (2022). Supply chain capabilities in healthcare also play a significant role in driving cost efficiency while maintaining or improving the quality of patient care. By optimizing supply chain processes, healthcare institutions can reduce operational costs, which in turn allows for the allocation of resources to improve patient outcomes. El-Baz and Govindan (2022) found that healthcare organizations with strong supply chain management practices reported not only cost savings but also improved patient satisfaction due to better access to medical supplies and more reliable service delivery.

2.5.3 Sustainable supply chain practice (SSCP)

SCP and SSCP address the dynamics incorporated into organizations through the influences of a globalized world with its characteristics of highly vulnerable logistic networks, globalized competition, digitalization and information-sharing capabilities (Beske, 2012, Beske et al., 2014; Hong et al., 2018). Golicic and Smith (2021) found that sustainable supply chain practices are critical for achieving sustainable performance across economic, environmental, and social dimensions. The authors argue that organizations that adopt these practices are better positioned to meet regulatory requirements, reduce operational costs, and enhance their reputation among stakeholders. Zhu et al. (2020) further support this assertion by demonstrating that organizations implementing sustainable supply chain practices experience significant improvements in both environmental and social performance. Sustainable supply chain practices encompass a wide range of activities aimed at reducing the environmental impact, improving social outcomes, and ensuring economic viability throughout the supply chain. These practices include green procurement, waste reduction, recycling, and the adoption of circular economy principles. SSC combines economic, environmental, and social factors into its operations, characterized by transparency and accountability for all stakeholders (Bag et al., 2023; Rahman et al., 2023). SSCP focuses on the capacity of a supply chain to function with optimal efficiency and effectiveness while simultaneously mitigating adverse consequences on the environment, society, and the economy (Mangla et al., 2020; Bag et al., 2020; Kumar and Goswami, 2019). The process entails integrating sustainable practices and concepts throughout multiple dimensions of the supply chain, involving sourcing, production, distribution, and disposal (Huma et al., 2023; Dubey et al., 2015). The lean philosophy, which concentrates on the elimination of waste in supply chains, has been adopted in a diverse range of sectors, from original equipment manufacturing (Adamides *et al.,* 2008) to food production and distribution (Perez et al., 2010) Case studies of its application have been conducted in developing country contexts (Arkader, 2001) as well as in the developed nations, where the majority of studies are set. Even where actions associated with it, such as supply base reduction, cannot be confirmed as a direct application of lean philosophy, there is widespread awareness of it. See, for example, Loader's (Loader, 2010) survey of English local authorities. Studies of lean SCM have been prevalent in healthcare settings too. De Souza (2009) reviewed over 90 studies, Mazzocato *et al.* (2010) presented a realist review of 33 studies, and Guimaraes and de Carvalho (2013) presented multiple case studies of strategic outsourcing as a lean technique across 15 different countries. The principal lean technique assessed is just-in-time, the practice of keeping low stock levels and pulling products from suppliers when required. Several empirical studies of just-in-time implementation demonstrate improved firm performance (Green and Inman, 2005; 2007). Explanations include speed and synchronization (Bartezzaghi, Turco and Spina, 1992) improved information flows (Germain, Dröge, 1997), and increased management focus (Dion *et al*. 1991; González-Benito, 2002). González-Benito's (2002) study is, however, a rare example of any contingent element in this area of research. Indeed, Bayo-Moriones, Bello-Pintado and Merino-Díaz-de-Cerio (2008) argue that organizational context, for example, the size and age of the firm, matters less than infrastructural features such as advanced technologies and quality management. Most studies, while they provide rich contextual detail, such as the country and sector, to support their methodological selection, contain little reflection on how this may affect implementation. Instead, there is an assumption that just-in-time practices can be mimicked and implemented in a wide range of contexts, (Fawcett and Birou, 1992; Vickery, 1989; Wafa, Yasin and Swinehart, 1996) and variables regarding successful implementation are considered managerial, for example, top management commitment and leadership (Ansar, 1986; Heinbuch, 1995 and Kannan, Keah Choon, 2005). Lean practices: inventory minimization, higher resource utilization rate, information spreading through the network, just-in-time practices, and shorter lead times.

Other studies have evaluated healthcare institutions and proposed the need for a sustainable supply chain (SC) perspective to control ever-increasing expenses and improve service delivery (Syahrir, Suparno and Vanany, 2015). This objective can only materialize in practice when the functional units in healthcare SCs properly coordinate to deliver effective healthcare services. Hospitals are burdened with increasing competitive pressures from stakeholders to provide effective and timely healthcare services (Zepeda *et al.,* 2016). Sustainability research in healthcare investigates the aspects of resource use and environmental pollution associated with healthcare practices. This emerging area offers tools and metrics to measure the adverse effects of the delivery of healthcare and identify successful measures to increase patient safety while protecting public health (Sherman et al. 2020). Scholarly work contends that resilience is more important in healthcare services than in manufacturing. The reason is that anything that impedes timely treatment and related services to patients can lead to a fatality (Zepeda *et al*., 2016; Dobrzykowski *et al*., 2014; Harvey, 2016). SSCM therefore, intending to achieve the triple challenge of being more efficient, more environmentally friendly, and ensuring improved conditions for both workers and communities served, leads to the subjects of SSCM practices and sustainable performance (Duque-Uribe, Sarache and Gutiérrez, 2019). Integrating environmental sustainability into the quality and value-based healthcare restructuring, and communicating in the language of these paradigms, can help to attain swift acceptance and durability of healthcare sustainability initiatives (Sherman *et al*., 2020).

Several studies have also dealt with industries and have found that industrial activities are one of the leading causes of damage to the natural environment and human life (Kusi-Sarpong *et al.*, 2015) and demonstrated that there is a persistent requirement for organizations to coordinate sustainable supply chains (Fabbe-Costes *et al.,* 2014), in consideration of social criteria and economic and environmental criteria (Mangla, Kumar and Kumar Barua, 2014). With the growing concern about sustainability, government policies, and increasing community awareness, sustainable performance is progressively becoming an important organizational strategy (Gaziulusoy and Brezet, 2015; Govindan *et al.,* 2016). However, the literature has focused on social sustainability to a much lesser extent, which is unfortunate, since not only can social sustainability practices help improve other aspects of sustainability, but all three dimensions are required to build a truly sustainable business (Seuring and Müller, 2008; Ashby et al., 2012). Some studies have proposed sustainability frameworks that include all three dimensions, although with a greater emphasis on economic and environmental sustainability. However, only a few have tried to examine social standards using empirical analysis. Considerable improvements have been made in supply chain management in many industries, but there has been limited success in making systemwide SCM improvements in the healthcare industry. Yet, there is significant evidence that this industry requires broader changes (McKone-Sweet, Hamilton and Willis, 2005).

This study seeks to correct the imbalance and provide a comprehensive analysis of the SSCM framework and method that can lead to unified evaluation and improved healthcare performance prioritizing economic, social, and environmental factors. Three research objectives are specifically addressed: (I) To develop a framework to reveal the sustainability of the public health care supply chain system in Ghana. (II) To measure the sustainability of the public health care supply chain system in the Ashanti region using the proposed framework. (III) To re-engineer a specific public health care system supply chain in the Ashanti region with new strategies, policies, and operational plans.

2.5.4 Sustainable healthcare performance (SHP)

The objective is to establish equilibrium among economic, social, and environmental factors to attain sustained viability (Kumar and Goswami, 2019). Companies must engage in partnerships with suppliers who demonstrate a commitment to upholding ethical labour standards and fostering diversity and inclusivity (Ortas et al., 2014). The economic viability of SSC is a crucial factor that must be considered to ensure financial feasibility for all parties involved (Mangla et al., 2020; Carter and Rogers, 2008). This entails the need to balance the expenses associated with adopting sustainable practices and the possible advantages, including mitigated operational risks, heightened consumer loyalty, and expanded market opportunities (Mangla et al., 2020; Carter and Rogers, 2008). Sustainable supply chain performance (SSCP) plays a significant role in the successful functioning of an organization. The timely and efficient evaluation of the supply chains helps to formulate strategy, implement, and monitor products and services (Gawankar et al., 2017; Dickson, 2016). The supply chain transformation towards a digital eco-system requires that the existing interdependencies between the SC practitioners are amended, and information is accessible to all practitioners in real-time. All the participants become equally relevant for successfully integrating collective value creation and shared responsibility (Kamble et al., 2018). Previous studies emphasized the inclusion of economic, environmental, and social dimensions of sustainability in supply chain (Belhadi et al., 2020; Carter & Rogers, 2008; Formentini & Taticchi, 2016). Furthermore, organisations striving for a sustainability strategy are increasingly exposed to unpredictable changes than they expect. More powerful partners in such environments are more likely to sanction organizations that do not respect their sustainability requirements. The worst thing is when these requirements are changing at a high pace and in unpredictable ways. Therefore, SCP and SSCP address the dynamics incorporated into organisations through the influences of a globalized world with its characteristics of highly vulnerable logistic networks, globalized competition, and almost instant digitalization and information-sharing capabilities (Beske, 2012, Beske et al., 2014; Hong et al., 2018). These factors are characteristics of a highly dynamic environment for which the dynamic capability concept is intended.

Green practices: Supply chain management practices enable supply chain capabilities or core competencies by reducing redundant and unnecessary materials, reducing replenishment frequency, integrating reverse material and information flow in the supply chain, environmental risk sharing, waste minimization, reducing transportation lead time, and increasing resource efficiency. These practices encompass general activities that work interrelated to achieve sustainability course. Prior studies (Ahmad et al. 2016; Bikram and Harmeet 2017; Chen and Kitsis 2017; Das and Hassan 2021) have described SSCM practices as a deliberate attempt to emphasise the integration of social equity, economic prosperity, energy efficiency, and environmental sustainability into supply activities to argument SP. SSCM practices are structured into three categories namely, economic, environmental and social. Each dimension contributes uniquely to SP within any given supply chain system. The economic dimension of SSCM is about building a strong and competitive economy by making enough resources available at the appropriate place at the appropriate time to support innovative growth, and by identifying and coordinating the developmental needs (Sanchez-Flores et al. 2020; Rajesh, Rajeev, and Rajendran 2022; Sachin and Rajesh 2022).

2.5.5 Sustainable economic performance (SEP)

Sustainable economic performance refers to an organization's ability to generate financial returns while ensuring long-term sustainability. This includes the efficient use of resources, cost reduction, and the generation of economic value in a manner that does not compromise future opportunities. Several economic, environmental, and social difficulties often confront hospital supply chains. From a financial point of view, increasing healthcare expenditures demand greater efficiency in the delivery of services (Kumar and Blair, 2013; Weisz, 2011). The Organization for Economic Co-operation and Development has estimated that hospitals account for approximately 40% of total health expenditures (OECD, 2017). Between 30% and 40% of a hospital´s budget is dedicated to supply chain costs (Landry, Beaulieu, and Roy, 2016), which can be reduced by up to 8% through best practices (McKone-Sweet and Hamilton, 2005); Willis. In addition, said best practices allow clinical personnel to focus on their core mission of caring (Landry, Beaulieu, and Roy, 2016). Newby (1999) reports that economic development "assumed that what is 'good for the economy' is automatically good for society" and "approaches that yield social, economic and environmental benefits together, rather than one benefit at the expense of another" (p. 68). Newby discussed five principles of sustainable local economic development that practitioners can use in economic development and those are quality of life, fairness and equality, participation and partnership, care for the environment, and thought for the future. Yildiz Çankaya and Sezen (2020) found that organizations with strong sustainability-oriented leadership and supply chain capabilities achieve superior economic performance. Their study reveals that sustainable practices lead to cost savings through resource efficiency and waste reduction, which in turn enhances economic outcomes. Moreover, Moktadir et al. (2021) argue that sustainable economic performance is closely linked to an organization's ability to innovate and adapt to changing market conditions, driven by sustainability-oriented leadership. A meta-framework grounded in the literature proposed by Olan et al. (2022) shows that in the food and drink industry, artificial intelligence adoption in supply chain networks can lead to sustainable financing which will enhance the sustainability of supply chains. Research by Jin et al. (2017) defines economic supply chain sustainability as the driver of an organization's improved financial performance and the supply chain through systemic and strategic coordination between multiple business functions.

Sustainability from a corporate perspective is defined as the right combination of economic, environmental and social aspects (Elkington, 1994). A growing number of businesses are adopting green initiatives to achieve sustainability (Teixeira, Jabbour and de Sousa, 2012). Organizations achieve sustainability through economic outcomes and operational outcomes. Economic outcomes are financial benefits through return on investment and reduction of cost across the supply chain (Eltayeb, Zailani and Ramayah, 2011). Business growth is another measure of economic outcomes. Operational outcomes (i.e. productivity) have a direct relationship with sustainability performance, which leads to economic performance. Economic performance is one of the pillars of sustainability performance and is equivalent to business performance, which is measured through productivity, cost reduction, revenue, profit, cash flow and business growth.

2.5.6 Environmental sustainable performance (ESP)

Sustainable environmental performance involves minimizing the negative impact of organizational activities on the environment, such as reducing greenhouse gas emissions, conserving energy, and managing waste effectively. Environmental sustainability encompasses the endeavour to diminish the ecological impact of the supply chain through the mitigation of resource use, waste production, and emissions (Bag et al., 2020). Various strategies can be employed to promote sustainability within industries. These strategies encompass utilizing renewable energy sources, adopting environmentally friendly packaging, optimizing transportation routes to minimize fuel consumption, and implementing energy-efficient techniques in industrial processes (Bag et al., 2020; Kumar and Goswami, 2019). Chowdhury et al. (2021) emphasize the importance of sustainable supply chain practices in achieving superior environmental performance. Their study shows that organizations that implement green procurement and waste reduction practices are more likely to achieve significant reductions in their environmental footprint. Dubey et al. (2022) also highlight the role of supply chain capabilities in enhancing environmental performance, particularly in terms of resource efficiency and waste management. Circular supply chain practices are linked with high environmental, social and economic risks (Lahane and Kant, 2021), which stem from internal and external barriers like strong perception towards low economic returns, lack of communication of information to customers about CSC practices and inadequate support from top management (Yadav et al., 2020). Environmental orientation (EO) advances environmental strategies within a firm and across its supply chain (Afum et al., 2022a, b; Chavez et al., 2021; Yu and Huo, 2019; Chan et al., 2012). EO encourages sustainable supply chain practices (Mariadoss et al., 2016; Salvador and Burciaga, 2020) and their relationships with performance (Zhang and Walton, 2017). With the increasingly strict government environmental regulations and growingly customer concern with the environment, firms have recognized the importance of enhancing environmental performance (Huang and Li, 2017; Jiang, Chai *et al*., 2018; Morse, 2018). The generally adopted approaches to improving environmental performance include implementing internal environmental management (Feng and Wang, 2016; Paillé *et al*., 2014; Tyburski, 2008), conducting green innovation (Huang and Li, 2017), and investing in information technology (Chuang and Huang, 2018; Jung, Nam *et al.,* 2018; Wang, Chen, and Benitez-Amado, 2015). Supply chain resilience refers to the ability of a supply chain to recover from the influences of environmental accidents or problems (Brandon-Jones et al., 2014; Cheng and Lu, 2017). According to the knowledge-based view (KBV) and natural resource-based view (NRBV), firms need to seek knowledge, resources, and capabilities required to enhance supply chain resilience across their supply chain partners (Brandon-Jones *et al*., 2014; Wu, 2013; Zailani, Govindan, Iran Manesh, Shaharudin, and Chong, 2015). Thus, environmental performance is likely to be improved by enhancing supply chain resilience. Resilient practices: strategic inventory, capacity buffers, demand visibility, small batch sizes, responsiveness, risk-sharing, and flexible transportation. Environmental sustainability practices from the Sustainalytics database can be measured using an aggregate indicator related to different sections on the environment, such as environmental and purchasing policies and systems, external certifications, emissions levels, programmes to reduce emissions and to report, environmental fines, use of renewable energies, and waste reduction.

Some studies reported that according to contingency theory (CT), the interaction of organisations with their external and internal environment could impact their practices and performance (Chavez et al., 2021). Interaction with internal and external environments can enable businesses to develop capabilities and obtain resources to support the implementation of circular supply practices (Farooque et al., 2022). According to research, environmental orientation (EO) can play a significant role in sustainability practices to achieve preferred performance (Niemann et al., 2022; Zhang and Teng, 2022). EO promotes pro-environmental behaviours and encourages the development of environmental protection strategies to enhance performance (Yu and Huo, 2019; Chavez et al., 2021). Prior studies in sustainability have long explored EO as a driver of environmental marketing (Keszey, 2020), green business strategy (Yasir et al., 2020), green supply chain integration (Zhou et al., 2020), green innovation capability (Gabler et al., 2015) and green supplier development (Chan and Ma, 2021). Adler (2015) addresses the issue of protecting future generations by clearly articulating the primary threats existing supply chain practices pose to the environment and human survival. Humanity is currently using the earth's resources 50 percent faster than they can be replenished. In the United States, that rate is nearly 600%. The best evidence suggests that we have only years, not decades, to restore the balance before we tip the planet's natural systems into irreversible cycles that will wreak havoc on vast swathes of nature and the lives of billions of people around the world. (p. NP13). Thus, the environment is the central constraint of our proposed Ecologically Dominant logic (Adler, 2015; Griggs *et al.*, 2013; Hart, 1995; Milne and Gray, 2013). A functioning ecosystem is necessary for mankind's survival. Although reducing harm may slow the rate of decline, recognizing the importance of a functioning ecosystem explicitly acknowledges that society must move beyond slowing unsustainability to becoming sustainable.

2.5.7 Sustainable social performance (SSP)

Sustainable social performance refers to an organization's impact on society, including labour practices, community engagement, and the overall well-being of stakeholders. Sustainability can be defined as meeting today's needs without compromising the needs of future generations (Bruntland Commission,1987). By way of contextualizing this definition, corporate sustainability can be described as meeting the needs of today's direct and indirect stakeholders (such as shareholders, employees, customers, regulatory bodies and society at large) without compromising its ability to meet the needs of future stakeholders. Moktadir et al. (2021) assert that sustainable social performance is closely tied to the adoption of sustainable supply chain practices. Social sustainability practices from the Sustainalytics database can be measured by employing an aggregate indicator that includes various social issues related to the company's stakeholders – such as employees, contractors, customers, society, and community – due to companies' putting into practice and disclosing socially responsible measures to avoid discrimination, increase workforce diversity, reduce labour risk, eliminate activities in sensitive countries, implement activities promoting local development, or prepare policies and systems to satisfy customers.

These practices ensure fair labour conditions, promote ethical sourcing, and contribute to community development. Gölgeci and Kuivalainen (2020) further suggest that sustainability-oriented leadership plays a crucial role in driving social performance by fostering a culture of ethical behaviour and social responsibility within the organization. Social responsibility is of utmost importance in guaranteeing equitable labour practices, safeguarding human rights, and maintaining safe working conditions across the supply chain (Bag et al., 2020). This literature review highlights the critical role of sustainability-oriented leadership, supply chain capabilities, and sustainable supply chain practices in achieving sustainable performance across economic, environmental, and social dimensions. The findings from recent studies underscore the importance of integrating these determinants into organizational strategies to enhance overall sustainability.

Social sustainability addresses how social issues can be managed in a way that ensures the long-term survival of the organization. These social aspects should not be limited only to the internal operations of the focal firm but also extended to the inter-organizational level to include upstream and downstream trading partners, and also to the broader societies in which it operates or otherwise affects (Carter and Rogers, 2008). To further discuss social issues in the supply chain, one needs to understand: to whom a firm needs to be socially responsible, and what issues must be addressed. Further, one needs to understand how these issues are addressed across the supply chain (Wood,1991). Stakeholder theory explains how managers have fiduciary duties to the corporation, shareholders and stakeholders (Donaldson and Preston, 1995). Sodhi's (2015) stakeholder resource-based view (SRBV), building on the resource-based view (RBV), advocates that SRBV is a "framework to inform the decision-makers of the importance of building and utilizing not only their own organisation's dynamic resources, routines and capabilities but also by developing those of the company's stakeholders thereby improving their respective utilities as well" (Sodhi, 2015). The firm needs to be socially responsive to all stakeholders to achieve sustainable advantage (Frooman, 1999; Freeman, 2004; Campbell, 2007; Sodhi, 2015).

Scholars emphasize that being socially responsible means integrating ethical principles in supply chain practices (Husted and Allen, 2000; Hemingway, 2005), or operationalizing fair-trade principles (Strong,1997). However, Carter and Jennings (2004) research debated that a focus on ethics alone is a necessary but insufficient means of achieving social responsibility. Other social issues, particularly those surrounding employee working conditions, have emerged (Emmelhainz and Adams, 1999). Supplier development issues through minority enterprises and their importance for social sustainability have been identified (Krauseetal, 1999). In addition, research by Carter and Jennings (2002, 2004), Carter (2005), and Carter and Easton (2011) propose purchasing social responsibility and logistics social responsibility which encompass social issues such as diversity, philanthropy, safety, and human rights in the supply chain. The social aspect of sustainability is our second constraint after the environment. For people to thrive, social systems for employment, health, housing, and overall quality of life will need to be supported by the environment. All environmental issues have social consequences, but not all social issues are environmental issues. For instance, basic human rights issues such as slave labour and access to education can be divorced from the environment. The social system is dependent on the environmental system; hence, it is subservient to it in the Ecologically Dominant logic. Similarly, the economic system is subservient to the social system. A functioning economic system should contribute to higher quality of life. The Ecologically Dominant logic is clear, however, that the protection of social systems and increasing quality of life are the real goals. Increased profits for members of a supply chain or increased GDP for an economy are a means, but not the only means, of protecting or improving society, and economic gains that harm society are not sustainable economic gains. Two dimensions of social sustainability have been utilized in literature both internal and external. Ahmad and Thaheem (2017), Gollan (2007), Kaminsky and Javernick-Will (2014), Pfeffer (2010) all described, internal social sustainability as an intention to manage and prioritize human resource, organizational design, and change management processes. In this sense, social sustainability refers to safeguarding and developing internal organizations in terms of human and social capital. External aspects of social sustainability deal with the issues related mainly to strategic management processes and public perception reports (Popovic and Kraslawski, 2018). These two techniques have further explained social sustainability as a means to give back to society rather than just exploiting the available resources (Docherty, Kira, and Shani, 2009). Summarizing the concepts, internal aspects significantly deal with defining the possibility and finding ways to secure and reproduce human and social capital within the organization. External aspects see the relationships across organizational lines where social resources and regeneration could be exchanged seamlessly and effortlessly.

2.6 Brief country profile – Ghana

Ghana is located on West Africa's Gulf of Guinea only a few degrees north of the Equator. It lies between longitudes 3°15' W and 1°.12' E, and latitude 4°.44' S and 11°.15' N. The country is bordered to the west by Cote d'Ivoire, east by the Republic of Togo, Burkina Faso to the North and the South by the Gulf of Guinea. The population of Ghana reached 30.8 million according to the 2021 population census. The figure showed a 6.1% increment recorded during the 2010 census. It covers an area of 238,535 km2 (92,099 sq.m.), spanning diverse biomes that range from coastal savannas to tropical rainforests. It is the second most populous country in West Africa, after Nigeria, with a population of approximately 31 million people and an annual growth rate of 2.1% (Ghana Statistical Service, 2021). Ghana's population is equivalent to 0.4**%** of the total world population. Ghana ranks number 47 in the list of countries (and dependencies) by population. Moreover, 56.7 **%** of the population is urban representing 17,625,567 people in 2020 (Worldometer, 2020). Ghana is divided into sixteen regions for administrative purposes. The country is further divided into 261 local Metropolitan, Municipal and Districts (MMDAs). Each MMDA is headed by an appointed and approved Chief Executive (CE). The MMDAs are further broken down into sub-districts and sub-units. The country's division into regions, districts, sub-districts, and units coincides with the division of the health sector in delivering health services. The number of regions increased from 10 to 16, thereby increasing the number of MMDAs from 173 in 2010 to 216 in 2017, in 2018 and 2019 the number of districts rose to 261 (Ghana Statistical Service, 2020). These MMDAs develop, plan, and mobilise resources for the development of their localities.

Politically, the country has made major strides toward democracy under a multi-party system in the past two decades. It has a stable political economy, with Presidential and Legislative elections held every four years since the inception of the fourth Republic after the promulgation of the 1992 constitution (National Health Accounts, 2015). This has led to its ranking as one of the top three African countries for freedom of speech and press. Ghana is also a multi-ethnic country with a diverse population and linguistic and religious groups. Three out of the nine major ethnic groups (Akan, Mole-Dagbani and Ewe), constitute more than three-quarters (77%) of the population (Population and Housing Census, 2021). Most of the population (more than 70%) are Christian; close to one-fifth are Muslims; and one-tenth practise traditional faiths or report no religion. Over the years, the country has performed relatively well in healthcare, economic growth, and human development. Economically, Ghana grew at an average of 7% per year between 2017 and 2019. This rapid growth, however, was halted by the COVID-19 pandemic, the March 2020 lockdown, and a sharp decline in commodity exports, among other factors. The economic slowdown had a considerable impact on households. The poverty rate is estimated to have increased slightly from 25% in 2019 to 25.5% in 2020. After slowing to 0.5% in 2020, growth rebounded to 5.4% in 2021, largely influenced by the agriculture and services sectors (World Bank Ghana report, 2022). Gross Domestic Product (GDP) growth is expected to average 3.3% over 2022-2024 as macroeconomic instability and corrective policy measures depress aggregate demand. The fiscal deficit is projected to remain high in 2023 (9.2% of GDP) and beyond. Improvements are projected to take place gradually with contributions from revenues and expenditures.

2.6.1 Ghana health sector

The Ghana Health Service (GHS) is a public service body established under Act 525 of 1996 as required by the 1992 constitution. It is an autonomous Executive Agency responsible for the implementation of national policies under the control of the Minister for Health through its governing Council - the Ghana Health Service Council. There are three-tier healthcare delivery systems in Ghana and these are primary (health centres), secondary (district hospitals) and tertiary (specialists and teaching hospitals). The GHS continue to receive public funds and thus remain within the public sector. Rationale - Establishing the Ghana Health Service is an integral part of the key strategies defined in the process of reforming the health sector, as outlined in the Medium-Term Health Strategy (MTHS), which are crucial steps to create a more sustainable, effective, accessible and responsive health care system. The mandate of GHS is to provide and maintain comprehensive and affordable health services with a focus on primary health care at district and sub-district levels in compliance with nationally approved policies. Objectives - The Service aims to: enforce approved national health delivery policies in the country, increase access to high-quality health services and prudently manage the resources available to deliver health services. Functions - The GHS must conduct the following roles, among others, to achieve its objectives: to provide comprehensive health services directly at all levels and through partnering with other agencies. (Ghana Statistical Service, 2020).

Healthcare delivery in Ghana is provided by both public and private facilities, with the public sector occupying 60% and the private serving 40%. According to the DHIMS2 as of August 2022, there were a total of 9,505 health facilities in Ghana, including 7,745 public health facilities, 1,360 private self-financing and 295 CHAG facilities. The majority of the facilities are CHPS, health centres, clinics and maternity homesThe public sector is made up of (4 teaching hospitals), (10 regional hospitals), (998 Clinics), (140 districts public), (1004 public health centres), (357 other hospitals), (346 maternity homes) (5421 CHPS), (12 mines hospitals), (38 polyclinics) and (3 psychiatric hospitals). The Ghana public health sector has 4,016 doctors and the doctor-to- to population ratio in 2017 was 1:7,374 as against the WHO recommendation of 1:1000. The nurse-to-nurse-to-population ratio is 1:505, with 58,608 nurses (GHS, 2023). Ghana recorded its first two Covid-19 cases on 12th March 2020 which were imported cases from two persons from Turkey and Sweden respectively (GHS Covid-19 update, 2020). After detecting the two cases, the country has been experiencing challenges faced by other countries relating to the management of inadequate vaccines and other essential logistics. Less than 3% of the population of 30 million people had been vaccinated as of 12 August 2021 specifically a total of 2.05% (Mathieu et al., 2021).

According to the Ghana health sector report (2023) also captured by the WHO Ghana report (2023) and world health statistics (2023), the public health system in Ghana is faced with challenges that must be dealt with to achieve the SDG goals. A critical review of the Health Sector Reforms in Sub-Saharan Africa points to the fact that besides the issue of ever-diminishing financial inflows to the health sector, lack of quality healthcare, mainly occasioned by a variety of inefficiencies at all levels of healthcare delivery is one of the most important concerns which has precipitated several reforms and strategies in nearly all the developing countries (Akazili *et al*., 2008). Health systems in developing countries including Ghana are faced with critical resource constraints in pursuing the goal of improving the health status of the population. The constrained ability to adequately meet healthcare needs is exacerbated by inefficiency in the healthcare systems, especially within public health centres (Akazili *et al.*, 2008).

Table 2.1 Ghana health statistics

	Indicator	Ghana Value	Sub-Saharan Africa Average	Global Average
1	Malaria mortality rate per 100,000 population in 2017	68.6	63	11
2	Life expectancy at birth (male) (2017)	61	61	70
3	Life expectancy at birth (female) (2017)	63.9	64	68
4	Life expectancy at birth (both sexes) (2017	63.4	N/A	70
5	Antiretroviral therapy coverage among people with advanced HIV infection (%) (2016)	58	63	53
6	Prevalence of HIV among adults aged 15-24 years in 2015	1.0	1.1	0.4
7	Unmet need for family planning (%) (2014)	29.9	25	12
8	Access to improved sanitation (%) in 2015	14.0	33.0	68.0
9	Access to improved drinking-water sources (%) (2014)	89.8	66.0	90
10	Private expenditure on health as % of total expenditure on health (2012)	31.67	41.2	42.3
11	General government expenditure on health as % of total government expenditure (2014)	6.8	11.4	14.1

Table 2.1 shows some gaps or challenges in the public health sector in Ghana. For instance, Ghana's health sector has not been able to achieve or meet both the global average malaria mortality rate per 100,000 population which are 11 and 63 respectively as Ghana recorded 68.8 far above both averages. Ghana could not meet life expectancy at birth for males, females, and both sexes in 2017 as compared to global averages of 70 years, 68 years, and 70 years respectively. With regards to antiretroviral therapy coverage among people with advanced HIV infection in 2016, Ghana met the global average of 53% but could not meet the African average of 63%. The prevalence of HIV among adults aged 15-24 years in 2015 was 1.0 while the global average was 0.4 which means people within that age bracket with HIV far exceed the global average. Ghana recorded 29.9% of unmet needs for family planning as against the global average of 12% and the African average of 25% meaning the country failed to meet some requirements to achieve the average. On access to improved sanitation, the country scored 14% against the African average of 33% and 68% for the global average. Access to improved drinking-water sources score was

89.9% as compared to Africa's average of 66% which means Ghana did well and the average global figure of 11% which poses a serious health threat. In summary, the table depicts health concerns that must be mitigated or eradicated with urgent interventions.

Cohen et al. (2005) argue that the emergence of a lot of substandard medicines in Ghana is due to inadequate supervision of the distribution process of the pharmaceutical industry. In Ghana, a study to evaluate the accessibility of antenatal POC diagnostic services in rural primary PHC clinics showed high stockouts of POC tests (Kuupiel *et al*., 2019). Gyimah *et al*. (2009) examine that the medical supply systems are often unreliable in most countries, particularly in sub-Saharan Africa, and thus do not guarantee the regular supply of these essential medicines. In the year 2015, the Ashanti Regional Health Directorate (ARHD) reported that the only regional medical store was virtually empty which therefore adversely affected healthcare delivery (https://www.myjoyonline.com/news/no-drugs-ashanti-regional-medical-store-is-empty). The WHO Ghana Report (2018) also shows that high mortality rates, frequent epidemics, unequal access to health services and uneven health outcomes throughout the country are also major problems that need immediate attention. Elmuti *et al.* (2013) outlined that while most industries use SC cost-minimization tools extensively, these applications are still missing in the healthcare sector. Ahmadi, Masel, and Hostetler (2019) illustrate that ineffective and inefficient inventory management contributes to loss of energy, distribution, and unnecessary movement. If the surgeon does not have the necessary supplies to perform a timely surgical procedure, nurses must search for supplies which means that both the surgeon and the patient must wait and waste time, Kim (2015) asserts that lack of cooperation from stakeholders in the health care supply chain is also a major obstacle to the cost-effective structure in the health care industry. Burns (2001) however, provided an excellent description of the challenges inherent in the healthcare industry. A variety of obstacles to effective supply chain management exist, including Constantly evolving technology resulting in short product life cycles and high costs for physician preference items, difficulty in predicting frequency, duration and primary diagnoses for patient visits and the associated product requirements, lack of standardized nomenclature/coding for healthcare products and commodities, lack of capital to build a sophisticated information technology infrastructure to support supply chain management efforts and inadequate business education and SCM capabilities among hospital-based buyers. Around 94% of Fortune 1000 companies have experienced coronavirus-driven supply chain disruptions (Kilpatrick and Barter, 2020). When this contagious virus was discovered in Wuhan City, China, Chinese exports were quickly postponed to keep it from spreading (Karmaker *et al*., 2021). To conclude, after reviewing numerous pieces of literature on SSCM, it was evident that SSCM has not been specifically defined especially the components which form the foundation and therefore studies should be conducted to address the challenge.

2.6.2 Ghana health service commodity flow

The division in charge of commodities flow is supplies, stores and drugs management with the mandate to develop comprehensive policies and plans to enhance the efficient and effective procurement and supply of goods and services for GHS. The logistics, clearing and warehousing department of Ghana Health Service has this vision statement: 1) Logistics: Our mission is to give our clients a competitive advantage through superior transportation of logistics services. We will meet and exceed our client's expectations of service through timely communications and quality information. We will accomplish our mission through our commitment to providing: Excellent Service, Value-added service, and continued innovation in management. 2) Warehousing: To ensure regular availability of health commodities delivered to health institutions at affordable prices, capable of responding to the total commodity requirement and as a centre of excellence using best practices in storage and distribution of quality, and safe efficacious health commodities" (Ghana Health Service, 2012). Effective and efficient logistics management plays a key role in organizations and the economy. Since logistics is such an important aspect of every economy, supply chain participants must coordinate all logistics management activities to maintain efficiency. Sangeeta and Nadeem (2004) define logistics as the specific functions that each supply chain partner must perform, such as selecting products, forecasting demand, ordering and procuring, warehousing and storing, managing inventory, transporting commodities from one level to the next until they reach clients, and managing data in the process. The service providers also constitute NGOs and Service Delivery Points (SDPs) such as hospitals, health centres and pharmacies. The coordination of these activities by the supply chain partners has a substantial impact on organisations and the economy.

It is impossible to overstate the importance of strategic logistics management in the Ghana Health Service system. According to Poulin (2007), logistics accounts for a significant amount of a hospital's operating budget. According to studies, between 30% and 46% of hospital expenses are spent on various logistical operations, and over half of the costs related to supply chain processes might be reduced by using best practices. The supply chain partners in the health logistics system include the manufacturers, pharmaceutical businesses that offer raw materials and procurement agents, which include ministries of health, health administrative units, UN organisations, and others. The transporters, and the central, regional, and district medical stores make up the distributors. Donors or financing agencies are examples of financiers. NGOs and Service Delivery Points (SDPs) such as hospitals, health centres, and pharmacies are examples of service providers. The supply chain partners' coordination of these activities has a substantial impact on organizations and the economy. In essence, the picture created by the mission is not what it is. One key issue of national medicines policies, according to Gyimah et al. (2009), is ensuring that their implementation plans include an ongoing supply of essential medicines that are safe and efficacious, physically and financially accessible, and used across the country. Unfortunately, medical supply systems in some countries, particularly in Sub-Saharan Africa, are often unstable, resulting in a lack of regular provision of these essential medicines. Because medicines and other health supplies in general are the foundation of all health systems around the world, it is always necessary to ensure their quality and consistent availability in the proper quantities at reasonable rates. To ensure regular availability of medicines and health commodities, it is important to integrate all the logistical functions by organizations to ensure effective and efficient logistics management.

Logistics has become more important since it enables businesses to effectively handle sourcing, production, and transportation to meet client expectations. In future corporate environments, the usage of Ghana Integrated Logistics Management Information Systems (GhLMIS) for the management of quick and accurate information flows will become critical (Shankar 2001). Healthcare institutions in many countries are seeking methods to increase operational efficiencies and save costs without compromising patient care (Msimangira, 2010). As a result, the significance of health logistics cannot be overstated. Silve (2009) cited WHO's findings in his article "Health logistics is a profession: increasing the Performance of health in developing nations." “Health and MDGs for development” and Task Force on Immunization Meeting, Maputo (2006) respectively as “We can now prevent or treat most illnesses by using known and inexpensive techniques, the problem lies elsewhere: it entails providing personnel, medicines, vaccines and information to those in need, at the appropriate time, insufficient quantity, reliable and sustainable manner, and at a cost acceptable.” Health logistics is more than just the role of managing material resources; it also involves the effective coordination and control of the flow of all operations, including staff, clients, facilities, information, and other resources. The role of the health logistician is to maximise the efficiency, quality, and traceability of health operations by utilising the technical and material resources available to health systems.

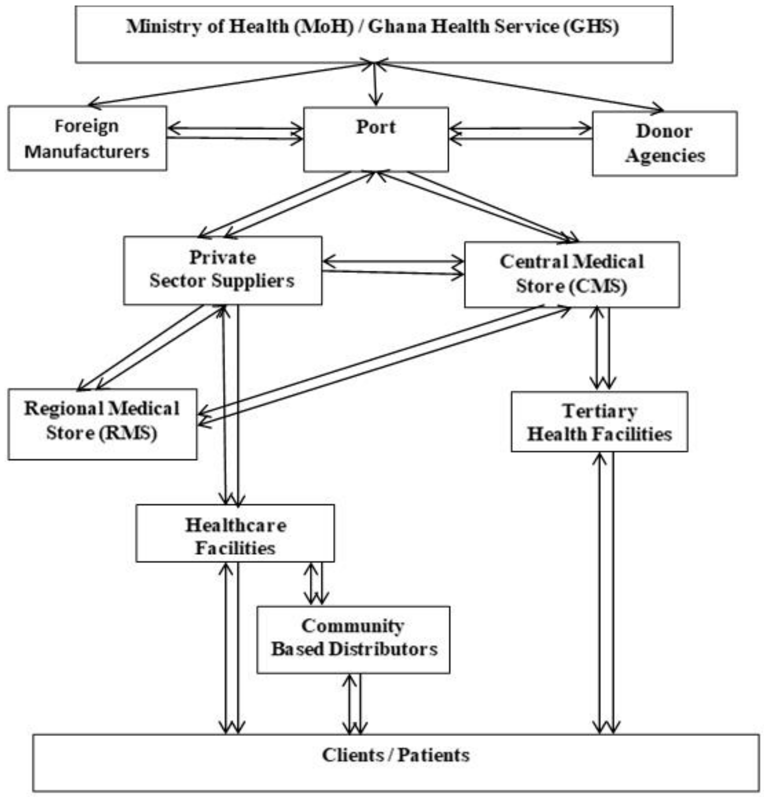

Figure 2.2 The flow of logistics in the health service delivery

Represents the flow of information

Represents the flow of commodities

The health commodity supply chain in the public sector in Ghana is constituted by the Central Medical Store and a network of Regional Medical Stores (RMS) in each of the sixteen administrative regions of the country. Medicines and supplies are managed through the Ghana integrated logistics management information system (GhILMIS) including contraceptives, are managed through this supply chain to health facilities throughout the country. When the Ministry of Health procures medical supplies, The Central Medical Store is responsible for the receipt, storage and distribution of all the supplies. The Central Medical Store supplies the lower levels of the tier. Health facilities are expected to get their supplies from the appropriate Regional Medical Stores, depending on their geographical location. Vaccines are managed a little differently through a network of cold storage warehouses in all the regions and refrigerated facilities. These are mostly located at the same place as the Regional Medical Stores. Each Regional Medical Store is managed by the respective Regional Health Administration (RHA), and it provides a supply service to health facilities in the region (Bossert *et al.* 2004). In exceptional cases, the teaching hospitals and the regional hospitals, after obtaining approval from the Ministry of Health, procure their supply directly from the suppliers. They also procure their supplies from the Central Medical Store. Fig 2.1 shows the supply chain structure of the Ghana Health Service. According to the supply chain unit annual performance report of the Ashanti regional medical stores, 2018, milestone achievements were reported on the reforms below:

I. Last Mile Distribution-update and sustainability
II. Framework contracting arrangement
III. Ghana integrated logistics management information systems
IV. Drones Delivery Program for emergency delivery of healthcare needs.

Last Mile Distribution

I. The concept of Last Mile Distribution is designed to consolidate orders and directly deliver health commodities to Service Delivery Points (SDPs) at the last mile.
II. Currently, the Region serves a total of 595 service delivery points in a bimonthly cycle arrangement.
III. Achieved a coverage of 100% at various levels of care after eight successful rounds of distribution.
IV. The concept of Last Mile Distribution is designed to consolidate orders and directly deliver the health commodities to Service Delivery Points (SDPs) at the last mile.
V. Currently, the Region serves a total of 595 service delivery points in a bimonthly cycle arrangement.
VI. Achieved a coverage of 100% at various levels of care after eight successful rounds of distribution.

- Distribution to cover 50%, 75% and 100% of all health facilities at the sub-district with a plan for expansion to lower levels.

Towards sustainable LMD-DESIGN

I. The Regional Internal Auditor will audit all transactions at the end of each Round of distribution.
II. This arrangement is to ensure responsiveness to operational issues and smoothen the distribution process as well as avoid delays resulting from bureaucratic arrangements and geographical challenges.

III. This design is intended to mimic the 3PL and retain the gains as well as maintain commodity accountability, professionalism and optimal distribution practices.

Logistics deals with the movement part of the supply chain. The distribution part has to deal with the three flows: the flow of information, the flow of cash, and the flow of goods. Information flow is very vital because if the information does not flow first there will be no flow of cash or goods. During the last decade, the healthcare sector has changed enormously in response to the increased competition, the growing influence of patients, and the necessity to deliver health services more efficiently and effectively (de Vries and Huijsman, 2011). Supply chain management in healthcare includes the internal chain (e.g. patient care unit, hospital storage, and patient) and the external chain (Lee, Lee, and Schniederjans, 2011). While healthcare providers' energies have been justly spent on identifying and eliminating waste in clinical operations, an effective and important approach to further shrink healthcare costs is to adopt sustainable healthcare supply chain principles (Buttigieg et al., 2020).

Supply chains of hospitals also face numerous cultural, financial, and social challenges. Increasing healthcare spending from an economic viewpoint requires greater flexibility in the procurement of services (Kumar and Blair, 2013). The Organization for Economic Co-operation and Development has estimated that hospitals account for approximately 40% of total health expenditures (Jindrová and Kopecká, 2017). Also, around 30% and 40% of the spending of a hospital is allocated to supply chain costs (Landry, Beaulieu and Roy, 2016), That can be cut by as much as 8% using best practices (McKone-Sweet, Hamilton and Willis, 2005). These best practices allow healthcare personnel to concentrate on their core care mission (Landry, Beaulieu and Roy, 2016). A study by McKone-Sweet, Hamilton and Willis (2005) showed that Canadian hospitals studied by these writers found that the restructuring of inter-site transportation resulted in economic benefits of up to 35%, significantly shortened delivery times, and a significant impact on patient satisfaction, the basis for consolidating external transportation. A case study analysed by (Landry, Beaulieu and Roy, 2016) illustrated that the concept of practice, per se, is difficult to define. Practices take various forms and can represent technologies, processes, ways of doing things, or ways of organizing work. A review of a study shows that hospitals produce large amounts of waste, for example, public hospitals produce as much waste in Victoria, Australia as 200,000 households do (McGain et al., 2017). As well as environmental concerns, waste management is critical for reasons of public health. As demonstrated by (McGain et al., 2017), single-use disposable trays double the cost of recycled trays, meaning that only reuse of these items would save $5,000 a year for a 300-bed hospital.

Most of the literature reviewed adopted a qualitative approach, many authors employed systematic literature review, cross-sectional and longitudinal design. Akazili et al. (2008) focused on technical efficiency in health centres in Ghana using a data envelopment method (DEA) with 89 randomly sampled health centres. The findings showed that 65**%** of health centres were technically inefficient and so were using resources that they did not need. The findings point to considerable inefficiency in the health care delivery network in public health facilities and that if steps were placed in place to curtail the duplication, large quantities of money could be saved. Another study used the data envelopment analysis (DEA) method, to calculate the technical and allocative efficiency of 113 randomly sampled health centres. A logistic regression model was also applied on whether health centres were technically efficient or not to determine the factors that significantly influence the efficiency of health centres. The overall efficiency, (product of the technical and allocative efficiency) was also calculated and over 90**%** of the health centres were inefficient. The findings showed that 78**%** of health centres were technically inefficient because they were holding resources that they did not need. Although the findings show a negative reflection, health centres do not receive much patronage compared to hospitals. Kuupiel *et al.* (2019) conducted a review of accessible PoC diagnostics in 100 PHC clinics in the upper- east regions of Ghana from February to March 2018. The study adopted a monitoring audit tool adopted from the World Health Organization with univariate logistic regression analysis. Overall, inventory management scored the lowest, at 53.5% compliance. This study was, however, limited to inventory management instead of the entire supply chain. Amegashie-Viglo and Kotei (2014) employed descriptive and quantitative methods to examine the supply chain of a private company and assess consumer perception of the degree of availability and affordability of efficacious pharmaceutical products in promoting quality health care delivery. The study concluded that Ernest Chemists Limited has an effective supply chain management system that provides efficacious medicines that are available to all levels of income earners in Ghana. However, it is worth noting that the supply chain in the private organization may not reflect the true picture of the public health supply chain.

However, since the focus of this research is on the healthcare commodity supply chain these will not be reviewed in detail and will only be referred to as appropriate. Besides, patient flow and hospital infrastructure will also not be reviewed. According to Duque-Uribe, Sarache and Gutiérrez (2019) using a systematic literature review, the suggested structure will serve as a starting point for researching the application of SSCM activities in hospitals to enhance efficiency in this category of organization, use a holistic approach to sustainability. It must therefore be validated and refined using both quantitative and qualitative methods of study. Research by the Centre for Studying Health System Change reports that hospital expenditure accounted for 47% of the overall 7.2% increase in healthcare costs during 2000 (Struck *et al.*, 2002). Supply chain costs resulted in as much as 40% of the actual hospital's operating budget, and the strategic significance of hospital supply chain management is profoundly recognized. Recent approximations of the potential advantage of an efficiently managed healthcare supply chain range from 2% to 8% of hospital operating costs (Haavik, 2000; EHCR, 1996; CAP Gemini, 2001). An efficient, user-friendly supply chain can also impact the hospital's revenues by stimulating physician loyalty and staff retention and providing better customer service (Computer Services Corporation, 1999). In conclusion, after reviewing the numerous articles it was evident that supply chain components that form the basis for sustainability drive, as well as developing a framework to measure sustainability performance have not been specifically defined and it is therefore necessary that this study addresses the challenge. Shah (2004) goes into detail about the features of these supply chains, including standard output standards. Long lead -times exist, with goods taking anywhere from 1,000 to 8,000 hours to complete their journey across the supply chain. In addition, inventory levels tend to be very high, with stock turns ranging from one to eight weeks. This is in line with Haavik's (2000) results, which stated that stock turns in hospital storerooms took four to five weeks in 1994. Demand amplification is another topic that has been posed by many writers (Corrêa, 2004; Shah, 2004). This is perhaps to be anticipated, given the number of intermediaries in the supply chain and the presence of batching in primary manufacturing. The supply chain for pharmaceutical products is important in the healthcare industry for maintaining a high quality of care for patients and sufficient prescription supplies for pharmacies. In terms of cost, it is estimated that supply accounts for 25-30% of hospital operating expenses (Roark, 2005). As a result, it must be efficiently handled to ensure that all service and cost goals are met.

2.6.3 Covid supply chain requirement for vaccines

The COVID-19 pandemic has led to a huge disruption in many value chains worldwide, especially in SSC (Govindan *et al*., 2020). Such disturbances have significant negative effects on sales revenue return on investment, procurement strategies, brand image, materials supply, stakeholder and customer health, logistics service, and overall performance in the supply chain (Bag *et al.*, 2020; Majumdar et al., 2020; Sharma et al., 2020). All these negative effects are caused by the immediate consequences of inaccessible supply chain components, including procurement, production, distribution, or logistics (Ivanov, 2020a). The COVID-19 epidemic has caused supply chain disruptions throughout the world. In the health sector, the supply chain is crucial in providing healthcare delivery (Ivanov and Das, 2020; Kilpatrick and Barter, 2020). This pandemic has been the most devastating natural occurrence in the last few decades (Remko, 2020). The COVID-19 pandemic is indeed not just a global health emergency, but also a labour market and economic case of emergencies. Analysis by the International Monetary Fund (IMF) according to predicted that the advanced economy would shrink by roughly 6% in 2020, while emerging markets and developing economies will shrink by 1% (IMF, 2020). The economic impacts of this pandemic include employment losses and/or considerable income reductions and working hours for people throughout the world. According to the International Labour Organization (ILO), the pandemic eliminated about 7.2% of working hours for over 125 million full-time employees throughout Asia and the Pacific (ILO, 2020). This pandemic has wreaked havoc on textile supply chains in underdeveloped economies around the world. According to the Clothing Manufacturers Association of India (CMAI), COVID-19 caused over US$ 3.17 billion in orders to be postponed in Bangladesh, affecting around 2.27 million workers (Majumdar et al., 2020). Around 94% of Fortune 1000 organizations had supply chain disruptions caused by the coronavirus (Kilpatrick and Barter, 2020).

Dun and Bradstreet (2020) examine that China is the tier-1 supplier for approximately 0.5 million organizations and the tier-2 supplier for over 5 million companies. They further demonstrated that nearly 16% and 94% of Fortune 1000 companies have China as their tier-1 and tier-2 suppliers respectively. When China (dubbed "the world's factory") faces troubles, the majority of many firms' SCs are turned upside down. Chinese exports dropped by roughly 17% during the first phase of the pandemic, and that figure is expected to rise to 32% by 2020 (Sarkis *et al.*, 2020). Per the Tradeshift data, average inter-national payment times increased by 1.7% to 37.4 days in the first quarter of 2020, up from 36.7 days in the previous quarter (World Economic Forum, 2020). Epidemic occurrences are classified as exceptional cases of supply chain risks because they occur in an unforeseen manner and have long-term effects on supply chains. As a result, predicting the effects of the COVID-19 outbreak on SCs is extremely challenging for academics and specialists. While COVID-19 continues to spread around the world, different countries and organizations are focusing on assisting affected employees, protecting their employees, and working together to develop new vaccines, medications, and efficient healthcare systems to reduce negative global health effects. However, the lack of appropriate personal protective equipment (PPE), such as ventilators, masks, face shields, gowns, hand gloves, and hand sanitisers, is concerning (Sharma et al., 2020). However, the pandemic has cast doubt on previously held beliefs concerning SCs (Choi, 2020; Ivanov, 2020a). The pandemic posed a challenge to policymakers and governments, as well as disrupting overall operations, systems, and SCs.

Other inventory control systems have been introduced into healthcare supply chains. There has been interest in vendor-managed inventory (VMI). Under VMI, the supplier assumes responsibility for the management of inventory at the customer and takes decisions regarding replenishment (Waller et al. 1999). To some extent, this builds on the information requirements of stockless inventory systems. The main difference is moving responsibility for stock control to the supplier, as the ordering process remains automated. For VMI to work successfully, there is a need for accurate information on current stock levels and consumption. However, providing such information within hospitals can be difficult (Haavik, 2000; McKone-Sweet *et al.*, 2005). Nonetheless, examples of VMI implementation do exist in the literature. In Kim (2005), VMI has brought several benefits including less administration at the hospital, fewer errors, improved information reliability, and a 30% reduction in inventory. By contrast, Altricher and Caillet (2004) found that, because of a lack of trust in the supply chain, the hospital kept over-ruling the VMI system, holding more stock and eliminating any benefits that accrued. The Organization for Economic Co-operation and Development has estimated that hospitals account for approximately 40% of total health expenditures (OECD, 2017) which can be reduced by up to 8% using best practices (McKone-Sweet, Hamilton and Willis, 2005). Despite well-documented evidence of significant competitive advantage and cost reduction resulting from supply chain management (SCM) practices, the healthcare industry has been extremely slow to embrace these practices.

In addition to the constraints of an inadequate supply of COVID-19 vaccines, one critical factor that must be addressed should vaccines be available in adequate quantities is the proper supply chain system to transport them from the point of manufacture to the point of administering to people in need. For proper storage and handling of the Pfizer-BioNTech COVID-19 Vaccine in a freezer, for instance, before mixing, the vaccine may be stored in the freezer between -25°C and -15°C (-13°F to 5°F) for up to 2 weeks. The Centre for Disease Control (CDC) recommended that providers only use the thermal shipping container for short-term storage. To keep vaccines at the right temperature, the container requires much support, including skilled personnel, a constant supply of dry ice, and standard operating procedures for routine maintenance. This beyond-use date replaces the manufacturer’s expiration date. The total time vials are stored at these temperatures should be monitored regularly and should not exceed 2 weeks. To properly store and handle the Pfizer vaccine in the ultracold freezer, vials stored in the freezer may be returned one time to ultracold temperature storage (-80ºC to -60ºC [-112ºF to -76ºF]). Once returned to ultra-cold storage, the 2-week time frame is suspended. Vaccines stored in the freezer can be moved to refrigerator storage where they can be stored for up to one (1) month (31 days) (CDC and Ncird, 2021b). Therefore, there was an urgent need for adequate facilities in the supply chain system to ensure the requirements are met for the preservation and usage of the limited vaccines that may be available for delivery to save lives. The role an effective supply chain plays in healthcare delivery cannot be underestimated because healthcare personnel can only provide the required services when they get the needed logistics through the supply chain. The healthcare supply chain is as important as direct healthcare delivery since it complements the latter. To achieve a successful healthcare delivery, medical supplies and other logistics needed by the healthcare personnel should be available in the right quality, at the right time and in the right quantity. To guarantee that there would be a need to ensure strict adherence to the requirements for transporting logistics and especially vaccines to places needed. To maintain the cold chain when packing and transporting the Pfizer-BioNTech COVID-19 Vaccine, there must be a temperature monitoring device in a thermal shipping container, a portable ultra-cold freezer unit, a portable freezer unit, portable refrigerator unit or a container/pack out qualified to maintain the recommended temperatures. Upon arrival at the clinic, place the vaccine in an on-site storage unit that maintains recommended temperatures, if available. If there is no storage unit available, keep the vaccine in the transport container, maintaining the recommended temperatures. Any breach in the process will render the vaccine expired or useless before it gets to the point of need (CDC and Ncird, 2021). Skilful supply chain practitioners or technocrats will be needed across the supply chain, both upstream and downstream of the chain. From sourcing raw materials, manufacturing, storage, transporting, handling, and administering should follow the laid down procedures to keep the vaccines safe for use.

According to the CDC, the vaccines should ideally be transported in equal amounts, diluents, and ancillary supplies (including vaccination record cards and personal protective equipment). Vaccine vials may be transported more than once and thawed vaccines should be transported at refrigerated temperatures as well as individual vials or partially filled trays. Vaccines stored at refrigerated temperatures should not be refrozen and both punctured and unpunctured vials may be transported. Punctured vials must always be transported at refrigerated temperatures for preservation. Although the CDC recommends transporting vaccines in vials, there may be times when transferring pre-drawn vaccines in a syringe is the only choice. The US Pharmacopeia COVID-19 Vaccine Toolkit provides operational considerations for healthcare practitioners and step-by-step instructions for transferring pre-drawn vaccines in syringes (https://www. usp.org/covid-19/vaccine-handling-toolkit). Best Practices for transporting mRNA vaccines include protecting vaccines as much as possible from drops, shocks, and vibration, minimizing movement, and transporting vials in the carton whenever possible. Individual vials must be transported based on the following conditions:

I. Place vials with padding materials like bubble wrap or similar materials to prevent breaking.
II. Secure storage containers during transport.
III. Keep vaccine vials upright whenever possible.
IV. Protect from light (CDC and NCIRD, 2021a)

Swaminathan et al. (2007) argue that if hospitals are to continue to function adequately, reliable access to effective personal protective equipment (PPE; gowns, N95 masks, gloves, and eye protection) and antiviral drug therapy will be necessary for an unpredictable period. PPE used in healthcare includes gloves, aprons, long-sleeved gowns, goggles, fluid-repellent surgical masks, eye, nose, and mouth protection, face visors, and respirator masks. Healthcare workers (HCWs) should wear protective clothing when there is a risk of contact with blood, body fluids, secretions, and excretions. HCWs should select the appropriate PPE based on a risk assessment of the task to be carried out (Swaminathan et al., 2007). There are focus airborne droplets (splatter) released through breathing or expelled through sneezing of infected COVID-19 patients may travel several meters and remain suspended for 30 min and survive on surfaces for potentially several days. Disinfection or sterilization of PPE on the surface or touched surface, as coronavirus does not penetrate materials. However, maintaining materials functionality after efficient treatment is the greatest challenge for reprocessing on one-time-use PPE. These essential materials cannot be available at the hospital without an efficient and effective supply chain management system.

Based on World Health Organization definitions and guidelines, the mean number of “close contacts” of the patient was 12.3 (range 6 - 17; 85% HCWs); mean “exposures” were 19.3 (range 15 - 26). Overall, 20 - 25 PPE sets were required per patient, with variable HCW compliance for wearing these items (93% N95 masks, 77% gowns, 83% gloves, and 73% eye protection). These data show that many current national stockpiles of PPE and antiviral medication are likely inadequate for a pandemic (Swaminathan, 2007). Although a new influenza pandemic may appear inevitable, critical parameters of transmissibility and attack rate are uncertain. Estimates based on extrapolations from the 3 influenza pandemics of the 20th century suggest that healthcare facilities in the United States alone may be required to cope with 314,000-734,000 additional hospitalizations and 18 - 42 million outpatient visits (Meltzer, Cox and Fukuda, 1999). During the early containment phase of a pandemic, patients with suspected infection are likely to be referred to hospitals for isolation, diagnosis, and treatment until the transmissibility and virulence of the pandemic strain are known. Although social distancing and school closures may reduce risk in the wider community (2), healthcare workers (HCWs) are likely to encounter repeated close exposures. With awareness of the recent severe acute respiratory syndrome (SARS) outbreak and growing concern about human deaths from avian influenza (H5N1), governments worldwide have begun to stockpile PPE and antiviral medication. Key strategies to control the speed and extent of viral spread within the healthcare sector have been advocated by national government guidelines (WHO, 2011) and the World Health Organization (WHO). These include rigorous infection control practices, prescriptive instructions for the use of PPE, and dissemination of antiviral medication (WHO/CDS/CSR/EDC/99.1), available at http://www.who.int/csr/resources/publications/influenza/en/whocdscsredc991.pdf).

HCW was defined as any person working within the healthcare facility (WHO, Avian Influenza: guidelines, 2011). We used the WHO definition of "close contact" as any person (including non-HCWs) coming within 1m of an API patient within or outside of an isolation room or area (WHO, Avian Influenza: guidelines, 2011). Close contacts were counted only once. An "exposure" was counted each time a close contact came within 1 metre of the API patient. A "PPE item" included a disposable gown, pair of gloves, pair of protective eyewear, or N95 mask (or equivalent particulate respirator). A "PPE set" was defined as the appropriate combination of PPE items recommended for HCW use in a particular clinical setting (WHO, Avian Influenza: guidelines, 2011). "Opportunity for PPE item use" was defined as any instance of actual use of a PPE item during the study as well as any instance where the wearing of a PPE item was recommended by WHO guidelines (WHO, 2011), as objectively noted by accompanying study observers. These items included PPE worn by HCWs involved in direct patient care (HCW close contacts) and ancillary HCWs who performed indirect clinical tasks associated with the API case-patient such as cleaning, ward support, and specimen transportation and processing. Environmental decontamination of clinical areas after use was considered adequate if cleaning and disinfection procedures were undertaken in a manner consistent with WHO recommendations. The time spent in each clinical area was recorded from when the API patient first entered an area to the time when the patient entered the next area (www.who.int/csr/disease/avian_influenza/guidelines/infection control1/en).

Table 2.2 WHO healthcare workers; personal and protective equipment guide

WHO recommendations for HCW barrier precautions, dependent on the type of exposure	
HCW activity	Recommended PPE set
Close contact (<1 m) with potential API-infected patient within or outside of the isolation room or area	Gloves, gown, N95 mask (or equivalent particulate respirator), eye protection
Cleaning	Gloves, either gown or apron
Patient transport within healthcare facilities	Gown, gloves
Specimen transport and processing t	Not defined except to use 'safe handling practices', interpreted as use of gloves (minimum) and gown if opening specimen bag

Source: (Adapted from Swaminathan et al., 2007)

2.6.4 Supply chain performance measurement

Holmberg (2000) and Eccles and Pyburn (1992) define SCPM as a framework that provides a formal description of the performance model of the supply chain based on mutually agreed targets, benchmarks and evaluation methods that define the processes, roles and accountability of the participants in the supply chain and their regulation of the system. The design and implementation of SCPM is an important issue as a medium for organizational change. Scholars and experts in the field have proposed different desirable features which have been presented and discussed. However, they all (Beamon, 1999; Keebler, 2001; Gunasekaran *et al*., 2004; Tangen, 2004; Ramaa *et al*., 2009; Akyuz, and Erkan, 2010; Kurien and Qureshi, 2011) agreed that an effective SCPM system should be characterized by: Inclusiveness: Covers all aspects and processes of a supply chain; Universality: Allows for comparison under different operating conditions; Measurability: Output is quantitative and can be measured and Consistency: Metrics are compatible with supply chain goals. The selection of the right performance metrics is another crucial issue. The appropriate measures do not only offer a means of tracking how far an organization is from achieving its objectives but also provide a means of communicating strategy and encouraging its implementation. Several researchers have addressed this problem and discussed the features and requirements of appropriate measures (Lai *et al*., 2002; Beamon, 1999; Keebler, 2001; Gunasekaran et al., 2004; Parker, 2000; Lapide, 2000; Chan and Qi, 2003; Chan, 2003; Simchi-Levi et al., 2002; Basu, 2001; Beamon and Ware, 1998; Bourne *et al*., 2000; Bourne *et al.,* 2002; Dasgupta, 2003). The scholars examined that performance measures must be quantifiable, non-conflicting and plainly defined across the chain along with many other characteristics.

Gunasekaran *et al.* (2004) for instance, have recently emphasized that supply chain performance measures should generally be balanced (financial vs. non-financial) and should be classified at the strategic, tactical and operational management levels. From a supply chain management standpoint, however, the literature is split regarding the healthcare sector. Although many healthcare practitioners have recognized the importance of adopting supply management practices, the healthcare sector cannot follow an industrial supply chain approach. Typically, a supply chain addresses three flows: physical product, information, and financial flow. This is due to the unique features of the sector, such as the complexity of the technologies being used and the existence of multiple stakeholders (de Vries and Huijsman, 2011). There is a common concern among scientists, decision-makers, and institutional and industrial managers regarding the use of observable metrics to determine and quantify the sustainability of an organization either manufacturer or service-oriented, or to move towards sustainability (Peixoto *et al.*, 2016). The metrics must be capable of concentrating on the goals. Admittedly, finding the required number of relevant indicators is a critical trend in sustainability assessment methods for the applicability of indicators (Atanda, 2018). The value of the need to identify suitable indicators which can be calculated at intervals is not superficial. Practitioners and scholars have addressed the areas that these metrics can include (Fang *et al.*, 2018). Involving stakeholders in finding indicators and choosing the method of sustainability assessment will increase the reliability of results (Collier et al., 2014).

Sustainable development is an integrative concept. Consequently, any assessment of progress toward sustainability must also be an integrative process with a corresponding framework for decision-making (Ginson, 2006). For 60 years, Gross Domestic Product (GDP) has been the dominant way in which the world has measured and understood progress. This approach has failed to explain several important factors that impact people’s lives (European Commission, 2007, 2009; Stiglitz, 2009; Thornhill, 2009). A plethora of approaches available to measure welfare and sustainable development now exist, without a consensus on which one is correct at a general level (Kulig et al., 2010). Beamon (1998) arranged the models of supply chains and provided a research agenda for supply chain researchers, and Thomas and Griffin (1996) studied the models around coordinated SCM. Both studies mentioned performance measurement, which is a goal in supply chain modeling. In addition, articles such as those by (Gunasekaran *et al*., 2001; 2004); Beamon (1999) discussed the problems with performance measurements in SCM.

2.6.5 Global supply chain challenges

Although many challenges exist in both domestic and international supply chains, they are more substantial and critical in global operations. It's significant to examine the distinctions between domestic and global supply chains and compare the risks that each faces in terms of the supply chain's goals. The objective of supply chains is maximizing profit (Hise, 1995; Nelson and Toledano, 1979). Identifying the balance between productivity (efficiency) and profitability (effectiveness) (Mentzer and Firman, 1994) to move goods and provide services between nations in a timely and seamless manner (Bowersox and Calantone, 1998a). Global supply chains need to consider all the differences in economies, cultures, politics, infrastructure and competitive environment (Schmidt and Wilhelm, 2000). Economic challenges comprise considerations such as transfer prices, tax rates, duties, exchange rates, and inflation (Nelson and Toledano,1979). Infrastructural differences include available modes; quantity, quality, and type of documentation; and the number and nature of intermediaries and facilitators (banks, warehouses, transport agencies, etc.) may require organizations to adjust and/or reconsider home-grown strategies being implemented. The infrastructural limitations in some developing economies may inflict limitations on the efficiency of logistical systems (Mentzer and Samli, 1981). The competitive environment, coupled with relatively high resource requirements, may bring about several difficulties regarding customer service levels, anticipated costs, and desired profitability. Political factors such as stability of government, law and order, and sanctions have implications for supply chain structure and related costs. Administering and managing a global logistics system creates conflict between the central management of the entire system and the local management of each division of the total system (Nelson and Toledano,1979).

To summarize, global supply chains have potentially more delivery points, greater uncertainties and thus the essence of greater coordination, communication, and monitoring. The above challenges require the need for an inclusive set of performance measurement standards due to fluctuations in national currencies and unpredictable inflation rates among both industrialized and developing countries. An organization structure should be capable of transferring knowledge and skills on a global basis, the desirability of mastering a complex set of relationships (integrating a system of domestic laws), and executive leadership with competency in managing logistical and informational flows to support global marketing and manufacturing strategies (Bowersox and Calantone, 1998b; Bowersox and Sterling, 1982). One question to ask is that if global supply chains are complex and difficult to manage, why would a firm choose to go global? The answer simply is that global configurations provide access to cheap labour and raw materials, subsidized financing opportunities, and larger product markets, and the governments of different countries may sometimes offer widely varying inducements (e.g., tax abatements) to attract new business. Kogut (1985) identified ways to profit from global operations: production shifting, tax minimization, financial markets, and information arbitrage. The advantages of global supply chains are outsourcing; transnational mobility of capital, information, people, products and services; increased e-business opportunities; tremendous leaps in information technology; and exploiting economies of location, such as differences in labour costs, productivity levels, and taxes (Harland, Brenchley and Walker, 2003).

2.7 Addressing the research gap

Based on the research gap and the research questions indicated, this thesis seeks to address the research gaps with the following objectives and the methodology which will be discussed in chapter four:

Chapter 1 To develop a framework to reveal the determinants of sustainability of the public healthcare supply chain in Ghana in the form of the theoretical model by researching and testing the hypothesised relationship between sustainable supply chain and sustainable healthcare performance.

Chapter 2 To develop a reliable measure of the determinants of sustainability of the public healthcare supply chain system in the Ashanti region of Ghana using the proposed framework.

Chapter 3 To develop strategies to re-engineer a specific public healthcare system supply chain in the

Ashanti region with new strategies, policies, and operational plans.

2.8 Study limitation

This study does not extend much into the clinical function and structures but rather how the health facilities acquire the needed medicines, pharmaceuticals and other logistics to perform uninterrupted service to the society or people in the Ashanti region of Ghana sustainably. Therefore, this study concentrates solely on supply chain management practices. Additionally, the study was negatively impacted by the Covid-19 pandemic since it extended the data collection period due to risk concerns leading to the inability to obtain ethics approval. Finally, the loss of my dear father during the research period was a challenging experience that almost derailed my studies.

2.9 Literature review summary and conclusion

This chapter has presented a concise assessment of the various factors that have been studied as major determinants of sustainable performance in the existing supply chain management practices and related literature. The assessment demonstrates that a host of many different factors, both external and internal to organisations have been examined. Among these are sustainability-oriented leadership (SoL), supply chain capabilities (SCC), supply chain management (SCM), sustainable supply chain (SSC), sustainability, healthcare supply chain, sustainable healthcare supply chain, sustainable economic performance (SEP), environmental sustainable performance (ESP), social sustainable performance (SSP) and supply chain challenges. A major conclusion from the literature assessment is that the role of sustainable supply chain practices has been conceived as a significant determinant of sustainable performance. However, empirical evidence on the antecedents of sustainable supply chain practices and performance remains extremely under-researched. Hence, it is concluded in this study that the significance of SoL, SCC and SSCP in the operational context of healthcare organisations is yet to be theoretically and empirically examined. Hence, there is a clear void in the supply chain literature for sustainable performance and this needs addressing. Based on the gaps that have been identified, the literature assessment turned to a discussion of sustainable supply chain practices and their relation to sustainable healthcare performance.

CHAPTER THREE - CONCEPTUAL FRAMEWORK AND HYPOTHESIS

3.1 Introduction

Chapter three of this thesis further uses sustainability-oriented leadership, supply capabilities as a group in stage one, sustainable supply chain practices in stage two and sustainable supply chain performance literature to develop a conceptual model of sustainable performance construct. The literature is applied to develop a series of hypothesised relationships between the constructs that are proposed to impact a sustainable supply chain in healthcare performance, section 3.1 discusses the introduction of the chapter, 3.2 theoretical underpinnings for the study, section 3.2.1 dynamic capability and resource-based view theories, 3.3 outlines the conceptual framework, section 3.4 highlights the hypotheses of the overall sustainable healthcare performance, section 3.4.1 justification of the impact of sustainability-oriented leadership on sustainable supply chain practices, 3.4.2 justification of the impact of supply chain capabilities on sustainable supply chain practices, 3.4.3 justification of the impact of sustainable supply chain practices on sustainable healthcare performance, 3.4.4 justification of the impact of sustainable healthcare performance on economic performance, 3.4.5 justification of the impact of sustainable healthcare performance on environmental performance, 3.4.6 justification of the impact of sustainable healthcare performance on social performance, 3.4.7 justification of the impact of sustainable supply chain practices on sustainable economic performance, 3.4.8 Justification of the impact of sustainable supply chain practices on environmental sustainable performance, 3.4.9 justification of the impact of sustainable supply chain practices on sustainable social performance, 3.5 justification of the impact of sustainability-oriented leadership on sustainable economic, environmental and social performance, 3.5. justification for the impact of supply chain capabilities on economic, environmental and social performance, 3.5.1 justification for the impact of sustainability-oriented leadership on healthcare performance, 3.5.2 justification for the impact of supply chain capabilities on sustainable healthcare performance and finally, 3.5.3 summarizes the chapter.

3.2 Theoretical underpinnings

Epistemology refers to the set of assumptions about enquiring into the nature of the world (Easterby-Smith, Thorpe, and Jackson, 2012). In other words, it relates to our notions and perceptions about knowledge. There are three general arguments surrounding the assumptions of knowledge. These debates focus on positivism, interpretivism and realism. Positivism relates to applying the methods of natural science to the study of social reality and beyond. Interpretivism, on the other hand, respects differences between people and the objects of the natural sciences and therefore requires the researcher to grasp the meaning of subjective action. Realism - empirical and critical - believes that the natural and social sciences can and should apply the same kinds of approaches to the collection and application of data while admitting that there is an external reality to which scientists direct their attention (Bryman, 2016). Apart from these three basic assumptions, there are other assumptions, one of which inspires this research, the social constructivist view. A review of the procurement and supply chain management literature suggests that an overriding theoretical paradigm that is often adopted by researchers interested in examining the determinants of sustainable supply chain practice and performance as the underlying theoretical bases are, dynamic, game theory and systems theory. Researchers of logistics and SCM have long realized the worth of borrowing and applying theories from other disciplines (Frankel *et al*., 2008; Rich and Hines, 1997; Stock, 1997, 2002). The complexity of contemporary supply chain systems shows that it is almost impossible to completely explain a supply chain phenomenon with a single theory. Consequently, to provide a more thorough comprehension of the emerging theoretical framework, a wide range of related literature was reviewed: strategic management, marketing and the social sciences. Specifically, two significant theoretical perspectives - the resource-based view (RBV) of the firm and dynamic capabilities theory are considered to be particularly important given the themes uncovered in the quantitative research. In the process of developing a comprehensive framework, a two-step approach was taken. First, a basic framework utilizing RBV and DCT is proposed. Next, explicit concepts derived from the quantitative research are incorporated, and specific propositions are offered.

3.2.1 The dynamic capabilities theory and resource-based view theory

Dynamic capabilities theory "Capability is considered dynamic when it enhances the firm's ability to make decisions, solve problems, identify opportunities and threats, and modify existing resources" (Barreto, 2010; Eisenhardt & Martin, 2000; Teece et al., 1997). Perks et al. (2017) claim that blockchain technology in supply chain brings together all the SC partners to co-create value by performing their assigned tasks, achieved through the dynamic configuration of supply chain resources. Dynamic capability is defined as "the capacity of an organization to create, extend, and modify its resource base purposefully" (Helfat & Winter, 2011, p 4). Following the dynamic capability theory, it is believed that organizations can create 'value' by modifying supply chain processes and resources. Blockchain technology's principal value drivers include increased transparency, immutability, ledger privacy, reliability, and trustworthiness (Kamble et al., 2018). These value drivers are expected to reduce transaction-based costs, add new services, delineate the organizational boundaries and automate and decentralize the supply chain decision-making (Angelis & da Silva, 2018; Pereira et al., 2019). The use of blockchain technology in supply chain is perceived to improve the productivity and performance of organizations through hyper-levels of supply chain integration, end-to-end integration of product and process data (Wang et al., 2019). Polim et al. (2017) also suggest Blockchain as a technology with high information integration capability. In this study, supply chain capabilities are considered dynamic capabilities “that provide the ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments” (Teece et al., 1997). Accordingly, digitalization technological advancements present increasing challenges to modern SC networks in terms of complexity and dynamicity, which requires a higher level of dynamic capabilities (DC) in the SC. Therefore, SSC performance and DC are related through similar environmental and organizational conditions, making the application of DC concepts in the field of SCP a logical choice (Hong et al., 2018; Beske et al., 2014). Dynamic capabilities theory (DCT) is an extension of the resource-based view (RBV). While the RBV emphasizes resource choice or the selection of appropriate resources, dynamic capabilities emphasize resource development and renewal (Hitt *et al.*, 2016). Dynamic capabilities theory is also integrated with RBV to illustrate how to achieve a competitive advantage within the supply chain (Squire *et al.*, 2009). Supply chain dynamic capability, building on dynamic capabilities theory, is the ability to adjust the supply chain. It is an emerging and popular concept in recent years and yet its essence is difficult to grasp (Defee and Fugate, 2010). Scholars of the RBV suggest the idea of firm “diversity‟ (Barney, 1991) and the notion that firms are “combiners‟ of valuable, heterogeneous, imperfect and mobile resources (Penrose, 1959; Nelson and Winter, 1982; Barney, 1991; 1986; 2001; Peteraf, 1993; Wernerfelt, 1984; Barney and Clark, 2007; Lippman and Rumelt, 1982). As such, the RBV “aspires to explain the internal sources of a firm’s “sustained competitive advantage” (Kraaijenbrink, Spenser and Groen, 2010, p. 349). Its central principle is that a firm can achieve sustainable competitive advantage and eventual superior financial performance if it acquires and controls valuable, rare, inimitable, and non-substitutable resources and capabilities, plus the organisation (VRINO) to absorb and apply them (Barney 1991; 2002). What then do the principles of the RBV mean? The RBV is based on a theory explaining that a firm’s performance may be based on the resources a firm owns and controls, and how such resources are used by the firm (Wernerfelt, 1984; Barney, 1991). It is argued that resources are not restricted to firms’ tangible assets such as production plants, raw materials, equipment and buildings, but can also entail “anything available to the firm that has an enabling capacity” (Hunt, 1997, p.64). In this regard, resources can include intangible assets as such financial (e.g., cash at the bank, access to credits in the financial market), legal (e.g., trademarks, licenses, copyrights, patents), human (e.g., skills, experiences, and knowledge of individual employees and managers), organisational (e.g., competencies, controls, routines, cultures, and behaviours), relational (e.g., relationships with customers, suppliers, competitors, distributors, and regulators), and informational (e.g., intelligence about customers, competitors, technology and other exogenous environmental forces) resources. Hunt and Morgan (1995) argue that all these resources have enabling capacities for organisations to achieve competitive advantage. A major suggestion from the RBV is that the performance outcomes of these resources depend on the extent to which they are applied. As such, it is argued that a firm's performance is based on the attributes of the resources it controls (Barney, 1986; 1991). Specifically, Barney (1991) argues that resources must be heterogeneous across organisations and imperfectly mobile. The significant conclusion is that the resources that a firm owns, and controls can be the source of its continued economic success (Barney, 1991). This study argues that sustainability-oriented leadership and supply chain capabilities are the internal resources of organisations that can facilitate sustainable supply chain practices, leading to the sustainable performance required in the healthcare sector and beyond.

3.3 A proposed conceptual model for SSCMP in healthcare

In response to the research question, this section presents an integrative framework for SSCM practices that may impact sustainable performance in hospital settings (see Figure 3.4). This can be considered innovative in at least three ways. First, as found in the reviewed literature, several publications have outlined relevant sustainability issues, but little attention has been given to the amalgamation of scattered practices and performance measures in a single and articulated framework. Most of the previous research on hospital supply chain management focuses on logistics from a cost. To improve the performance of health services, policymakers need to implement approaches to tackle usability, acceptability, the strength of usage and conformity with professional orders, the standard of treatment, recurring costs, and community ownership (WHO, 2000). Planners require advanced knowledge of the productivity rates at health services to implement these strategies. Unfortunately, there is limited literature on healthcare efficiency initiatives, particularly in developing countries and especially in Africa, and this needs to have advised the African office of the World Health Organization (WHO) to call for robust work on health sector efficiency.

The proposed framework has three stages (Figure 3.4). The first stage is the antecedents of SSCP determinants; the second stage consists of the supply chain practices and performance as mediators; the third level is the healthcare sustainable performances (triple bottom line). The proposed framework could be applied using the following steps to measure SSCM performance:

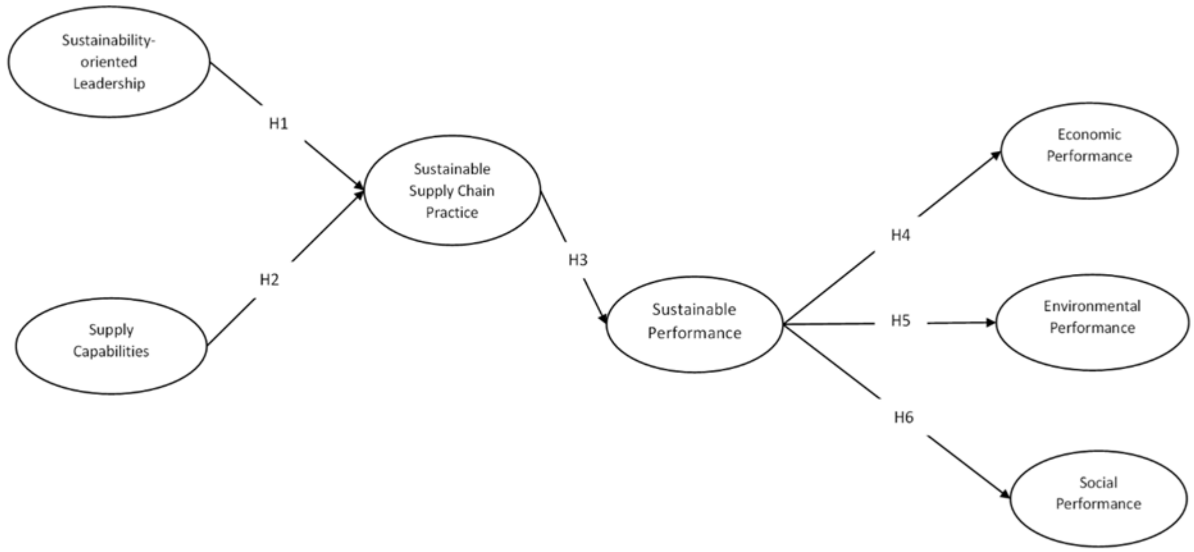

Figure 3.1 SSCMP conceptual model

3.4 Hypotheses Formulation - Two antecedents of the overall SSCMP model

3.4.1 Impact of sustainability-oriented leadership on sustainable supply chain practices

As presented in section 2.5.1 in the literature review, previous researchers have discussed less sustainable leadership as an antecedent of a sustainability supply chain and the significant studies are mostly in two aspects: individual and organizational contextual factors. Ethical leadership drives the decision of firms to adopt practices to fulfil environmental, social and ethical responsibilities to stakeholders (Saha et al., 2020). Organizational ethics makes firms voluntarily engage in and commit to promoting sustainability practices in a supply chain because they find it just right to do it (Paulraj et al., 2017; Chan et al., 2012). Ethical leaders create mutual coordination and support across a supply chain network (Gupta et al., 2019; Agyabeng-Mensah et al., 2022a, b). Supply chain leadership ethics promote information exchange between a firm and its customers and suppliers to innovate and implement sustainability practices (Mokhtar et al., 2019). A focal firm with a high level of supply chain ethical leadership (SCEL) tends to commit to practising business ethics by prioritising sustainability practices (Gosling et al., 2016) and providing partners with the knowledge that might help improve their circular capacity to meet sustainability demands of end consumers, government regulations and other stakeholders (Agyabeng-Mensah et al., 2022a,b). To ensure that supply chains become circular, a focal firm with a high level of SCEL will collaborate with customers and suppliers to promote circular procurement and develop circular products (Wang and Feng, 2022). Empirically, Cheffi et al. (2023) reported that ethical leadership positively impacts circular economy practices of SMEs in the United Arab Emirates. Ogaga et al. (2023) report that ethical leadership has a positive impact on sustainability practices of SMEs in Nigeria. Nguyen et al. (2021) reveal that ethical leadership positively impacts corporate social responsibility among SMEs in Vietnam. Blome et al. (2017) claim that ethical leadership promotes green supplier championing and discourages greenwashing among firms in Germany. Eide et al. (2020) establish that intellectual leadership drives sustainability strategy among Norwegian manufacturing firms. Feng et al. (2022) argue that sustainability-oriented leaders have a positive impact on green customer and supplier integration through entrepreneurial orientation and organisational learning capability in Chinese firms. Wang and Feng (2022) report that SCEL can promote green supply chain integration through a green image and perceived institutional force in Chinese manufacturing firms. In terms of individual factors, Tasçı and Titrek (2019) and Armani et al. (2020) discovered that developing managers' self-awareness can boost sustainable leadership because the development of sustainability relies on the way managers view the world and the relevance they attach to certain organizational behaviours that involved ethical issues. Cheng et al. (2021) found that many individual characteristics, such as humility, cognition and integrity can positively influence sustainable leadership, but this promotion was more likely to occur in highly ethical organizations. In terms of organizational contextual factors, Shaaban (2020) discussed the concept of responsible leadership and sustainable leadership and empirically examined it with a sample of 250 employees and leaders from 18 companies in Egypt and confirmed the facilitative effect of responsible leadership on sustainable leadership. Shaaban (2020) reported that sustainable leadership enhanced employees' behaviour and accordingly made them responsible employees. Moreira et al. (2022) examined that sustainable leadership encourages employees to feel that the organization they work for cares about them and values their competency development, hence reducing their willingness to leave. Sezginnartgun et al. (2020) also pointed out that sustainable leadership can enhance organizational effectiveness. Recently, empirical analyses by scholars have linked the outcomes of sustainable leadership to organizational sustainability. Burawat (2019) and Iqbal et al. (2020a, b) examined the effects of sustainable leadership in numerous SMEs in different countries and reported that sustainable leadership had a positive impact on sustainable performance. In addition, Fatoki's (2021) analysis with a sample of hotel companies confirmed the positive relationship between sustainable leadership and sustainable performance. Empirical studies by Javed et al. (2020) and Iqbal et al. (2020a) based on many SMEs in Asian coastal countries have shown that sustainable leadership had a significant positive effect on environmental performance. Furthermore, scholars have further explained the mechanism of the effect of sustainable leadership on performance-related consequences on organizational behaviours that involved ethical issues. House (1996) argues that leaders' behaviour will enhance work unit performance to the extent that such behaviour; (a) facilitates collaborative relationships among unit members, (b) maintains positive relationships between the unit and the larger organizations in which it is embedded, (c) ensures that adequate resources are available to the work unit, and (d) enhances the legitimacy of the work unit in the eyes of other members of the organization of which the work unit is a part. While some materials managers suggested that executive support is the critical driver for crafting a successful SCM strategy, others had demonstrable success in creating the strategy and then obtaining executive endorsement. Irrespective of the path chosen, the necessity of articulating a clear, consistent SCM strategy and linking it to the organizational mission was a recurrent theme. These findings suggest that the lack of executive support and the misaligned incentives lead to poor work performance. Changes need to be made to facilitate collaborative relationships, provide resources and increase the legitimacy of the supply chain improvement efforts.

To drive change in the supply chain, it is also crucial to have supply chain management representation at the executive level. The supply chain leader must have a deep understanding of SCM practices, to be able to effectively communicate across the organization, elicit support from clinicians (through project teams or cross-functional hiring) and lead change efforts. A structured training program for executives and materials managers must be established to develop good decision-making and planning capabilities (McKone-Sweet, Hamilton and Willis, 2005). Thus, hypothesis 1 is formulated;

Hypothesis 1: Sustainability-oriented leadership has a positive and significant influence on sustainable supply chain practice.

3.4.2 Impact of supply chain capabilities on sustainable supply chain practices

With reference to section 2.5.2, supply chain organizations cannot manage their circular economy (CE) operations effectively due to a lack of organized information systems and vibrant technology (Kumar, Raut, Nayal, *et al.*, 2021). It is critical to integrate cutting-edge technology that can supply real-time data for predictive and cognitive learning, hence improving decision-making. Industry 4.0 (I4.0) technologies are seen as important drivers for developing a proactive, self-configuring, and automated manufacturing system to meet sustainability goals. Cyber-Physical Systems (CPS), the Internet of Things (IoT), Big Data Analytics (BDA), Cloud Computing (CC), and artificial intelligence (AI) are all part of I4.0 (AI) (Ivanov et al., 2021; Luthra et al., 2020) that can provide real-time data and dynamic monitoring capabilities, to improve CE and sustainable production and consumption (Ma *et al*., 2019). A study also identified six main enabler technologies of the basic capabilities to support a traditional supply chain becoming a digital supply chain (DSC). Although we have identified several DSC antecedents in the literature, we have only selected those enabler technologies identified as having a relationship with digital supply chain capabilities (DSCCs), namely big data analytics (BDA), blockchain, artificial intelligence (AI), augmented reality (AR), robotics (R), omni channel (OC), cloud computing (CC), sensor technology (ST), self-driving vehicles, unmanned aerial vehicles (UAV), nanotechnology (N), internet of things (IoT), 3D printing (Büyüközkan and Göçer, 2018; Ivanov *et al.*, 2019).I4.0 technologies have the potential to disrupt the status quo and assist efficient resource utilisation to improve long-term environmental performance (Li *et al*., 2020). The combination of CE and smart technologies associated with I4.0 can pave the path for resource-efficient business models that remanufacture, repurpose, and recycle trash. The exceptional advancement of information and communication technology (ICT) (Alshawi et al., 2003) has led to a phenomenon known as digital disruption. Traditional business models focused mostly on physical tasks are being challenged and migrating to digitization in this setting. The digitalisation process has outcomes for all industries (Büyüközkan and Göçer, 2018). Therefore, digital disruption impacts business models and other aspects of society, including new partnerships and interactions with organisations and people (World Economic Forum, 2016a). Moreover, ICT has facilitated a Fourth Industrial Revolution known as Industry 4.0 (Barreto et al., 2017; Hofmann and Rüsch, 2017), with its foundations in German industry (Hecklau et al., 2016) and supported predominantly by the Internet of Things (IoT) and cyber-physical system (CPS) technologies (Qin et al., 2016). Accordingly, businesses worldwide are rethinking digitization as a requirement for which strategies must be developed. Consequently, ICT has aided the shift of an organization's connection with its network. Smart cities, for example, create supply chain design issues (Kumar et al., 2016) to support new operations business models, connecting customers and organisations more efficiently (Li *et al*., 2016; Qin *et al*., 2016).

These technologies can be considered antecedents of DSCCs due to their influence in the digitalisation process. For instance, BDA has been shown to improve firms' performance and competitive advantage (Akter *et al*., 2016; Fosso-Wamba *et al.*, 2017); Blockchain in supply chains (Queiroz and Fosso-Wamba, 2019; Queiroz *et al*., 2019) has been provoking disruptive change given in intra- and inter-organisational contexts; regarding the interaction between AI and workers, several organisations believe in its potential and are investing large amounts of money. However, we believe that there is a critical and unexplored issue regarding this relationship, namely that CC services are a critical enabler due to their ability to integrate resources in the digitalisation context, enabling more accurate monitoring of companies' internal activities and their SCM network (Porter and Heppelmann, 2014). In the Industry 4.0 era, CPS has an essential function of integrating the systems and the physical infrastructure (Wang *et al*., 2016). In the DSC context, we consider these systems to be a fundamental enabler because of the various interactions between smart objects. The final enabler identified in this study was IoT, which is of great importance, especially in providing feedback (Büyüközkan and Göçer, 2018) in terms of the (smart) product's information and, consequently, contributing to continuous improvement in organisations. In the following sub-sections, we provide a detailed description of these technologies. Accordingly, hypothesis 2 is formed;

Hypothesis 2: Supply chain capabilities have a positive and significant impact on sustainable supply chain practice.

Conceptual model of SSCP stage one - antecedents

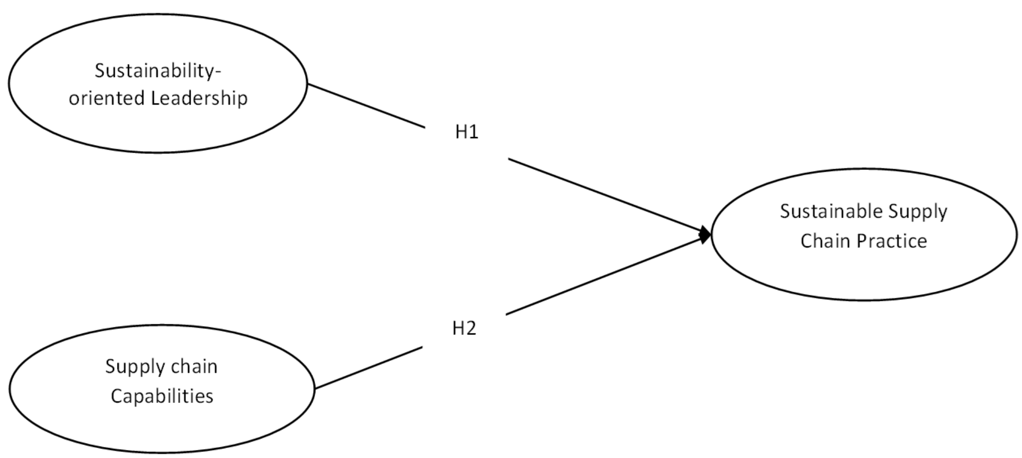

Figure 3.2 Antecedents of SSCP

3.4.3. Impact of sustainable supply chain practice on sustainable healthcare performance

In relation to section 2.5.3 of the literature review, an empirical investigation reveals that to gain a competitive advantage, medical institutions need to achieve efficiency by reducing costs and improving performances on their own and also make efforts actively to improve the efficiency of the value chain to which they belong (Kim and Kim, 2019). The efficiency of a healthcare supply chain can reduce 2% to 8%

of the operating costs of hospitals (Haavik, 2000) and offer a high level of customer service by promoting the loyalty of medical staff, which leads to the improvement in revenue of hospitals (Storey et al. 2006). Some studies contended that the relationship between the buyer and the supplier can improve delivery quality to customers (Lai et al., 2005; Fynes *et al*., 2005). Kaynak and Hartley (2008) confirmed that SCM-related quality practices have a significant effect on quality performance. This use of the value chain can enable managers to identify social and environmental initiatives with the greatest strategic value (Porter and Kramer, 2006). According to the Council of Supply Chain Management Professionals (2013) SCM 'integrates supply and demand management within and across organisation.' A survey published by the Chartered Institute of Procurement and Supply reveals that 86% of supply chains are impacted by the COVID-19 pandemic in the United Kingdom (Remko, 2020), and the Institute for Supply Management disclosed that the number of companies experiencing supply chain impact rose from 80 to 95% (Remko, 2020). According to Walmart, multiple industries, and categories (ranging from hand sanitiser and toilet paper to hair products) have experienced enormous panic buying due to the COVID-19 pandemic (Remko, 2020), and the world's largest 1,000 companies had over 12,000 factories, warehouses and operations in quarantined regions in early March 2020 (Linton and Vakil, 2020, p. I). Supply Chain Movement (2020) states that almost two-thirds (62%) of respondents were contacted by a supplier to warn about the impact of coronavirus on their supply chains, according to the survey. However, 37% didn't find out until a supplier failed to deliver. Most customers have now increased their communication with suppliers: 58% communicate regularly with their key suppliers, and 34% have extended communication to all tiers of their supply chain. The survey also found that 24% of the companies lacked adequate supply chain risk mitigation plans to deal with the severe disruption resulting from the virus outbreak. 61% of buyers have since conducted risk analysis, and 49% have found alternative suppliers in the case of disrupted deliveries. Above all, the current health crisis has prompted buyers to rethink their future supply chain strategies. Close to 58% intend to mitigate risk by moving away from single sourcing, while 47% are considering holding more inventory in the future.

In terms of the business outlook, 58% of the respondents observed that prices for goods and services increased astronomically, and the same number expected an economic downturn in the subsequent months. Abdul-Rashid et al. (2017) identified the co-relationship of sustainable practices and performance in the manufacturing industry, and Adebanjo *et al*. (2016) studied the impact of external pressure and sustainable management practices on manufacturing performance and environmental performance. Numerous academic studies on sustainable supply chain in emerging economies have been conducted to boost the development of the discipline (Mustaffa and Potter, 2009; Paulraj, 2011; Wolf, 2011; Natalia *et al*.,2012; Gopalakrishnan *et al*., 2012; Harms *et al.,* 2013; Shokri *et al.,*2014; Varsei and Polyakovskiy, 2016). Research concentrating on emerging economies is scant as SSCM practices in these countries are relatively weak (Kim, 2011; Silvestre, 2014; Esfahbodi *et al*., 2016; Galal and Moneim, 2016). Silvestre (2015) explains that supply chains in developing and emerging economies face more barriers to sustainability than those operating in developed countries. However, improving the sustainability of supply chains in developing countries bears significant value to the entire world as these are more developing countries. The sustainable development of society to a certain degree depends on the sustainable development of the supply chain. Therefore, focusing on SSCM is a good starting point for supply-side reform. Our research empirically tests how SSCM can affect the sustainable development of Chinese firms positively and sustainably under the special circumstances of market economy reform. Meanwhile, coupling SSCM and dynamic capabilities theory (Beske, 2012; Beske *et al.,* 2014), this paper also embeds SC dynamic capabilities into the framework and examines whether SC dynamic capability can mediate SSCM practices and firm performance. Accordingly, the study hypothesizes that:

Hypothesis 3: Sustainable supply chain practice has a positive and significant effect on sustainable healthcare performance.

3.4.4 Impact of sustainable healthcare performance on sustainable economic performance

Because they increase resource efficiency, sustainable supply chain strategies frequently result in significant cost savings. According to Zhu et al. (2020), organisations that use green supply chain methods can lower their energy and material costs, which improves their financial performance. Businesses can increase their profitability by reducing their operating expenses through resource optimisation and waste minimisation. Implementing sustainable supply chain techniques improves operational efficiency through waste reduction and process simplification. According to Dubey et al. (2022), businesses adopting sustainable practices like circular economy initiatives see an increase in process efficiency, which lowers production costs and boosts profits. Improved collaboration and coordination among suppliers result in this efficiency. Sustainable supply chain management strategies enhance a business's reputation, which can result in a rise in market share and consumer loyalty. According to Golicic and Smith (2021), businesses that are recognised for their dedication to sustainability can stand out from rivals, draw in eco-aware clients, and command higher prices for their goods all of which improve economic performance. Resource scarcity, supply chain interruptions, and environmental laws are some of the risks that sustainable supply chain policies help to reduce. According to Moktadir et al. (2021), businesses that embrace sustainable practices early on are better able to adhere to rules, stay out of trouble, and guarantee a steady flow of resources all of which support long-term financial stability and sustainable economic performance. Sustainable supply chain strategies encourage creativity, which results in the creation of novel goods and services that have the potential to tap into untapped markets. According to Gold et al. (2020), businesses that innovate with a focus on sustainability have a higher chance of creating eco-friendly products that satisfy changing customer needs, opening new revenue streams and improving overall economic performance. Stronger ties with suppliers can result in cost reductions through improved cooperation and resource sharing, which is encouraged by sustainable supply chain policies. According to Gölgeci and Kuivalainen's (2020) research, companies that collaborate closely with their suppliers on sustainability projects can save money by reducing waste and optimising resource usage, which enhances economic performance. Sustainable supply chain management techniques guarantee adherence to ever-tougher environmental standards, potentially averting expensive penalties and legal proceedings. According to Yildiz Çankaya and Sezen (2020), adhering to these rules might help businesses become more appealing to consumers by presenting them as responsible corporate citizens and preventing financial fines. Energy efficiency is a direct result of implementing sustainable supply chain strategies; this lowers energy costs and improves economic performance. According to Chowdhury et al. (2021), businesses can greatly reduce their operational expenses and increase profitability by incorporating energy-efficient methods into their supply chain management. By guaranteeing that economic performance is maintained in a way that does not deplete resources or harm the environment, sustainable supply chain policies contribute to an organization's long-term existence. According to Dubey et al. (2022), businesses can maintain profitability while reducing their environmental effect by using sustainable practices that match economic performance with long-term sustainability goals. Sustainable supply chain management practices can increase financial performance and lower risks, which increases shareholder value. Companies that prioritise sustainability in their supply chains typically generate better financial outcomes, which translates into higher returns for shareholders, according to research by Günzel-Jensen et al. (2020). Recent research provides strong evidence in favour of the concept that sustainable supply chain practices affect sustainable economic performance. These procedures guarantee regulatory compliance, promote innovation, enhance brand reputation, save costs and improve operational efficiency. These elements work together to greatly improve sustainable economic performance, which is compelling evidence for businesses to implement sustainable supply chain management techniques. Accordingly, hypothesis 4 is formulated:

Hypothesis 4: Sustainable healthcare performance helps organizations to achieve economic sustainability.

3.4.5 The impact of sustainable healthcare performance on environmental sustainable performance

Beyond only streamlining operations, sustainable healthcare performance improves public health by lowering waste, pollution, and resource depletion. Sustainable healthcare practices promote healthier ecosystems by reducing the transmission of pollutants and toxins within populations. According to Heath and Barak (2023), healthcare institutions that prioritise sustainability have been able to lessen their environmental effect while simultaneously improving the quality of the air and water, which benefits public health. According to George et al. (2022), hospitals that used circular economy models saw decreases in resource consumption and waste production, which improved environmental sustainability. Hospitals that adopted waste-reduction and energy-efficient technologies dramatically reduced their environmental effect, according to Gupta et al. (2022), bolstering the claim that sustainable healthcare performance positively improves environmental results. Benachio et al. (2023) report that waste reduction techniques, like separating recyclables and cutting back on single-use plastics, significantly improved the environmental performance metrics of healthcare organisations. Healthcare facilities that have implemented energy-saving and renewable energy technology have seen a significant decrease in their carbon footprint, as shown by Aydin and Ari (2023), highlighting the link between environmental performance and sustainability. Hospitals that made green procurement a priority decreased their overall environmental impact and improved the sustainability of their supply chains, according to White et al. (2023). According to Wang et al. (2023), healthcare institutions that adopted sustainability programs witnessed a decrease in their total greenhouse gas emissions, which improved their environmental performance. According to Tang et al. (2022), healthcare facilities that were built with sustainability in mind had far lower energy consumption and carbon emissions than conventional facilities. Hospitals that prioritised sustainability saw less environmental harm, regulatory penalties, and compliance concerns (Lynch et al., 2023).

Hypothesis 5: Sustainable healthcare performance is positively related to environmental sustainable performance

3.4.6 The impact of sustainable healthcare performance on sustainable social performance

Enhancing service accessibility is a common component of sustainable healthcare performance, especially for marginalised communities. Through waste reduction and energy conservation, healthcare organisations can lower operating costs and reallocate funds to enhance patient access and affordability. Strong sustainability plans enabled hospitals to invest in additional services for rural and low-income populations, which improved healthcare equity and had a favourable impact on social performance (Nunez and Ortiz, 2022). According to Lozano et al. (2023), hospitals that implemented sustainable practices - like lowering waste and enhancing indoor air quality - reported better health outcomes and higher patient satisfaction ratings. Hospitals that adopted sustainable measures, such as reducing waste and improving indoor air quality, reported better health outcomes and higher patient satisfaction ratings, according to Lozano et al. (2023). According to Jones and Taylor (2023), hospitals that prioritise sustainability had higher involvement rates in community health programs, which enhanced public health outcomes and strengthened community bonds. Hospitals that placed a high priority on sustainability, according to Sharma and Verma (2023), were more likely to create initiatives that addressed socioeconomic determinants of health, especially among marginalised and vulnerable populations. According to Thompson et al. (2023), healthcare institutions that adopted workforce development programs with a sustainability focus saw an improvement in employee job satisfaction and professional development, which had a favourable effect on social performance. Hospitals that integrated sustainability into their supply chains were able to lower labour violations and enhance social outcomes, especially in the manufacturing of pharmaceuticals and medical supplies, according to Khan and Gupta (2022). Hospitals with sustainable building designs reported superior social performance outcomes, such as reduced staff stress and higher patient recovery rates, according to White and Santos (2023). According to Omar and Williams (2022), hospitals that have transparent reporting procedures and well-defined sustainability targets enjoy greater public trust, which raises their levels of social responsibility and community involvement. The study therefore hypothesizes that:

Hypothesis 6: Sustainable healthcare performance is positively related to sustainable social performance

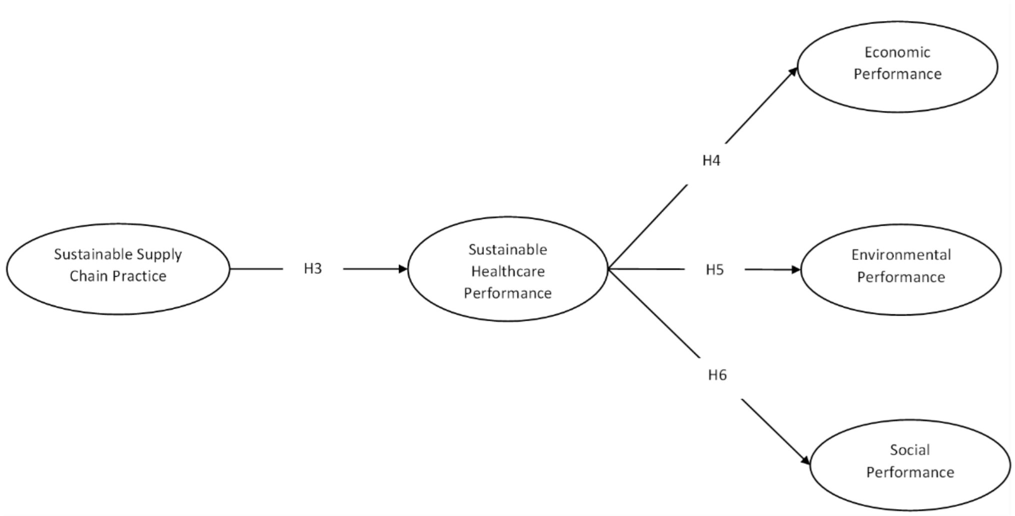

Figure 3.3 The SSCP and healthcare performance model

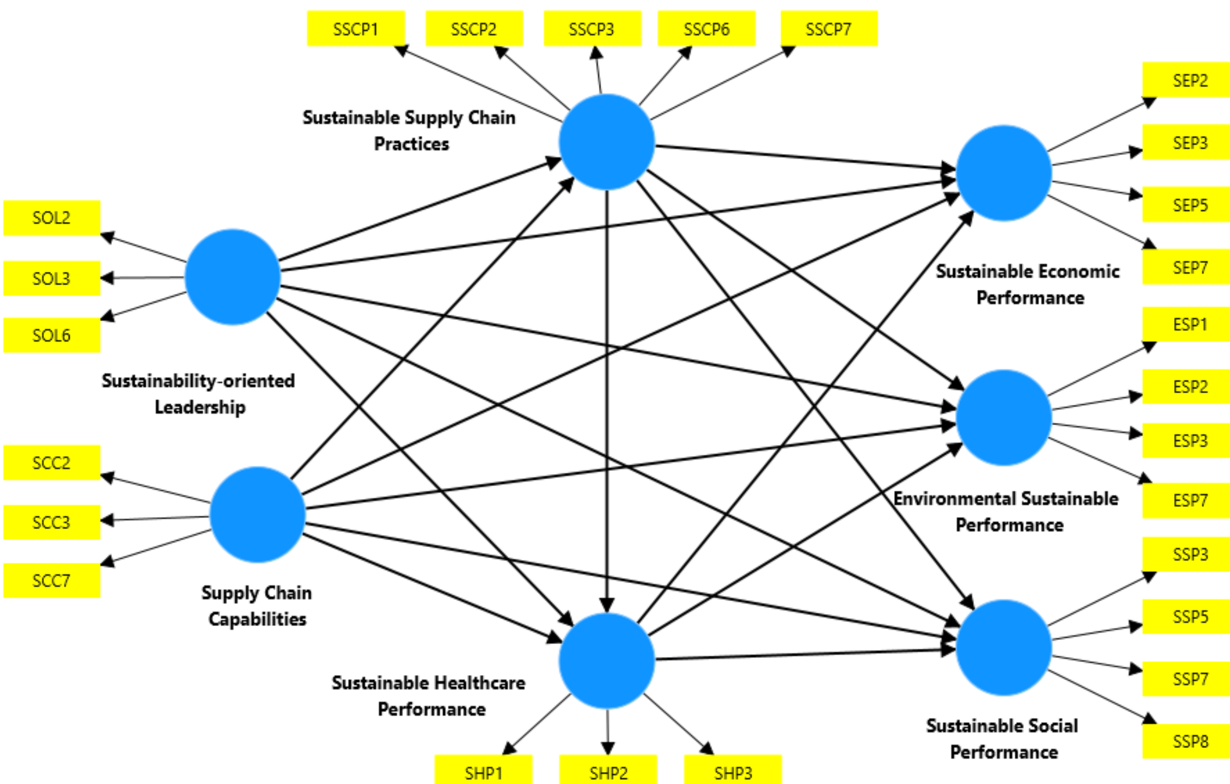

Figure 3.4 Structural model

3.4.7 The impact of sustainable supply chain practices on economic performance

Through lower operating costs, sustainable supply chain practices including resource optimisation, energy efficiency, and waste reduction significantly enhance economic sustainability performance. According to Moktadir et al. (2021), businesses that implement these strategies save a lot of money by using resources more effectively and producing less waste. Furthermore, adopting sustainable practices can boost the company's image, draw in clients and investors, and boost profitability. To improve environmental sustainability performance, sustainable supply chain practices like green sourcing, environmentally friendly transportation, and emissions reduction are essential. Green supply chain initiatives, according to Zhu et al. (2020), result in lower energy consumption, improved resource efficiency, and a decrease in greenhouse gas emissions. Reducing the detrimental effects of supply chain practices on the environment, this enhances environmental performance and supports environmental sustainability. Due to their ability to guarantee moral sourcing, decent working conditions, and social responsibility along the entire supply chain, sustainable supply chain practices also have a major impact on socially sustainable performance. According to Golicic and Smith (2021), businesses can lessen their social impact by implementing sustainable practices including working with suppliers who uphold social responsibility and protecting the health and safety of their employees. Improved ties with the community, higher staff morale, and a beneficial social influence can result from this. Sustainable supply chain methods promote innovation and teamwork among supply chain participants, which results in comprehensive gains in sustainable performance in the social, environmental, and economic spheres. According to Chowdhury et al. (2021), these approaches enable businesses to collaborate closely with suppliers and other stakeholders to develop creative solutions that support sustainability objectives, creating long-term value for the whole supply chain. To reduce the risks connected to social compliance, resource scarcity, and environmental restrictions, sustainable supply chain techniques are essential. According to Dubey et al. (2022), businesses can lower their risk of supply chain interruptions brought on by social or environmental concerns by putting sustainable procedures into place. In addition to ensuring business continuity, this risk mitigation improves the company's sustainable performance in all spheres i.e., economic, environmental, and social. Recent empirical studies provide substantial support for the concept that sustainable supply chain strategies have a favourable influence on economic, environmental, and social sustainable performance. These methods result in financial savings, preservation of the environment, moral employment practices, and creativity. Organisations may improve their triple bottom line which is achieving long-term benefits to the economy, the environment, and society by using sustainable supply chain policies.

Hypothesis 7: Sustainable supply chain practices positively and significantly impact sustainable economic performance.

3.4.8 The impact of sustainable supply chain practices on environmental performance

One essential element of sustainable environmental performance is the reduction of greenhouse gas (GHG) emissions, which can be achieved through the implementation of sustainable supply chain techniques. According to Zhu et al. (2020), businesses that use eco-friendly transportation methods and green buying techniques see a major decrease in their carbon footprint. Natural resource conservation techniques, like those involving water, energy, and raw materials, are frequently included in sustainable supply chain processes. Companies can drastically lessen their environmental impact by optimising resource consumption through effective supply chain operations, according to Gold et al. (2020). In the supply chain, for instance, using energy-efficient technology and procedures can result in significant drops in energy usage, supporting long-term environmental performance. Sustainable supply chain techniques lead to important results such as efficient waste management and pollution reduction. Organisations that use sustainable waste management techniques, such as recycling and properly disposing of hazardous materials, greatly lessen their influence on the environment, according to Golicic and Smith (2021). By following these procedures, pollution can be reduced and environmental damage from trash can be avoided. Organisations can improve their environmental performance by reducing their total greenhouse gas emissions by choosing suppliers who follow environmental regulations and streamlining their logistics. Implementing green technologies in the supply chain is a crucial element that impacts environmental performance. According to Moktadir et al. (2021), businesses can lessen their environmental effect by investing in eco-friendly technologies like renewable energy sources and energy-efficient machinery. These devices improve environmental results by limiting emissions and reducing energy use. Reducing waste and increasing resource efficiency are the main goals of sustainable supply chain activities, which improve environmental performance. Organisations that implement circular economy principles in their supply chains can reduce waste generation and increase material reuse and recycling, according to Dubey et al. (2022). This preserves natural resources and lessens the negative effects of production operations on the environment. To achieve sustainable environmental performance, companies must adhere to environmental norms and standards, which are made possible by sustainable supply chain activities. Ecosystem and biodiversity conservation through sustainable supply chain management improves environmental performance. Businesses that place a high priority on sustainable sourcing and land use management in their supply chains contribute to the preservation of biodiversity and natural ecosystems,

according to Chowdhury et al. (2021). These procedures are essential for preserving ecological harmony and minimising supply chain activities' negative environmental effects. According to Yildiz Çankaya and Sezen (2020), companies that comply with environmental regulations and standards in their supply chain operations not only evade legal ramifications but also improve their standing as environmentally conscious businesses. Adherence to regulations frequently results in improved environmental consequences and management. The resilience of the supply chain is enhanced by sustainable supply chain practices, and this resilience is directly related to sustainable environmental performance. According to Gölgeci and Kuivalainen (2020), resilient supply chains contribute to environmental sustainability by being more resilient to shocks and disturbances from the environment, such as natural catastrophes and resource scarcity. Organisations can maintain environmentally friendly practices even in challenging circumstances by developing resilience. Reducing an organization's total environmental impact requires the implementation of sustainable supply chain principles. According to Moktadir et al. (2021), eco-design, environmentally friendly packaging, and energy-efficient logistics all greatly lessen the environmental effect of items throughout their lifetimes. These methods reduce waste, energy use, and resource use, which helps to leave a reduced environmental impact. Involving stakeholders in environmentally sustainable supply chain activities raises awareness of environmental issues and encourages group action to maintain environmental sustainability. According to Günzel-Jensen et al. (2020), incorporating stakeholders such as consumers, suppliers, and other parties in sustainability initiatives facilitates the adoption of environmentally responsible practices throughout the supply chain. The supply chain's total environmental performance is improved by this cooperative strategy.
Therefore, hypothesis 5 is formulated:

Hypothesis 8: Sustainable supply chain practices positively and significantly impact environmental sustainability.

3.4.9 The impact of sustainable supply chain practices on social performance

As already discussed in section 2.5.7, social sustainability is concerned with the human side of sustainability (Huq et al., 2014). The concept is incorporated with the company's impacts on the social systems where it operates and its relationship with various stakeholders (Labuschagne et al., 2005). The social dimension is known but obtains less prominence than expected in supply chains (Ashby *et al*., 2012). According to Klassen and Vereecke (2012) social issues in the supply chain are defined as three levels of stakeholders (who), concentrating on the developing set of social concerns for which the organization has an impact in the supply chain (which issues), and including management abilities that react to these concerns by moderating risk or improving customer value (how). Supply chain social sustainability consists of multiple core dimensions like equity, safety, health and welfare, philanthropy, ethics, and human rights (Mani *et al*., 2016b). Healthcare is a major emitter of environmental pollutants that adversely affect health. Healthcare sustainability science explores dimensions of resource consumption and environmental emissions associated with healthcare activities. While health professionals strive to help patients cope with the adverse health effects of pollution, health professional leadership is essential to draw attention to these effects and to help identify and prioritize mitigation strategies (Costello *et al*., 2009; Costello *et al.,* 2013). Ironically, modern healthcare itself is a major emitter of environmental pollutants that adversely affect human health (Eckelman and Sherman, 2018; Eckelman *et al*., 2018; Malik et al., 2018; National Health Sustainable Development Unit, 2016). Awareness of healthcare pollution and the duty to address it are only beginning to gain recognition in the clinical community. The following quote highlights the fact that efforts are being made for improvements to the hospital supply chain, but significant changes still need to take place. “A lot of people are saying that the supply chain is broken - I don’t think it’s broken as much as it is a runaway train. The train is derailed but running along on its railroad ties. It is still moving forward but there are serious flaws in the system.” (Rick Barlow, editor of First Moves and contributing writer to MDSI). There is a significant opportunity for change within the healthcare supply chain (McKone-Sweet, Hamilton and Willis, 2005).

An empirical work by Wolf (2014) reports a direct effects model that shows SSCM is positively related to the perception of an organization as sustainability is dependent on pressure from outside stakeholder groups. This finding suggests that organizations benefit from the adoption of SSCM strategies. This enables organizations to build a reputation as ‘‘good citizens’’ by promoting environmental and social sustainability in their supply chains. This reputation necessitates legitimacy and access to key resources. Li and Mathiyazhagan (2018) analysed the influential indicators of SSC implementation to enhance the sustainability performance of the automobile sector. Munny *et al.* (2019) identified the most significant social sustainability practices, including customer needs, health and safety of the workplace, wages, and other benefits of workers. Supply chain managers must acknowledge that good sourcing and supply chain practices are more than just cost-reduction activities and can lead to more satisfied doctors and better patient care (McKone-Sweet, Hamilton and Willis, 2005). In conclusion, Recent empirical investigations provide substantial support for the idea that sustainable supply chain strategies impact sustainable environmental performance. These methods encourage adherence to environmental laws and the uptake of green technologies while reducing waste, resource consumption, and greenhouse gas emissions. Organisations can significantly enhance their environmental performance by incorporating these practices into their operations, which provides strong evidence in favour of the widespread adoption of sustainable supply chain strategies. Accordingly, the study hypothesizes that:

Hypothesis 9: Sustainable supply chain practices positively and significantly influence sustainable social performance.

3.5 The impact of sustainability-oriented leadership on sustainable economic, environmental and social performance.

Strong economic success results from leadership that is focused on sustainability, which harmonises social and environmental goals with commercial ones. According to Günzel-Jensen et al. (2020), executives who place a high priority on sustainability can successfully incorporate these objectives into their business plans, resulting in a robust correlation between sustainable practices and financial gains. Through the integration of sustainability into the fundamental business plan, executives may stimulate creativity and productivity, resulting in reduced expenses and increased profits. Leaders who prioritise sustainability can improve an organization's reputation, giving it a competitive edge and better financial results. According to Golicic and Smith (2021), businesses run by sustainability-focused executives have a higher chance of being seen as socially conscious, which can draw in partners, investors, and customers who share their commitment to the environment. Gaining a favourable reputation can result in more market share and profits. Sustainability-oriented leadership contributes to long-term financial stability by reducing risks related to market volatility, resource shortages, and environmental restrictions. According to Zhu et al. (2020), executives who prioritise sustainability are better equipped to handle these difficulties and make sure that their companies maintain their financial stability and resilience in the face of outside demands. This proactive strategy improves economic performance and lessens the possibility of expensive disruptions. Leaders who prioritise sustainability foster an innovative and resource-efficient culture, which can yield substantial financial gains. According to Dubey et al. (2022), these leaders promote the use of environmentally friendly practices and technologies, which boosts productivity and lowers expenses. Through the promotion of innovation, these executives assist their companies in creating new goods and services that satisfy the needs of the growing market, which boosts revenue. Improved economic performance is directly associated with more employee engagement, which is a benefit of sustainability-oriented leadership. According to Chowdhury et al. (2021), leaders who place a high priority on sustainability encourage their staff members to be more dedicated and effective, which improves organisational performance. Employee engagement increases the likelihood that they will contribute to creative ideas and cost-cutting projects that will improve the bottom line of the business. In conclusion, evidence supporting the hypothesis that sustainability-oriented leadership has a positive impact on sustainable economic, environmental and social performance indicates that this type of leadership improves employee engagement, fosters the strategic integration of sustainability and economic goals, strengthens organisational reputation, reduces risks, and encourages innovation. When taken as a whole, these elements lead to better financial results, which is compelling evidence of the role that sustainability-oriented leadership plays in promoting economic performance. Hence, hypotheses 8, 9 and 10 are formed:

Hypothesis 10: Sustainability-oriented leadership has a positive and significant impact on sustainable economic performance.

Hypothesis 11: Sustainability-oriented leadership positively and significantly influences environmental sustainable performance.

Hypothesis 12: Sustainability-oriented leadership has a positive and significant influence on sustainable social performance.

3.5.1 The impact of supply chain capabilities on sustainable economic, environmental and social performance.

Supply chain skills like integration and agility, which increase operational effectiveness and cut costs, directly support economically sustainable performance. Strong supply chain capabilities enable businesses to optimise operations, cut waste, and improve resource utilisation, which results in considerable cost savings and increased profitability, according to Dubey et al. (2022). These skills help businesses adapt quickly to changes in the market, promoting sustainability and economic resilience. Sustainable supply chain capabilities can only be adopted with the support of supply chain capabilities, which are essential for improving environmental sustainability performance. According to Zhu et al. (2020), innovative and flexible supply chains enable businesses to adopt eco-friendly strategies like waste reduction and green buying more successfully. Lower greenhouse gas emissions, less resource usage, and improved environmental results are the results of these approaches. Strong relationships with suppliers, consumers, and communities are fostered by supply chain capabilities, especially integration and collaboration, which are essential for enhancing socially sustainable performance. According to Golicic and Smith (2021), businesses that possess strong supply chain capabilities are better able to handle their interactions with stakeholders, guaranteeing fair labour standards, moral sourcing, and constructive community involvement. These activities support improved corporate social responsibility and societal performance.

To achieve holistic sustainable performance across economic, environmental, and social dimensions, one must possess the capacity for rapid innovation and adaptation. According to Chowdhury et al. (2021), supply chain capabilities like creativity and agility are crucial for enabling sustainability-driven innovations, which let businesses create new goods and procedures that support environmental objectives. The simultaneous improvement of social, environmental, and economic performance is guaranteed by this all-encompassing strategy. The ability of the supply chain to mitigate risk is essential for achieving sustainable performance in all respects. Businesses possessing robust supply chain risk management skills are better equipped to handle hazards related to the environment, society, and economy, according to Gölgeci and Kuivalainen (2020). Organisations can preserve sustainability in their operations, guaranteeing long-term financial viability, environmental stewardship, and social responsibility, by proactively controlling these risks. Recent literature provides strong support for the concept that supply chain skills affect economic, environmental, and social sustainable performance. For organisations to manage their sustainability objectives across economic, environmental, and social aspects, supply chain Recent literature provides strong support for the concept that supply chain skills affect economic, environmental, and social sustainable performance. Thus, hypotheses 11, 12 and 13:

Hypothesis 13: Supply chain capabilities positively and significantly impact sustainable economic performance.

Hypothesis 14: Supply chain capabilities have a positive and significant impact on environmental sustainable performance.

Hypothesis 15: Supply chain capabilities positively and significantly influence sustainable social performance.

3.5.2 The impact of sustainability-oriented leadership on sustainable healthcare performance

By enhancing employee well-being, sustainable leadership which incorporates ethical principles and long-term perspectives improves healthcare performance. Improved healthcare performance is a result of leadership behaviours like servant and authentic leadership, which have a substantial positive impact on workers' job happiness and engagement. The objectives of sustainable healthcare are well-aligned with an emphasis on social responsibility and organisational justice (Frontiers, 2023). In healthcare settings, leadership strategies that promote innovation and information sharing are essential. Collaboration and ongoing learning are fostered by transformational and servant leadership styles, and they are critical to attaining sustainability in healthcare operations. By increasing productivity and patient outcomes, this leadership style promotes process and product innovation, which strengthens the sustainability of healthcare (MDPI, 2023). To ensure comprehensive healthcare performance, sustainability-oriented leadership integrates social and financial factors in addition to addressing environmental problems. This leadership approach guarantees that healthcare organisations may accomplish their sustainability objectives while retaining high performance by giving organisational aims equal weight with societal welfare (BMJ Open, 2021). According to recent studies, achieving sustainability in healthcare requires integrating many leadership paradigms, such as environmental and sustainable leadership. These frameworks place a strong emphasis on actions and competencies that improve overall organisational performance by coordinating healthcare systems with sustainability objectives (MDPI, 2023). Sustaining the resilience of the healthcare system during crises such as the COVID-19 pandemic required the presence of sustained leadership. It was easier for leaders to make sure their healthcare organisations could continue to function successfully under duress when they concentrated on procedural knowledge, moral decision-making, and staff well-being (BMJ Open, 2021). Therefore, this study hypothesizes that:

Hypothesis 16: Sustainability-oriented leadership positively and significantly influences sustainable healthcare performance.

3.5.3 The impact of supply chain capabilities on sustainable healthcare performance

Effective supplier collaboration is a prerequisite for strong supply chain capabilities in the healthcare industry, as it is vital for advancing sustainability initiatives. Healthcare institutions may make sure that environmentally friendly products and procedures are incorporated into their supply chains by collaborating closely with their suppliers. In addition, cooperative efforts can guarantee ethical sourcing, minimise resource use, and cut down on medical waste. According to a study by Shang et al. (2022), supplier and healthcare provider collaboration in the supply chain has a favourable effect on the sustainability performance of healthcare organisations. Sustainability is largely improved by supply chain capabilities that increase resource efficiency. Healthcare facilities can cut waste, energy use, and expenses by streamlining the acquisition, distribution, and storage of medical equipment and supplies. According to Carter and Rogers (2021), effective supply chain management is essential for cutting operating expenses and enhancing environmental sustainability at the same time. Disruptions have the potential to negatively impact the sustainability performance of healthcare supply chains. Risk management and resilience-related supply chain capabilities assist healthcare organisations in lessening the effects of supply chain disruptions, like those brought on by pandemics or natural disasters. Resilient supply chains can quickly adjust and carry on with their business as usual, ensuring a constant supply of vital medical supplies. Resilient supply chains allow healthcare providers to preserve high levels of sustainability in times of crisis, as shown by Choi et al. (2023). Healthcare organisations that invest in green supply chain skills, according to Kaur and Singh (2023), have better environmental performance with lower emissions and waste production. Ivanov and Dolgui's study from 2022 demonstrated how integrating technology into healthcare supply chains might improve operational and environmental sustainability. Walker and Seuring's (2022) study highlighted how supply chain management based on the circular economy might help healthcare organisations perform better in terms of sustainability. Johnson et al. (2023) demonstrate that healthcare companies see notable improvements in sustainability performance when they consistently enhance their supply chain capabilities. Mena and Whipple (2021) found that healthcare institutions with robust ethical sourcing capabilities reported improved environmental and social outcomes. Accordingly, Hypothesis 15 is formulated:

Hypothesis 17: Supply chain capabilities positively and significantly impact sustainable healthcare performance.

3.5.4 Chapter summary and conclusions

This chapter discusses the study's formal conceptual model, Figure 3.4 above and hypotheses development. Accordingly, a framework relating determinants of sustainability i.e. sustainability-oriented leadership (SoL), supply chain capabilities (SCC), sustainable supply chain practices (SSCP), to sustainable healthcare performance (SHP), sustainable economic performance (SEP), environmental sustainable performance (ESP) and sustainable social performance (SSP) have been introduced. The resource-based view (RBV) theory and the dynamic capability theory (DCT) theories of firms are used as key theoretical underpinnings for the conceptual model. In drawing on the RBV and DCT, the model argues that SoL and SSC are intangible internal organisational resources that practitioners use to generate superior competitive advantage in their operations, and ultimately, SSCP is argued to be a major determinant of sustainable performance. Fundamentally, SOL and SCC might predict SSCP positively, and SSCP will positively influence sustainable performance. The theoretical model is made up of 6 hypothesized relationships:

Hypothesis 1: Sustainability-oriented leadership positively and significantly impacts sustainable supply chain practices.

Hypothesis 2: Supply chain capabilities have a positive and significant relationship with sustainable supply chain practices.

Hypothesis 3: Sustainable supply chain practice has a positive and direct effect on sustainable healthcare performance.

Hypothesis 4: Sustainable healthcare performance positively and significantly impacts economic performance.

Hypothesis 5: Sustainable healthcare performance significantly and positively impacts environmental sustainability.

Hypothesis 6: Sustainable healthcare performance is positively and significantly related to social performance in an organisation.

Hypothesis 7: Sustainable supply chain practices positively and significantly impact sustainable economic performance.

Hypothesis 8: Sustainable supply chain practices positively and significantly impact environmental sustainability.

Hypothesis 9: Sustainable supply chain practices positively and significantly influence sustainable social performance.

Hypothesis 10: Sustainability-oriented leadership has a positive and significant impact on sustainable economic performance.

Hypothesis 11: Sustainability-oriented leadership positively and significantly influences environmental sustainable performance.

Hypothesis 12: Sustainability-oriented leadership has a positive and significant influence on sustainable social performance.

Hypothesis 13: Supply chain capabilities positively and significantly impact sustainable economic performance.

Hypothesis 14: Supply chain capabilities have a positive and significant impact on environmental sustainable performance.

Hypothesis 15: Supply chain capabilities positively and significantly influence sustainable social performance.

Hypothesis 16: Sustainability-oriented leadership positively and significantly influences sustainable healthcare performance.

Hypothesis 17: Supply chain capabilities positively and significantly impact sustainable healthcare performance.

Next, the chapter of this thesis proposes a research methodology for sustainable supply chain practice and healthcare performance.

CHAPTER FOUR - RESEARCH METHODOLOGY

4.1 Introduction

The research approach used in this study is presented and justified in this chapter of the thesis. The specific research objectives are stated first in section (4.2), then a description of the philosophical research position to be taken for the study is discussed in (4.3), and subsequently, a description of the study's research design is elaborated in (4.4). The use of a combined exploratory and descriptive research design is justified (4.4.1 to 4.4.4), as well as the use of mixed research method (4.5), is then discussed, including the benefits, implications, and procedure involved in using structural equation modeling (4.5.5). The proposed measurement deployment and operationalization for the study are detailed in section 4.6, while measure reliability and validity are reviewed in section 4.7. Finally, section (4.8) presents and discusses the structural models' validity, as well as the consequences of common methods bias, non-response bias, and intra-construct correlation (4.9). The chapter is summarized and concluded in section (4.10).

4.2 Research study objectives

The research focuses on the use of a sustainable supply chain and how it affects public healthcare performance. The objective of this research is to gather theoretical and empirical data on the concept of a sustainable supply chain. Specifically, the three objectives of this study are:

RO1 To develop a framework to reveal the determinants of sustainability of public healthcare supply chain system in Ghana.

RO2 To measure the determinants of sustainability of the public healthcare supply chain system in the Ashanti region of Ghana using the proposed framework.

RO3 To develop strategies to re-engineer the public healthcare system supply chain in the Ashanti region.

The above objectives define the scope of the proposed research study, and they were considered while determining the study's underlying research philosophy, developing its research design, and selecting individual research methodologies. The background of the study focuses on conducting research in the social science domain, specifically in the context of public health institutions and researching the sustainability of supply chain systems. The study draws heavily on literature in supply chain and operations management, medical supply chain, and sustainability to investigate the supply chain operations of healthcare facilities. Within the supply chain discipline, Carter and Rogers (2008) stipulate that research is likely to significantly benefit from an awareness of the underlying research philosophy assumptions that researchers make in their research designs. Such literature on the philosophy of science posits several epistemological approaches, however, two major approaches dominate, the scientific method and the interpretive method (Lee and Lings, 2008).

4.3.2 Research implication of the scientific and interpretive methods debate

In identifying correlations between phenomena, scientific methods aim to formulate hypotheses and general rules (Crotty, 1998) and it is commonly termed positivism (Thomas, 2004). Since the world is independent of the researcher, and people in general, positivists argue that the world can be objectively measured, with logical and realistic contention proven or verified scientifically either by logic or mathematics (Walliman, 2005). As a result, scientific claims in the form of hypotheses are examined to be correct or incorrect (Anderson, 1983). The proposed research is based on a theoretical model whose constructs are taken from a set of quantitative measurement scales. The proposed research study follows the scientific and positivist research principle since it tests the theoretical model by investigating hypothesised theoretical links between the phenomena captured within. The interpretive method, on the other hand, views individual humans as having a significant impact on their environment and the processes that occur inside it (Thomas, 2004). Reality is subjective and interpreted by its participants, rather than being collectively agreed upon by researchers and thus considered generalizable. Knowledge is collaboratively constructed and context-specific, rather than being collectively agreed upon by researchers and thus considered generalizable (Blaikie, 2004). In consideration of reality as a construction in the mind of the observer, that is consequently interpreted (Walliman, 2005), interpretive methods are critiqued as subjective and strongly rely on the interpretation of information to construct theory. Furthermore, they are criticized for promoting description and generating local understanding of phenomena over-explanation, prediction and creating general laws (Hirschman, 1989). The purpose of the proposed research study is not to significantly interpret the research findings but to simply report them. As a result, the pure interpretive method does not appear to be appropriate for the proposed study, confirming the conclusion that it is positivist.

4.3.3 The scientific realist stance within the scientific tradition

The scientific philosophical theory of positivism comprises additional competing epistemologies, those of logical positivism, logical empiricism and realism (Feyerabend, 1985). In comparison to deductive logic to establish its knowledge claims, logical positivism considers all knowledge claims to be conclusively true or false (Anderson, 1983). It takes the position that ideas are only meaningful if they can be verified and empirically tested; it is deemed impossible to know anything that is not directly observable (Adorno and Horkheimer, 1997). As a result, knowledge claims should be limited to correlations between directly observable variables, and a phenomenon cannot exist if it cannot be seen, heard, touched, smelled, or tasted (Deshpande, 1983). Such a stance, however, rejects the possibility of latent variables as they represent unobserved phenomena. The evolution of logical positivism, logical empiricism, agrees that a theory must be related to observed variables, but differs in that knowledge and propositions must be confirmed by steadily increasing confirmation rather than immediate and absolute confirmation (Adderson, 1983). Again, such a stance rejects the possibility of unobserved latent variables.

However, realism, a variant of positivism, accepts general positivist ideas but asserts that it is impossible to observe reality without some type of interpretation, to a greater or lesser extent (Thomas, 2004). Realism acknowledges that constructs that do not physically exist might appear because of interpretation (Lee and Lings, 2008), supporting the use of latent variables in research. However, to limit the interpretative element of realism, the realist view is combined with scientific realism, which guides explicitly or implicitly many academic researchers (Hunt, 1990). Scientific realism perceives knowledge claims to be fallible; they can be known but not with absolute certainty (Feyerabend, 1995), accepting that the world is imperfect and only relies on an approximate truth (Hunt, 1991). In maintaining objectivity regarding the research, researchers intend to construct theories moving constantly towards the truth without influencing and being influenced by the subject under investigation (Guba and Lincoln, 1994). Therefore, scientific realism is more receptive to latent constructs that are not directly observable but can be expressed in a series of measurement items that attempt to operationalize the construct in a specific context or setting. The proposed research study is an example. Because the study incorporates latent constructs linked to the practice of a sustainable healthcare supply chain. The goal of the study is to see if any correlations between constructs aren't directly observable and if they're predictable. If the researcher can prove that these relationships exist and are relatively stable, the theory that drives the conceptualization of the theoretical model and its component interactions is more likely to be accepted. However, in the implied evaluation of the analysis and theory, there is some leeway in terms of interpretation. It is therefore concluded that scientific realism, rather than a pure positivist approach, is more appropriate as a research philosophy for the proposed study.

4.4 Research design

Iacobucci and Churchill (2010) classify research designs into three categories: namely, exploratory research, descriptive research and causal research. Each category is discussed below in the context of the proposed study.

4.4.1 Exploratory research

Exploratory research is deployed to acquire background information on the nature of a research problem, define and clarify terms, formulate hypotheses and establish research priorities (Iacbucci and Churchill, 2010). It is predominantly applicable to the early stages of a research project (Saunders, Lewis and Thornhill, 2000) and has five main purposes (Selitz, Wrightsman and Cook, 1976): formulating a problem for more detailed examination or developing hypotheses, establishing priorities, collecting information about the practical problems of researching statements, hence increasing the analyst’s familiarity with the problems and clarifying concepts. As indicated in the literature, as the most flexible research design, exploratory research consists of four types (Iacobucci and Churchill, 2010); namely literature search, experience survey, focus groups and analysis of selected cases. The techniques associated with conducting an exploratory analysis include secondary data analysis, experience surveys, case analysis, focus groups, in-depth interviews and projected techniques.

For this study, exploratory research is deployed to construct a sustainable supply chain practice model in the public healthcare in Ashanti region. Aiming to both increase the researcher's familiarity with the research problem and clarify its associated concepts. The precedent set for exploratory research in the development and empirical testing of sustainable healthcare supply chain practice (Staurt, 1998;1999; Alessandri, 2001; Melewer and Jenkins, 2002; Melewer, 2003; Suvatjis and de Chernatory, 2005), is to review the existent operations and supply chain literature to modify or develop new models of the supply chain. As such, in this context, the use of experience surveys and in-depth interviews are not considered as research methods for exploratory purposes. Rather, previous research studies indicate these research methods are potentially deployed to test the applicability and relevance of sustainable supply chain practice (Melewer, Karaosmanoglu and Paterson, 2005; Suvatjis and de Chernatony, 2005) and are therefore considered descriptive research methods. The proposed study adopts the exploratory research design in the form of a literature review to develop a sustainable supply chain theoretical model in public healthcare. The empirical testing of this is discussed in the next section, which is devoted to addressing descriptive research.

4.4.2 Descriptive research

Based upon an initial proposition or hypothesis, descriptive research seeks to identify the frequency of a particular occurrence, or the relationship between two variables (Iacobucci and Churchill, 2010). This is achieved by extracting a sample from a population and estimating the behaviour of the population based on the results. In contrast to exploratory research, descriptive research is characterised by being very rigid, with clear specifications and well-defined boundaries (Iacobucci and Churchill, 2010). Both longitudinal and cross-sectional research studies are features of a descriptive research design (Webb, 2001). Cross-sectional research studies utilise a sample that is representative of a wider population, with data being collected from the selected sample at one point in time only (Iacobucci and Churchill, 2010). Alternatively, longitudinal studies employ panel data and panel methods where a fixed sample is taken from a given population and measured on different occasions.

Historically, to test the sustainable supply chain practice model and verify the relationships within the constructs, in-depth interviews were deployed using a cross-section of senior practitioners in the organisations (Melewer, karaosmanoglu and Paterson, 2005; Suvatjis and de Chernatony, 2005). Both Melewer and Karaosmanoglu (2006), Suvatjis and de Chernatony (2005) represent widely recognized empirically tested and formative studies in the sustainable supply chain literature. They deploy qualitative research techniques to test and validate the relationships between constructs in their respective models of sustainable supply chain practice. The proposed study builds on this foundation by adopting such a cross-sectional approach (see section 4.5.4.3), whilst developing it further by refining the testing of the frequency of the proposed relationships between constructs by adopting a quantitative research method (see section 4.5.3). Iacobucci and Churchill (2010) suggest taking a quantitative approach to descriptive research provides the added advantage of the research results, specifically quantifying the frequency of a particular occurrence and strength of the proposed relationships between constructs. A quantitative descriptive research design, therefore, supports the testing of the study research hypotheses developed in Chapter three of this thesis; and a descriptive research design is thus deployed.

4.4.3 Causal research

A causal research design concerns identifying cause and effect relationships (Iacobucci and Churchill, 2010), to attempt to address the inherent weaknesses of the causality established in a descriptive research study. Whilst descriptive research establishes the relationship between constructs it does not explain the causality of the relationship (Webb, 2001). Therefore, causal research attempts to identify the nature of the relationship under investigation, rather than concentrating on the identification of a hypothesised relationship. Typically, an experimental approach is taken with causal research designs (Iacobucci and Churchill, 2010), which requires a high degree of control by the researcher to be able to convincingly manipulate the dependent and independent variables and measure if X causes Y (Burns and Bush, 2010). As the scope of the proposed study is concerned with establishing the frequency of occurrences and the strength of the proposed relationships between constructs, causal research is not proposed as a component of the study's research design.

4.4.4 The study research design

To present a clear overview, the three research designs presented above were grouped in distinct sections. The intention is not to imply that each is mutually exclusive, but rather that each, in its specific way, may potentially contribute to a research study depending on the objectives of the study. Specifically, the literature is very emphatic in stating that all research problems require their special emphasis and approach because each research problem is unique in some way (Iacobucci and Churchill, 2010). This, therefore, supports a flexible and pragmatic approach to applying the prescribed formula. Therefore, in this study, a descriptive approach is deployed and supported by elements of an exploratory research design. To develop a supply chain model, an exploratory research design is deployed. Following the precedent set for developing sustainable healthcare supply chain practice construct. The hypotheses that result from the exploratory stage justify the adoption of a descriptive research design, in that the research outcomes of a quantitative, cross-sectional study, are related to the specified occurrences and relationships between constructs hypothesised in the theoretical model. The question of causality, while not addressed specifically in the research design, has not been dismissed and is discussed in the limitations section 8.3.3 of chapter eight.

4.5 Research methodology options

In line with the traditional methodology adopted in the operations and sustainable supply chain literature to develop a sustainable supply chain practices model, the proposed study takes a deductive approach to develop a sustainable healthcare supply chain model. In the literature, sustainable supply chain models are developed from the existing literature, including existing models to arrive at the adapted or new models of the constructs (Dey *et al*., 2020). Similarly, this exploratory element of the research designs also develops a series of potential relationships between the constructs which are then tested through data collection, analysis, and interpretation (Melewer and Karaosmanglu, 2006). This forms a descriptive element to the research design, where historically such supply chain studies use qualitative research methods to test supply chain models. Alternatively, an inductive approach to defining and modeling a sustainable supply chain could be implemented, using observations and research findings to develop theory rather than to test it (Bryman, 2012). Arriving at the theory by collecting data, analysing and interpreting it aligns closely with the interpretive philosophy of research, which tends to be subjective, descriptive, collaboratively constructed and very context-specific (Lee and Lings, 2008). Very valuable inductive research studies contribute to the operations and sustainable supply chain (Cushen, 2009; Russell, 2012; Buchann-Oliver, 2012). They are very detailed and organisationally specific research studies, that interpret supply chain phenomena to arrive at numerous detailed, specific and alternative conclusions. However, such an inductive approach does not address the purpose of the proposed study, not only specifically exploring the literature but also model the construct and test the relationships between its hypothesised phenomena. It is therefore proposed that an inductive approach would not take full advantage of the extensive extant supply chain and operation literature, including current models. Nor would it rigorously test the frequency of occurrence and relationships between phenomena or arrive at a set of generalisable hypotheses concerning such relationships. It is recognised in this dissertation that inductive research makes a very valuable contribution to the supply chain and operations literature. For the reasons stated above it is not considered appropriate for the proposed study.

In undertaking the deductive research design study to theoretically model sustainable supply chain practice, it is also necessary to decide whether a qualitative or quantitative methodology is to be deployed to determine the relationships between the constructs contained in the healthcare, along with their frequency. For this purpose, both qualitative and quantitative research methodologies are reviewed to determine which methodology is best deployed in the descriptive design element of the research study.

4.5.1 Qualitative research methodologies

Ethnography, action research and grounded theory are commonly cited qualitative research methodologies (Lee and Lings, 2008; Bryman, 2012). Ethnography concerns the idea that first-hand experience of a culture or environment is a much better basis for understanding than studying and examining it from the outside. A researcher immerses himself through observation in a given situation and context to understand and describe the situation, without directly influencing the situation itself (Hammersley, 1992). Ethnographic studies result in content-rich descriptions of a social context, while not generalising such descriptions to other contexts, conveying what it is like to be part of the culture, environment or social setting (Hammersley and Atkinson, 1995). The researcher in action research is not a passive bystander, apart from the research and the subject of the study. Rather the researcher is part of the research itself, a practitioner, intervening to test the theory by putting it into action and in doing so collaborating with the research subjects (Gibson, 2004). Theory coming from action research tends to be very context-specific and takes many studies over a long duration to develop general theories (Bryman, 2012). Put simply, grounded theory (Glaser and Strauss, 1967), an analytic inductive research method involves setting a general research question, using theory to hypothetically explain the research question and then deploying qualitative interviews with research subjects to refine the theory, which is then further tested and iteratively refined in further sets of interviews (Strauss and Corbin, 1998). The researcher understands well what the concept is, how it varies and that the relationships between it and other concepts are well defined (Strauss and Corbin, 1998). Grounded theory is a very complex and rigorous form of qualitative research that uses complex processes of coding and categorisation to develop and test theory (Strauss and Corbin, 1990). Both ethnography and action-based research do not readily fulfil the needs of the descriptive research element of the proposed study, as both are context-specific methods that in general are content-heavy and descriptive. Action research has the potential to determine the relationship between sustainable supply chain practice and healthcare performance constructs, but only after many studies and generally, because of the direct collaboration of the researcher with the research subjects, moves away from the scientific realist research philosophy upon which the study is orientated. However, grounded theory is a potential qualitative research option that meets the overall requirements of the descriptive element of the proposed research study.

4.5.1.2 Case study

To further validate the empirical findings of this study, a case study will be conducted at one of the district hospitals Healthcare supply chains are notoriously complicated, with multiple parties involved, rules to follow, and logistical difficulties to overcome. Researchers can examine these complex relationships in-depth via a case study, revealing subtleties that may be missed by quantitative data. According to Sweeney et al. (2022), case studies are especially useful for breaking down intricate supply chain relationships and operational difficulties since they offer a comprehensive perspective that is essential for empirical validation. To adequately reflect operational reality, statistical models or surveys are frequently the basis of empirical investigations in healthcare supply chains. Case studies support these conclusions by providing real-world validation, guaranteeing that theoretical models hold in real-world scenarios. Case studies, according to Bastl and Johnson (2022), can be used to confirm and improve empirical findings by showing how models and hypotheses are applied in real healthcare supply chains. Yin (2023) contends that case studies give academics the chance to investigate the "how" and "why" questions, which are crucial for comprehending the intricate supply chain operations that take place in healthcare settings. According to Holt and Hughes (2022), case studies are perfect for empirical validation since they can be used to pinpoint the impact of organisational and external factors on the healthcare supply chain. Examining a hospital's inventory control strategy or supplier relations methods, for instance, might confirm the efficacy of supply chain procedures. Brusset and Teller (2023) discover that case studies offer practical insights that healthcare supply chain workers can use to better utilise empirical findings in their day-to-day work. Nikolopoulos et al. (2022) found that case studies can be used to find operational best practices, which will help healthcare companies enhance their supply chain plans with empirical data. According to Pagell and Wu (2023), case studies validate the results of empirical research in these areas by providing a deeper insight into how organisations are implementing sustainable supply chain practices and coping with disruptions. The methodological flexibility of case studies, as highlighted by Eisenhardt and Graebner (2023), enables the investigation of many variables and settings within healthcare supply chains. Case studies are very helpful for analysing technology advancements and confirming empirical results about the uptake and efficacy of these technologies in healthcare supply chains, as Chopra and Meindl (2023) point out. Case studies, according to Mentzer and Moon (2023), provide a more nuanced knowledge of supply chain performance and are therefore a crucial instrument for confirming empirical research in the medical field.

Regarding the case selection, Kokofu General Hospital is one of the few Ghana health service facilities within the Ashanti region of Ghana that provides specialised services in dermatology in addition to general medical services. Although it is far from the regional capital, people come from far and near including people from other regions to seek general care as well as dermatological care. The author is familiar with the case under study because the author once worked at the facility and therefore, he is privy to the facility’s operations and challenges. Despite the high patronage and the critical services, the facility provides, the supply chain system does not support the operations of the hospital as it should. The challenges emanate from economic performance, environmental performance and social performance. These challenges are what this research seeks to remedy to necessitate improvement in the hospital. The purposive sample technique was used to select the case since the researcher is familiar with the environment and understands the dynamics within the enclave. The case selection process includes i. Identify the sample pool; ii. Approach the potential organisation; iii. Pilot the focal organisation which agrees to take part in the survey; iv. Identify the focal organisation's supply chain sustainability performance; v. Select and conduct the study with the healthcare personnel who gave consent to participate in the study. Data will be collected from the pharmacy stores, dispensary units, general stores, procurement units, administration, and heads of wards but strictly supply chain-related data without patients' information. Data will be collected from multiple sources such as observations, documents, archival records and a brief discussion.

4.5.2 Quantitative research methodologies

In taking a deductive research approach, quantitative methodologies set a research question, develop research concepts in the form of theoretical models, determine measures upon which to test hypothesised relationships between constructs, collect data, analyse the data, interpret the results and form conclusions (Hammersley, 1996). Quantitative research methodologies concern explanation, prediction and creating generalised laws by developing and testing hypotheses that propose relationships between different phenomena and constructs (Bryman, 2012). Multivariate analysis, a form of quantitative research analysis, is applied to analyse the data collected in quantitative studies to estimate the relationships between two or more constructs in a theoretical model (Hair et al. 2010). There are many multivariate techniques available including simple and multiple regression, canonical correlation, conjoint analysis, cluster analysis and structural equation modeling, to name but a few (Hair *et al*., 2010). Each technique is deployed under different research conditions and has its uses, benefits and limitations (Hair et al., 2010). In the domain of supply chain and operations research, structural equation modeling, in favour of multiple regression, is increasingly being deployed as a quantitative multivariate analysis technique, used to test theoretical models as a whole and individual relationships between constructs (Singh, 2009).

Structural equation modeling (SEM) tests a theoretical model by estimating both the influence and significance of hypothesised relationships between the model constructs and also estimating the goodness-of-fit between the data collected in the hypothesised theoretical model. SEM primarily tests theory and not data (Diamantopoulos and Siguaw, 2000), providing the capability to estimate components of theory through individual latent constructs. Even though a latent construct may not be directly observable by the researcher, each latent construct is measured by a set of items that represent the manifestation of the construct (Hair et al., 2010). This enables not only relationships between constructs to be determined, but also for the estimation of the strength of the influence one construct has over another, the coefficient, and the significance of that relationship, i.e. to what degree the relationship between the constructs is down to chance (Diamantopoulos and Sigauw, 2000). SEM also captures the effects of measurement error, which if not considered, as with other multivariate techniques, is likely to seriously bias the potential strength and significance of structural relationships (Bollen, 1989). The multivariate data analysis techniques of a quantitative research methodology, in particular structural equation modeling, meet and exceed the requirements of the descriptive research elements of the proposed research study. SEM not only estimates a hypothesised relationship between two constructs, but it also calculates the likely frequency of this, in terms of the strength of one construct's influence over another and calculates the degree to which this influence is down to chance. In addition, SEM estimates the overall effectiveness of a hypothesised theoretical model in calculating the goodness of fit between the data collected and the structural model. SEM therefore fully meets the descriptive research requirements of the proposed study.

4.5.3 The research methodology of the study

The review of qualitative and quantitative research methodologies concludes that both grounded theories, a qualitative research method, and structural equation modeling, a quantitative research method, are suitable for deployment in the descriptive element of the proposed research study. The requirements of the descriptive element of the proposed study are to determine the relationships between sustainable supply chain practice along with the impact of healthcare performance of such relationships. Previous research studies designed to test corporate sustainable supply chain models, and the relationships between the model's constructs, effectively deploy qualitative methods (Melewer and Karaosmanoglu, 2006; Suvatjis and de Chernatony, 2005; Melewer and Karaosmanoglu, 2006). As such these studies sample participants across an array of organisations, the findings and conclusions of which are considered as generalisable.

However, the context of the proposed study differs from the previous studies. Deploying the proposed study within Ashanti regional medical stores, a tertiary hospital and thirty metropolitan, municipal and district health facilities apply certain contextual constraints and opportunities to the study. Having access to a significant healthcare facility presents the opportunity to thoroughly research supply chain construct. Deploying a grounded theory approach throughout this population is likely to be relatively time-consuming and costly, as against data collection for SEM purposes. It is also likely that the organisations concerned are unlikely to put aside the time available for sustainable supply chain practitioners to participate in an extensive grounded theory research study. As the study is restricted to health facilities in the Ashanti region of Ghana, rather than sampling a number across Ghana, the descriptive elements of the study must capture as much detail as possible concerning the determination of the relationships between the supply chain and constructs and frequency of occurrence of such relationships. SEM, in addition to establishing the relationship constructs, as with grounded theory, also estimates the strength of one construct's influence over another and the degree to which this influence is down to chance. SEM also estimates the overall effectiveness of a hypothesised theoretical model in calculating the goodness-of-fit between the data collected and the structural model. It is therefore concluded, given the research context of the research study, that SEM can be justified for use in the study's descriptive research phase and that SEM fully meets the descriptive research requirements of the proposed study. It also recognised that given a different research context, grounded theory is an equally applicable research method for the descriptive element of a research study concerning the sustainable supply chain construct.

4.5.4 Requirements for deploying a quantitative methodology

In justifying the selection of a quantitative methodology, consideration is to be given in this section to the use of primary and secondary data, the use of survey research, the deployment of either a cross-sectional or longitudinal study and survey administration.

4.5.4.1 Primary or secondary data

Operationalising a sustainable supply chain would be difficult based on secondary data. Secondary data has already been collected for other reasons than for studying the problem or research questions at hand (Malhotra and Birks, 2006). Conversely, primary data is specifically collected to answer the research question at hand and is, therefore, for this study, the most appropriate data on which to test the sustainable supply chain theoretical models (Iacobucci and Churchill, 2010).

4.5.4.2 The use of survey research

To test the theoretical model presented in section 3.4, there are certain conditions implied when adopting a quantitative research method. Large amounts of data are required to make the data and its associated hypotheses in the study generalisable for the organisations in which the study is based (Hair *et al*. 2010; Iacobucci and Churchill, 2010). Therefore, a large amount of data must be collected in an efficient manner that minimises resources and labour and uses a research method that utilises modified and existing measures for the constructs that comprise the theoretical model. In doing so, the study will be easier to administer, code, analyse and interpret, and its reliability increases as a result of the survey being standardised with fixed alternative answers that respondents select from (Malhotra et al. 1996). It is for these reasons that survey research has been adopted (Iacobucci, 2010) to meet the requirements of the proposed research study.

4.5.4.3 The selection of a cross-sectional study

In adopting survey research there is a choice of two survey designs, longitudinal and cross-sectional (Iacobucci and Churchill, 2010). Longitudinal research measures a set of constructs and their relationships at two or more different times, studying changes over time. Its major advantage is that the researcher controls the timing and sequence between the constructs and in doing so a truly able to assess causality (Edwards and Bagozzi, 2000). However, longitudinal surveys not only take many years to complete, but they also are typically costly and given the need for following up with respondents at least once limit the potential for the study to gather a large sample of data (Weiss and Heide, 1993). Alternatively, a cross-sectional study involves sampling constructs and their relationships at one point in time. Although there are proposed limitations concerning the measurement of causal relationships at only one point in time (Bowen and Wiesrsema, 1998; Edwards and Bagozzi, 2000) for this study cross-sectional research delivers the necessary sample size and volume of data required to test the hypothesised theoretical model. Such benefits have been derived by other scholars when adopting a cross-sectional approach to related quantitative studies and quantitative research in the operations and supply chain domain (Hong, Zhang and Ding, 2018; Yoo and Dhonthu, 2001; Morhart *et al*., 2009; Hughes and Ahearne, 2010). Therefore, due to time, cost and potential sample size constraints, a cross-sectional research study has been selected in favour of taking a longitudinal approach.

4.5.4.4. Survey administration method

Finally, a method of survey administration requires selection between a range of three commonly used alternatives, namely telephone, mail and personal interviews (Hait, Bush and Ortinau, 2000). It is not always a straightforward decision to select a method of survey administration, as context and culture largely dictate which form of survey administration is used (Iacobucci and Churchill, 2010). In the context of this study, where the research is to be conducted in thirty-two health facilities where respondents spend most of their working day in-person, telephone and online surveys are appropriate due to risks posed by the Covid-19 virus. Face-to-face contact was not needed to gain respondents' agreement to complete the survey questionnaire and therefore a degree of personal contact was restricted unless it was necessary to explain the purpose of the study and to answer any questions concerning its completion. After this point, a weblink to the survey is administered and is self-completion, in the sense that respondents complete the surveys themselves and the completed instruments are delivered to the researcher upon completion of the last question. Adopting a self-completion method of administration has the benefit of offering the researcher a high degree of control, in addition, a diversity of questions may be asked and perceived sensitive information may be obtained as respondents consider themselves to have high levels of perceived anonymity (Hair Bush and Ortinau, 2000). Undertaking self-completion administration via Qualtrics (www.qualtrics.com) which instantly sends the feedback to the researcher upon completion of the last question reduces the stated disadvantages of the usual self-completion by post method of administration. The disadvantages of postal self-completion, slow data collection, low social desirability and low response rates (Hair, Bush and Ortinau, 2000), are likely to be significantly reduced, although this is offset by having researchers in place for some days. Therefore, the method of survey administration adopted for the study is virtual respondent self-completion. The researcher developed the questionnaire using Qualtrics software and sent the questionnaire to respondents via created WhatsApp group chat and email addresses to allow them to complete it easily. The questionnaire was designed to be mobile phone friendly, and a respondent needs just an internet connection to complete it. Upon completion of the last question the completed questionnaire will be automatically submitted. Reverse questions were added to the questionnaire to reduce response biases, increase respondent engagement and improve scale reliability. Reverse-worded were carefully designed and balanced to help researchers collect more valid and trustworthy data. The questionnaire takes between 15 – 20 minutes to complete and it could be paused and continued once a respondent starts. Reverse-worded questions according to Wong et al. (2021) help combat respondent tiredness, leading to more accurate and varied responses. Weijters et al., (2010) also reported that reverse-coded items help respondents pay attention, which results in more accurate and varied responses. Reverse-worded items are useful in lowering acquiescence bias, which enhances the accuracy of self-report data (van Sonderen et al., 2013).

4.5.5 Structural equation modeling

Broadly, SEM is a method of multivariate data analysis that uses covariance rather than variance, the conventional base of multiple regression and other popular forms of statistical analysis. SEM, by incorporating several statistical models attempts to explain relationships among multiple variables (Chin, 1998). Diamantopoulos and Sigauw (2000) contend that SEM combines methodological contributions from two disciplines, psychological theory, confirmatory factor analysis (CFA), and econometrics, structural equation models. Whilst the CFA concerns identifying and confirming a structure within a set of observed variables (Stewart, 1981), the structural equation models can be thought of as the simultaneous testing of multiple regression equations (Hair et al., 2010). Similar to multiple regression, structural equation models contain their form of independent and dependent variables, termed exogenous and endogenous constructs.

4.5.5.1 Exogenous and endogenous constructs

Exogenous constructs are the latent multi-item equivalent of independent variables. They are determined by factors outside of the models and visually as a component of a structural equation model and their independence is depicted in not having any paths from another construct going into them (Hair *et al.*, 2010). Endogenous constructs are the latent multi-item equivalent to dependent variables. They are theoretically determined by other constructs in the model and their dependence is usually represented by a path to an endogenous construct from an exogenous construct (Hair et al., 2010).

4.5.5.3 Specification of the measurement and structural models

Having defined and operationalized each of the constructs that comprise the research study, the next stage of SEM is to specify the study's measurement and structural models. Specifying the measurement module requires the researcher to identify the latent constructs to be included within the model, assigning the measured indicator variables, i.e. to the latent constructs (Hair *et al*., 2010). In doing so, the measurement model and the relationship between the items of each construct, the observed measures, and the latent constructs that are associated with them (Schmaker, Randall and Lornax, 2004). In the literature, a measurement model is sometimes referred to as confirmatory factor analysis, or (CFA) (Byrne, 1998; Kline, 1998). This CFA, when estimated, assesses the validity of the measurement model by deploying some goodness-of-fit measures, as further discussed in section 4.6.5.6 of this chapter. Accurate specification and estimation of the measurement model are essential before estimating and drawing any significant meaning from the structural model (Aaker, Kumar and Day, 1995), the next step of the SEM process. Therefore, the estimation of an SEM measurement model, a CFA, forms an integral part of this research study.

A structural model is specified by assigning relationships from one construct to another based on a proposed theoretical model (Hair *et al*., 2010). Hair et al. (2010) demonstrated drawing a path diagram that is a graphical representation of dependent relationships between the various constructs within the model. In SEM terms, the path diagram depicts the multiple dependencies between exogenous and endogenous constructs (Holmes-Smith, 2000), with arrows and curves depicting the nature of relationships between constructs. Arrows indicate direct causal relationships between constructs and curve lines indicate the correlations between them. When estimated, the structural model calculates goodness-of-fit indices assessing the model validity of the structural model, along with a coefficient for each relationship between constructs. Each estimated coefficient is supported by an unstandardized parameter estimate, a standard error, an error variance and a t-value. The t-value determines the statistical significance of the structural path coefficient (Joreskog and Sorbom, 1993). A higher t-value means that there is a lower chance of the parameter estimates having been generated by chance (Hayduk, 1987). Section 4.8 of this chapter discusses structural model identification, goodness-of-fit and the testing of structural relationships in more detail. The specification and estimation of a structural model, therefore, forms an integral part of this research study.

4.5.5.2 Construct definition

Hair *et al*. (2010, p735) argued that a prerequisite to a successful deployment of the SEM process is to define individual constructs, stating that “a good measurement theory is a necessary condition to obtain useful results from SEM.” As presented in section 3.4 of this thesis, each construct requires a precise definition at the conceptual level, forming the basis upon which individual indicator items are selected or designed to operationalize the construct. Operationalising a construct often involves a series of scale items in a common format such as the Likert scale (3.4). In many cases, as with this study, both definitions and scales are adopted and potentially modified from previously published research studies where the definitions and the scales have performed well (Hair *et al.,* 2010).

4.5.5.4 Confirmatory modeling strategy

Hair *et al.* (2010) argued that at the outset the researcher must define a modeling strategy, from a choice of three alternatives: confirmatory modeling, competing modeling or a model development strategy. The confirmatory modeling strategy uses a single model development for its fit to the observed data. It is the simplest of the options and it is as rigorous as the competing model's strategy as it does not consider alternative models. Alternatively, the competing modeling strategy demonstrates that from many competing strategies and competing models, one particular model fits the data best. Finally, model development, the third strategy, is driven by theory and allows researchers to study alternative models based upon theory and then select the most appropriate. This research study concerns the testing of a single sustainable supply chain practice model and therefore adopts a confirmatory modelling strategy.

4.5.5.5 Advantages of using structural equation modeling for the study

The study requires operationalizing the theoretical model of sustainable supply chain practice as developed in the literature review of this thesis. The sustainable supply chain theoretical model contains a set of theoretical constructs with hypothesised directional relationships between them. The full testing of the theoretical model developed in the literature review of this thesis required an analytical technique that first estimates multiple and interrelated dependence relationships. Structural equation modeling fully addresses each of these requirements (Hair *et al*., 2010). In addition, SEM primarily tests theory and not data (Diamanthopoulos and Sigauw, 2000), providing the capability to estimate components of theory through individual latent constructs and their associated estimated manifest variables using empirical data. This is important as the researcher intends to operationally test a construct definition founded upon and derived from theory. SEM uniquely, relative to other multivariate data analysis techniques, captures the effects of measurement error (Hair *et al*., 2010). If the measurement error is not accounted for then it is likely to severely bias parameter estimates and the potential strength and significance of structural relationships (Bollen, 1989). Finally, SEM represents an analytical technique that both fits the requirements of the study and offers more flexibility than other multivariate analysis techniques (Hair *et al*., 2010). SEM is therefore adopted as the multivariate data analysis technique used in this study.

4.5.6 Sampling methodology

Malhotra and Birks (2006) stipulate five stages to the sampling process. These are, defining the target population, determining the sampling frame, selecting the sampling technique, determining the sample size and executing the sampling process.

4.5.6.1 Definition of the target population

The focus of the current study is to operationalize the sustainable supply chain theoretical model. A target population is required, i.e., a collection of objects or elements that have the information required to research the operationalization of sustainable supply chain management practices so that deductions can be made by researchers (Malhotra *et al*., 2006). As the target population of the research is healthcare supply chain practitioners then a sample of the supply chain practitioners is required for this study research study.

4.5.6.2 Determining the sampling frame

The next step is the sampling frame, which is defined as a list of members of a population that generates a random sample (Aaker, Kumar and Day, 1995). Sampling frame error is a risk and arises if there is a difference between the target population and the sampling frame (Malhotra *et al*., 1996). For the proposed study, there is no distinction between the target population and sampling frame, as the sampling frame of the study is identical to the target population, i.e., the healthcare supply chain. Prior published research demonstrates that procurement/supply officers, medical officers, nurses, pharmacists, biomedical scientists, accountants and health service administrators are appropriate and relevant sources of a population of a healthcare supply chain that accurately reflects a wider population of such employees (Kuupiel *et al.,* 2019; Rakovska and Stratieva, 2017; Homburg *et al*., 2016). Procurement/ supply officers, medical officers, pharmacists, nurses, biomedical scientists, healthcare administrators, accountants and health information officers who receive their inputs/commodities from the supply chain practices form the sampling frame for this study. Four hundred participants from thirty-two (32) metropolitan, municipal, district and teaching hospitals as well the regional medical stores were selected through purposive sampling. Procurement/supply officers – 139 (3 from each health facility and 10 from the regional medical stores), medical officers – 30 (1 from each facility), pharmacists – 70 (2 from each facility and 10 from the regional medical store), nurses – 150 (5 from each facility), health administrators Managers – 10 were initially expected to participate of which 40 participants will be selected for validation. One participant from each of the facilities and 10 from the regional medical stores. Inclusion/exclusion criteria: Participants may choose to participate if: You are between 18 – 60 years of age; You are either a casual or permanent healthcare personnel in the Ashanti region; You are part of the hospital supply chain system; You have experience in the distribution of healthcare commodities. Purposive sampling was adopted to focus on healthcare personnel only and subsequently, the samples were divided into strata using stratified sampling afterwards simple random sampling technique was used to select the intended participants and therefore those who do not use/handle medical supplies were excluded.

4.5.6.3 Selection of the sampling frame

In selecting the appropriate sampling techniques, a choice is to be made between probability and non-probability sampling (Malhotra *et al.* 1996) because a sampling design falls into one of the two categories (Nurns and Bush, 2000). In non-probability sampling, each member of a population has an unknown chance of being chosen, whereas with probability sampling each member of a population has a known, non-zero probability of selection. In the case of the proposed study probability sampling is selected given its relative sampling efficiency, considering the ratio of accuracy over cost (Aaker, Jumar and Day, 1995). A further consideration during the selection of a sampling technique is the potential for non-response error, a form of non-sampling error that occurs when some of the respondents included in the sample do not respond (Malhotra, 1993).

4.5.6.4 Determining the sample size

Determining the sample size is the penultimate step in the sampling process and refers to the number of elements to be included in the study. Malhotra *et al*. (2006) propose that several considerations are taken into account when determining the size of a sample. For a particular unit of analysis, the considerations include the nature of the research, the number of variables, incidence and completion rates and resource constraints. In this study, the unit of analysis is at the individual healthcare supply level. The sample size is an important element of SEM and is of interest, as with all other statistical methods, as with the foundation for establishing sampling error. The larger the sample size the less sample error and the greater likelihood that the results are statistically significant. SEM is described as a large sample technique, where the number of observations needed differs depending upon the number of parameters in the model to be estimated. Hair *et al.* (2010) contend that as model complexity increases so should the sample size. A rule of thumb is provided by Bentler and Chou (1987), who recommend a minimum ratio of a sample size to free parameters of 5:1, under the conditions of normal distribution theory. To increase effectiveness, further recommendations are made to increase the ratio to 10:1 from 5:1. There is little universal agreement in the literature as to what constitutes an adequate sample size, however, there are concerns small sample sizes lead to unstable results (Hulland, Chow and Lam, 1996). Sample size recommendations vary from 100 (Bollen, 19989) to greater than 200 (Boomsma, 1982; Kelloway, 1988). However, there is a broad consensus that at least 200 cases are recommended for a more complex model (Hulland, Chow and Lam, 1996; Sharma, Mukherrjee, Kumar and Dilion, 2005). Kaiser-Meyer-Olkin sampling adequacy will be adopted to analyse the sample size to ascertain if it corresponds with the broad guidelines stated.

4.5.6.5 Execution of the sampling process

With the target population defined, the sample frame, the sampling technique and the sample size determined, the sampling processes can be executed. The chosen public health organisations in the Ashanti region include: Ashanti Regional Medical Store, Kumasi, Ghana, Komfo Anokye Teaching hospital, and 30 healthcare facilities in the region namely: Kumasi South Hospital which is the regional hospital, Kumasi Metropolitan Hospital, Maternal and Child Health Hospital, Manhyia Government Hospital, North

Suntreso Hospital, Tafo Government Hospital, Obuasi Government hospital, Mampong Government Hospital, Ejura Government Hospital, Kokofu District Hospital, Nkenkasu District Hospital, Kuntenase District Hospital, Nyinahin District Hospital, Nkawie District Hospital, Mankraso District Hospital, Asonomaso Government Hospital, Kwabre District Hospital, Tepa Government Hospital, Bekwai Municipal Hospital, New Edubiase District Hospital, Konongo Odumasi District Hospital, Fomena District Hospital, Ejisu District Hospital, Juaben District Hospital, Juaso District Hospital, Agona district Hospital, Effiduase District Hospital, Bosome Freho District Hospital, Sekyere Aram Plains District Hospital. Overall, 500 hundred respondents were targeted from the healthcare facilities listed above.

4.5.7 Selection of SEM technical options

Hair et al. (2010) examined several technical decisions that are necessary for a researcher to make in the deployment of SEM. These decisions concern the use of either covariance or correlation matrices during model estimation, the treatment of missing data, the selection of an estimation technique from a few alternatives and the selection of SEM computer software. Each of these issues is addressed in turn in the following.

4.5.7.1 Use of covariance matrix

Researchers conducting SEM analyses in the past were faced with two alternatives, using either a covariance matrix or a correlation matrix (Hair *et al.,* 1998). The use of either matrix is determined by the types of data and the outcomes of the appropriate diagnostic tests, even though the covariance and correlation matrices are very similar (Hair et al., 1989). In the literature, there are competing positions as to whether correlation matrix input is more appropriate than the covariance matrix (Bollen, 1989) or vice versa (Kelloway, 1998). Researchers have tended to prefer covariance matrix input as the correlation matrix removes important information from the data about the scale measurement of individual variables, and the hypothesised test in SEM (Kelloway, 1998). It is for this reason that the use of covariance matrix input is preferred for the present study. However, most modern SEM software computes a model solution from raw data without the researcher computing a correlation or covariance matrix separately. As in this research study, the debate concerning correlation matrix versus covariance matrix SEM input is no longer relevant. However, the researcher is faced with the alternative of using the correlations or covariance matrix generated from the base data on which their SEM testing and analysis is based. Although there are relative advantages and disadvantages attached to both, (Hair *et al*., 2010, p.78) state that “in computing the use of correlations versus covariances we recommend using covariance whenever possible. Covariance provides the researcher with far more flexibility due to the relatively greater information they contain". Therefore, the proposed study adopts the use of covariance.

4.5.7.2 Missing data

Three methods are commonly used to replace missing data: list-wise deletion, pairwise deletion and model-based, all of which are adequate methods of replacing missing data (Hair *et al.,* 2010). Listwise deletion concerns the exclusion of any cases in the analysis that have missing observations (Kline, 1998). One of its drawbacks is that if the sample is poor, its application may eliminate a significant number of cases. Pairwise deletion means excluding cases only if they have missing data on the variables involved in a particular computation (Kline, 1998). The main disadvantage here is different calculations in the analysis might be based on different sample sizes (Malhotra and Banks, 2006). The aim of the third alternative, model-based imputation, at the most basic level, is to maximize the effective sample size by substituting missing observations of a particular variable with the sample mean for that variable (Schafer and Graham, 2002). Another more advanced procedure, the Expectation-Maximization (EM) algorithm method (Dampster, Laird and Rubin, 1977), uses a two-step iterative procedure. A potential disadvantage of imputation is that the imputed values can produce exaggerated variance (Bollen, 1989). For this thesis, two methods are selected for managing missing data. First, cases with 20% or more missing data are list-wise deleted. Secondly, missing data in the cases that remain after list-wise deletion is imputed using the EM algorithm method. Missing data in the research study is discussed further in section 5.2.1 of chapter five.

4.5.7.3 Estimation technique

Having specified a measurement model, the most appropriate technique for the model estimation requires selection (Hair *et al.,* 2010). The objective of estimation is to minimize the difference between the estimated covariance generated by the model and the covariance of the sample, i.e. covariance matrix (Holme-smith, 2000). There are several estimation procedures available to estimate parameters and compute test statistics. Diamanthopoulos and Sigauw (2000) identify seven methods that may be used to estimate parameters. These are categorized into partial information techniques, with the remainder classified as full. Two-stage least squares (TSLS) and instrument variables (IV) are partial techniques and estimate every parameter equation separately. In contrast, maximum likelihood estimator (MLE), unweighted least squares (ULS), diagonally weighted least squares (DWLS), generated least squares (GLS) and generally weighted least squares (WLS) are full information techniques that estimate all the parameters simultaneously. Diamanthopoulos and Sigauw (2000) consider full information techniques to be relatively less statistically efficient. The most common full information techniques are ULS, GLS, and MLE, each operating effectively under different conditions. For instance, the importance of GLS estimation on small samples is not as good as MLE (Bollen, 1989). On the other hand, ULS does not in the main lead to the most efficient estimation of the model parameters when compared to MLE (Bollen, 1989). Generally, maximum likelihood estimation is the most popular technique for parameter estimation and reporting results if the condition of normality is met (Anderson and Gerbing, 1982; Hayduk, 1987). If not, other estimation methods such as OLS, WLS, and GLS will be considered.

4.5.7.4 Computer software

Many computer programs are readily available and are convenient for performing SEM (Hair et al., 2010). According to Hair *et al.* (2010) LISREL, Equations with Software (EQS), AMOS and CALIS are the four most recognised. LISREL can be applied in cross-sectional, experimental, quasi-experimental and longitudinal studies (Bentler, 1993), whilst AMOS performs similar functions to LISREL and is an addition to SPSS. CALIS is a SEM program available within SPSS. Researchers in many fields have applied SEM using Smart Partial Least Squares (PLS) or AMOS due to their significant flexibility and effectiveness thus have become synonymous with SEM (Hair *et al.,* 2010). In this study, both SmartPLS and AMOS are used as the SEM computer software for the research study for validation purposes.

4.6 Measurement Development

The conceptual and operational definitions of the constructs that comprise the theoretical model of the study are presented in this section. The latent constructs of the study are operationalized using a pre-existing scale, that was adapted to suit the research context. The pre-existing scales are to be found in existing operation and supply chain literature. Before conceptually and personally defining each of the constructs, their measurement must be discussed. Indicators for the constructs that comprise the theoretical model are measured on Likert scales. As summated scales, Likert scales are comprised of two parts, an item and an evaluative element (Aaker, Kumar and Day, 2002). In the case of the present study, the item is a statement about a particular function, whereas the alternative element consists of a list of response categories ranging from “Strongly Disagree” to “Strongly Agree” are also termed as scale points (Iacobucci and Churchill, 2010), representing the two extremes scale points within a range. As such, it is concluded that the Likert scales are appropriate for use in this research study as it is assumed that the resulting scales are unidimensional (Aaker, Kumar and Dey, 2002). There is a debate as to the optimal point of response alternatives and scale points within a Likert scale, with little agreement within the literature. Research suggests that the reliability of a measure increases when the number of scale points increases (Iacobucci and Churchill, 2010). Cox (1980) found in the literature a range of scale points have been used, starting at two and finishing at twenty, although the recommendation of that study is to use seven, plus or minus two data points/response alternatives. Cox (1980) study reported that the five to seven data points/response options are appropriate in subject-centred research. Most of the pre-existing scales used as the basis for operationalizing sustainable supply chains use five-point Likert scales. Thus, it is concluded that the five-point Likert scales are used for this study, where respondents are asked to click one of the five options data points/response options that best capture their beliefs and functions toward each item. Using "1 = Strongly Disagree" and "5 = Strongly Agree" as anchors for each item statement. Having determined that Likert scales are to be used for the proposed study, this section turns to the conceptual and operational constructs.

4.6.1.1 Sustainability-oriented leadership

Dey *et al*. (2020) demonstrate that sustainability-oriented innovation (SOI) is responsiveness-focused, which allows organizations to achieve overall sustainability through trade-offs among economic, environmental and social factors. (Dey *et al*., 2020), (Shin and Park, 2021), (Ivanov and Dolgui, 2020b), (van Hoek, 2020), (Schleper *et al.*, 2021), (García-Quevedo *et al.,* 2020; Jeronimo *et al.,* 2020).
The Cronbach's Alpha for the six items to measure sustainability-oriented leadership was 0.83. Sustainability-oriented leadership is therefore measured as follows:

We have skilled leaders who develop and supervise supply chain priorities. SOL1
Our leaders ensure sustainable goals are always achieved. SOL2
Our managers have a strategic plan for supply chain sustainability. SOL3
Our leaders want us to practice a green supply chain. SOL4
Our managers develop healthy supply chain policies. SOL5
Our leaders include both clinical and non-clinical staff in supply chain decision-making. SOL6

4.6.1.2 Supply chain capabilities

Dynamic capabilities are defined as higher-order capabilities that organize resources to enhance the performance of an organization in changing contexts (Teece, 2014). Big data analytics (BDA) recognized as a supply chain solution is defined as“a holistic process that involves 5V (volume, velocity, variety, value, and veracity) in terms of collection, analysis, use, and interpretation of data for various functional divisions, to gain actionable insights, create business value, and establishing competitive advantages”(Fosso Wamba et al., 2015, p. 235). (Fosso Wamba *et al*., 2015, p. 235) (Xu and Gursoy, 2015), (Shi and Liao (2013), (Kumar, Raut, Nayal *et al*., 2021), (Ivanov *et al*., 2021), (Luthra *et al*., 2020), (Li *et al*., 2020), (Rajput and Singh, 2020)
The Cronbach’s Alpha for the seven items to measure supply chain capability was 0.85. Supply chain capability is therefore measured as follows:

We have assets to enable sustained production levels. SCC1
We are capable of producing outputs with minimum resource requirements. SCC2
We have adequate knowledge of the status of operating assets. SCC3
We integrate external data with internal to facilitate high-value analysis of our business environment. SCC4
We have allocated adequate funds for the digitalization of sustainable operations. SCC5
We are able to work effectively with other entities for mutual benefit. SCC6
We have developed human resource structures to help the organization succeed. SCC7

4.6.2 Sustainable supply chain practice

Supply chain management practices, according to Li *et al*. (2005), are the collection of activities that a business engages in to support effective supply chain management Wolf (2012)
The Cronbach’s Alpha for the nine items to measure sustainable supply chain practice was 0.88. Supply chain practice is therefore measured as follows:

We share information relating to the planned consumption of medical devices and pharmaceuticals (MDPs). SSCP1
We share information relating to the real consumption of MDPs. SSCP2
We share information relating to contracts with suppliers. SSCP3
We order quantities of MDPs based on historical consumption data. SSCP4
Our suppliers send Advanced Shipping Notifications. SSCP5

We join initiatives with suppliers relating to material flow management. SSCP6
We have energy-efficient manufacturing facilities. SSCP7
We have policies for optimum warehousing and distribution practices. SSCP8
We provide information for optimum and safe usage of the product to our customers/clients. SSCP9

4.6.2.1 Supplier relationship management

Beaulieu, Landry and Ro, 2011), (Burt, Petcavage, and Pinkerton, 2010), (Mirghafoori, Sharifabadi and Takalo, 2018), (Schieble, 2008), (Li *et al.*, 2005)

A strategic supplier partnership is defined as a long-term relationship between an organisation and its suppliers that encourages the strategic and operational capacities of individual participants to assist them in achieving significant long-term benefits (Li *et al*., 2005; Li *et al*., 2006; Monczka *et al*., 1998).
The Cronbach's Alpha for the eight items to measure supplier relationship management was 0.87. Supplier relationship management is therefore measured as follows:

We practice supplier-based rationalization. SRM1
We share information with suppliers relating to material flow management. SRM2
We integrate suppliers into our strategic decision-making. SRM3
We select ISO 14000-certified suppliers. SRM4
We work with suppliers to innovate and improve the availability of sustainable products. SRM5
We assess suppliers' sustainability and ethical practices. SRM6
We conduct routine supplier ratings. SRM7
Relationships are based on formal contracts with clearly set product quality and requirements. SRM8

4.6.2.2 Lean supply chain

Lean is economy-focused and environmentally friendly, philosophically, lean management focuses on waste reduction through resource optimization (De et al., 2018; Dey et al., 2019)
Dey *et al*., 2018; 2019; 2020), (Reichhart and Holweg, 2007), (Perez *et al.,* 2010), (Womack *et al*., 1991), (Green and Inman, 2005; 2007), (Mason, 2006).

The Cronbach's Alpha for the seven items to lean management was 0.84. Lean management is therefore measured as follows:

We minimize waste in the downstream supply chain. LSC1
We make the right product available to the customer at the right time. LSC2
We concentrate on the elimination of waste in supply chains. LSC3
Our cost reduction strategy helps us to save more. LSC4
We have a flexible approach that focuses on process improvement by reducing/removing all waste. LSC5
Our just-in-time practice enables us to keep low stock levels. LSC6
We pull products from suppliers when required. LSC7

4.6.2.3 Supply chain agility

Shin and Park (2021), (Agyei-Owusu *et al.,* 2022), (Liu *et al*., 2013, p. 1453)
SCAG is defined as "a firm's ability to perform operational activities together with channel partners to adapt or respond to marketplace changes rapidly" (Liu *et al*., 2013, p. 1453).
The Cronbach's Alpha for the seven items to supply chain resilience was 0.84. Supply chain agility is therefore measured as follows:

We have adapted SC processes to decrease lead times. SCA1
We have adjusted SC processes to increase on-time delivery. SCA2
We have streamlined SC processes to decrease non-value-added activities. SCA3
Our agility is characterized by flexibility. SCA4
Our agility enables speed/responsiveness. SCA5
We have adapted SC processes to decrease new product development cycle time. SCA6
Over the past 2 years, our volume flexibility has improved. SCA7

4.6.2.5 Supply chain resilience

Traditional strategies related to resilience as anticipation and coping adaptation (Duchek, 2019) or risk detection, mitigation and recovery (DuHadway *et al*., 2019) are in their early stage of coping with the challenges of this unprecedented epidemic outbreak (Ivanov, 2020a, b).

(Dubey *et al.,* 2021a, b), (El Baz and Ruel, 2021), (Hosseini and Ivanov, 2020), (Xu *et al*., 2020), (Piprani *et al*., 2020), (Gu *et al.*, 2021), (Ivanov, 2021b), (Katsaliaki *et al*., 2021), (van Hoek, 2020). (Singh and Singh, 2019) (Duchek, 2019; Kaviani *et al.,* 2020), Ambulkar *et al.* (2015).

The Cronbach's Alpha for the nine items to supply chain resilience was 0.88. Supply chain resilience is therefore measured as follows:

Our products can be made by a variety of machines and workers. SCR1
We have many alternate sources for key inputs. SCR2
Our supply contracts can be easily modified to meet specifications, quantities, and terms. SCR3
We have a significant reserve capacity of materials. SCR4
Our organisation has the right workforce to quickly boost output if needed. SCR5
We can quickly bounce back from supply chain disruption. SCR6
For a long time, our supply chain retained the same stable situation as it had before some changes occurred. SCR7
For a long time, our supply chain has been able to carry out its functions despite some damage done to it. SCR8
When changes occur, our supply chain grants us much time to consider a reasonable reaction. SCR9

4.6.3 Sustainable economic practice

According to Dey *et al*. (2000) economic performance is one of the pillars of sustainability performance and is equivalent to business performance, which is measured through productivity, cost reduction, revenue, profit, cash flow and business growth.

(Dey *et al*., 2020), (Dey *et al.,* 2019), (Dey *et al*., 2018), (Pisters *et al*., 2017)

The Cronbach's Alpha for the seven items to supply chain resilience was 0.84. sustainable economic performance is therefore measured as follows:
We have achieved higher output in recent years. SEP1
We have recently achieved higher business growth. SEP2
We have achieved a substantial reduction in the cost of service. SEP3
We have achieved higher resource efficiency. SEP4
Our overall productivity has increased. SEP5
We have diversified our products to new markets. SEP6
We have achieved a substantial reduction in the cost of production. SEP7

4.6.3.1 Environmental sustainable performance

Dey *et al.* (2000) argue that environmental sustainability of the supply chain can be achieved through the reduction of emissions and waste across the supply chain. According to Wolf (2012), the ESP indicator looks at environmental supply chain-related issues and controversies and assesses the organization's reputation among stakeholders to deal with them. The indicator examines the range to which individuals have been affected by an issue. It assesses the degree of control the organization had to prevent the issue. It also rates the quality of preventive steps taken by the organization.

(Dey *et al.*, 2020), (Sherman *et al*. 2020) (Weisz *et al.* 2011; Zhu, Johnson, Sarkis, 2018)
The Cronbach's Alpha for the seven items to supply chain resilience was 0.86. Environmental sustainable performance is therefore measured as follows:

We have reduced energy consumption in facilities. ESP1
We have substantially reduced energy consumption in production processes. ESP2
We have reduced overall CO2 emissions substantially. ESP3
We have substantially reduced waste across production processes. ESP4
We have substantially improved the recycling of waste. ESP5
We have substantially improved the reuse of machines, equipment, and finished products. ESP6
We have disposed of unused and inefficient machines and equipment on time. ESP7

4.6.3.2 Social sustainable performance

Wolf (2012) examined that this indicator provides an assessment of whether social standards are included in supply chain policies or codes of conduct and what the scope of these standards is. Organizations are expected to have a general policy statement defining their expectations for the working conditions of contractors and suppliers. Such a statement might deal with one of the following issues: (1) health and safety, (2) minimum living wages, (3) maximum working hours, (4) freedom of association/ right to collective bargaining, (5) child labour, (6) acceptable living conditions, (7) non-discrimination, (8) corporate punishment/disciplinary practices and (9) forced labour. CSR is the combination of environmental and social practices that are strategy-driven within an organization (Martinez-Conesa, Soto-Acosta and Carayannis, 2017). Environmental and social practices across the supply chain are also called green supply chain management practices, which include green product development, green design, green procurement, green manufacturing/operations, green logistics, green marketing (Luthra et al., 2011) and key aspects for achieving sustainability performance.

(Dey *et al.,* 2020), (Sherman *et al.,* 2020), (Adebanjo, Laosirihongthong and Samaranayake, 2016), (Rakovska and Stratieva, 2018), (Wolf, 2012).

The Cronbach's Alpha for the seven items to supply chain resilience was 0.86. Social sustainable performance is therefore measured as follows:

The learning and development of our employees is good. SSP1
The health and safety standards of our organization are very high. SSP2
Employee turnover in our organisation is optimum. SSP3
The wellbeing of our employees is outstanding. SSP4
We give priority to local sourcing. SSP5
We offer jobs to the people in the community. SSP6
We organize community activities to improve living conditions. SSP7
We make donations and support charity work in the community. SSP8

4.6.3.3 Sustainable healthcare performance

Sustainability from a corporate perspective is defined as the right combination of economic, environmental and social aspects (Elkington, 1994). This indicator is an overall assessment and score of an organization's social and environmental performance (Wolf, 2012).

The Cronbach's Alpha for the seven items to supply chain resilience was 0.86. Sustainable performance is therefore measured as follows:

We have reduced inventory/carrying costs. SHP1
We have reduced the cost of transportation. SHP2
We have reduced business waste across our processes. SHP3
Over the past 2 years, our customer service level has improved. SHP4
We have improved compliance with environmental standards. SHP5
We increased revenue from sustainable practices. SHP6
We have improved the work environment (safety) in recent years. SHP7

4.6.4 Measurement deployment in the survey

The questionnaire for the research study was prepared using Qualtrics software and it is divided into five sections and is contained in Appendix 3. The first section intends to seek participants' consent and the purpose of the study. The second section intends to collect demographic information and the remaining three sections contain items used to measure the constructs. In measuring the constructs, the first part intends to capture the antecedents of a sustainable supply chain model that comprises sustainability-oriented leadership and supply chain capabilities. The second part intends to measure sustainable supply chain practices that could lead to sustainable supply performance and the constructs include supply chain practices, supply chain resilience, supply chain agility, lean supply management, risk management, and supplier relationship management. The last part of the constructs contains four constructs including sustainable performance, economic sustainability, environmental sustainability and social sustainable performance. After designing the questionnaire and adding the relevant items in the constructs contained in theoretical models, there was the need to pre-test the questionnaire to be able to test the whole instrument. Two stages were used in pre-testing the questionnaire, the first part was to test the length of the questionnaire and as well the language used for each of the items. The questionnaire was therefore tested with thirty key participants in the healthcare supply chain in the jurisdiction under consideration. Proceeding from the first pre-testing exercise, data was collected from the group chosen and tested to measure the performance of the items in the respective constructs as a complete model. Having done that, full testing was conducted using both measurement models and structural equation modeling.

The questionnaire prepared with Qualtrics software was distributed through the sharing of the hyperlink created for the questionnaire to make it easier for participants to access it and that is also cost-effective. Once there is internet connectivity, just upon clicking the hyperlink, the questionnaire will be accessed. Participants were given notice about the study before the questionnaire was rolled out to them. Various authorities especially the heads of the organisations involved were duly consulted and approval was sought before engaging the respondents for the study.

4.6.5 Measure reliability and validity

Reliability focuses on the internal consistency of indicators and reflects the degree to which indicators measure a shared latent construct in the measurement model (Hair *et al.,* 2010). Both scale reliability (Holmes-Smith, 2001) and construct reliability (Steenkamp and van Trijp, 1991) are addressed. In addition, within SEM, a construct’s measures may not satisfactorily load upon their hypothesised constructs and thus adversely affect the overall CFA goodness-of-fit (Hair *et al*., 2010). The extraction of poor-performing items that adversely affect CFA performance and measurement reduction, is also addressed. Validity refers to the extent to which a measurement item measures what it is intended to measure (Bollen, 1989). Therefore, the CFA is also used to assess discriminant validity which determines if a latent construct explains more of the variance in its observed variables than it does in the observed variables of other constructs (Fornell and Larcker, 1981). Finally assessing the validity of an SEM measurement model via goodness-of-fit indices is addressed.

4.6.5.2 Construct reliability

Construct reliability uses the structural equation modeling parameters of a measurement model to capture the size of the relationship between a latent construct and the indicators that relate to the construct (Steenkamp and van Trijp, 1991). It measures the internal consistency of a set of indicators, rather than the reliability of a single indicator, and estimates of ≥ 0.70 are desirable (Hair et al., 2010).

4.6.5.3 Measure purification

Within SEM, a CFA is required to generate the output necessary to calculate both scale and construct reliability as well as discriminant validity. For these purposes, constructs that are theoretically considered to be closely related are included and estimated together as part of a CFA (Hair *et al,* 2010). For reliability purposes, indicators may be removed from a CFA's constructs, after CFA is estimated to assess goodness-of-fit. At this stage, the CFA's theta delta modification indices and the item's standardised residuals are reviewed and used as the basis to reduce each construct's items so that the goodness-of-fit measures are optimised, and that where possible the remaining items' standardised residuals do not exceed 2.58 (Byrne, 1998; Diamantopolas and Siguaw, 2000) and their modification indices do not exceed 3.84 (Byrne, 1998; Diamantopolas and Siguaw, 2000). Such item extraction is also subject to theoretical support (Diamantopolas and Siguaw, 2000). The ultimate aim is to refine a construct's indicators to eliminate those that do not contribute to the reliability of the scale or do not load satisfactorily on their hypothesised construct and this refers to measurement purification (Iacobucci and Churchill, 2010).

4.6.5.1 Scale reliability

Scale reliability in SEM is estimated via average variance extracted (AVE) analysis, using the structural equation modeling parameters of a study's measurement model (Holmes-Smith, 2001). AVE calculates the amount of variance in items or indicators that are accounted for by its associated construct. An AVE of ≥ 0.50 indicates that more than 50% of the variance in each item is explained by its associated construct, thus indicating good reliability (Hair *et al.,* 2010).

4.6.5.4 Discriminant validity

Discriminant validity estimates if a latent construct explains more of the variance in its observed variables than it does in the observed variables of other constructs (Fornell and Larcker, 1981). By comparing the AVE of a construct with the square of the construct's correlation between that and any other construct, a construct's AVE should ideally be greater than that of the square of its correlation between that and another construct.

4.6.5.5 Measurement model validity

With the measurement model specified, data collected and decisions made concerning the estimation technique to be used, Hair et al (2010) recommended that the researcher should proceed to the most fundamental event of SEM testing, measurement model validity and consideration of measurement model goodness of fit.

4.6.5.6 Measurement model goodness of fit

Regarding goodness-of-fit, by undertaking a confirmatory factor analysis, the measurement model stipulates the causal relationships between the observed variables (the scale items in the questionnaire) and the latent constructs under investigation (Hunter and Gerbing,1982). As there is normally a discrepancy in the relationships between the observed and the theoretical variables, assumed as measurement error, tests of model acceptability are required. Such tests are termed goodness-of-fit indices. Hair *et al* (2010) recommend the application and evaluation of some fit indices to assess measurement model validity, stipulating three major types. The first, absolute fit indices demonstrate the ability of the model to reproduce the actual covariance matrix (Kelloway, 1998). The second set of indices, comparative fit, shows comparing two or more competing models to assess which provides the better fit to the data (Kelloway, 1998). Whereas, the third set of indices, parsimonious fit, illustrates that a better-fitting model can always be obtained by estimating more parameters (Kelloway, 1998). There are some different fit indices available for each of the above model fit categories. It is common for researchers to only calculate and report a subset of the measures available (Hulland, Chow and Lam, 1996).

The most popular absolute fit measure is the chi-square statistic, which tests whether the null hypothesis in that the estimated covariance matrix differs from the sample covariance matrix and if it is solely due to sampling error (Baumgarnter and Homburg, 1996). The smaller the chi-square value the better the fit, so long as it is insignificant at the >0.05 level, signifying that the close differences between the models predicted and observed covariance matrices are assumed to be the result of sampling fluctuations (Hayduk, 1987). Researchers also aim to produce models with high degrees of freedom to predict an acceptable fit between the predicted and observed covariance model. Other examples of absolute fit indices are the standardised root mean residual (SRMR) and the root mean square error of approximation (RMSEA). Both indices run on a continuum from zero to one. For SRMR a value of ≤ 0.08 indicates an acceptable fit for above 250 cases, whilst for RMSEA a value of ≤ 0.07 is expected for an acceptable fit for a volume of cases above 250 (Hair *et al.,* 2010). The Chi-square statistic has several weaknesses. It increases in line with the sample size unlike RMSEA and has no upper threshold, unlike RMSEA and SRMR. As these three indicators complement each other, Hair *et al.* (2010) recommend using more than one absolute fit index. Chi-square, SRMR and RMSEA are reported for each of the models estimated in this study.

Incremental fit indices compare the fit of the estimated model against a baseline model often called the null model (Hair *et al*., 2010). Examples of incremental fit measures are the comparative fit index (CFI) and relative fit index (RFI). These indices range from 0 to 1 with values of ≥ 0.92 considered to indicate a good fit in a data set or 250 or more cases. Hair *et al.* (2010) stipulate that as a minimum, in addition to reporting the chi-square statistic and degrees of freedom, a researcher reports at least one absolute fit index and one incremental fit index. In the case of this study, CFI and RFI are reported.

Parsimonious fit measures allow for the comparison of different model formulations or competing models. Examples of parsimonious fit measures include the parsimonious normed fit index (PNFI), parsimonious goodness of fit index (PGFI) and the normed chi-square. Whilst no absolute threshold levels exist for PNFI, PGFI scores range between 0 and 1 (Byrne, 1998) and the normed chi-square should range from one to five (Fan and Wang 1998). Specifically, PNFI and PGFI should be used and reported to compare one or more competing models, with the model that returns higher PNFI and PGFI scores demonstrating a better fit (Kelloway, 1998). There are no competing models in the proposed study as only one model is to be tested; there is therefore no requirement to report parsimonious fit indices. In conclusion, the proposed study is to report for all measurement model estimations the chi-square, degrees of freedom, SRMR and RMSEA absolute fit measures along with CFI and RFI measures of incremental fit.

4.7 Structural model validity

The final step of the SEM process involves determining structural model validity (Hair *et al*, 2010). Hair *et al.* (2010) stipulate three stages to this step: identification of the structural model, evaluating the model's goodness-of-fit and testing structural relationships.

4.7.1 Structural model identification

Identification of a structural model indicates whether sufficient information is provided by the empirical data to allow for a single solution of the model's structural equations, given the model's parameters. A model is said to be identified when it is theoretically possible to calculate a unique estimate of every one of its parameters (Kline, 1998). A basic requirement for identification is that there must be as many distinct elements in the covariance matrix of the observed variables as there are model parameters (Baumgartner and Homburg, 1996). For a model to be considered as identified its degrees of freedom must be ≥ 0 (Hair *et al.,* 2010). An unidentified model is indicated by negative degrees of freedom, where the number of parameter estimates to be estimated in the model exceeds the number of data points available (Byrne, 1998). A just-identified model has zero degrees of freedom and equal numbers of parameters and observations (Byrne, 1998). An over-identified model has positive degrees of freedom where there are fewer parameters to be estimated in the model than there are data points (Byrne, 1998). Over-identification is considered to be a positive outcome, as a greater number of degrees of freedom, when combined with acceptable model fit, means the model is generalizable (Hair et al, 2010). It is the aim of this study for both structural models to be specified so that they have positive degrees of freedom and are therefore considered to be over-identified.

4.7.2 Structural model goodness of fit

The options available for goodness of fit indices in estimating a structural model are the same as those available for estimating a measurement model. As with estimating the measurement model, Hair *et al*. (2010) argue that at least one absolute measure and incremental measure should be used in support of the chi-square statistic and degrees of freedom. Therefore, the same goodness-of-fit indices used to measure the measurement model of the study are to be applied to the estimation and assessment of the study's structural models. The study therefore reports chi-square, degrees of freedom, SRMR and RMSEA absolute measures and the CFI and RFI measures of incremental fit for all structural models.

4.7.3 Testing structural relationships

Once the goodness of fit of the structural model is established as acceptable, the researcher then tests structural relationships within the model, the hypothesized structural paths, to determine whether they are significant (Hair *et al.,* 2010). Diamantopoulos and Sigauw (2000) observe that for each structural path in the model, a coefficient is computed. Each coefficient is supported by an unstandardized parameter estimate, a standard error, a t-value, an error variance and an R^2. The t-value determines the statistical significance of the structural path coefficient and is obtained by dividing the value of the parameter by its standard error (Joreskog and Sorbom, 1993). A higher t-value means that there is a lower chance of the parameter estimate having been generated by chance (Hayduk, 1987). Therefore, the structural path coefficient is significant at a particular level of significance if a t-value is greater than 1.96. For a directional, one-tailed hypothesis, the following t-values are applied to indicate specific levels of significance: 1.28 (10%), 1.645 (5%), 2.326 (1%) and 3.090 (0.1%) (Hair *et al.,* 2010). For a two-tailed hypothesis, the following t-values are applied to indicate specific levels of significance: 1.645 (10%), 1.96 (5%), 2.58 (1%) and 3.291 (0.1%) (Hair *et al*, 2010). For this study, all structural paths contained within the structural model are directional and are therefore assessed for significance against the one-tailed significance criteria.

4.8 Methodological and measurement biases

Before progressing through the methodological stages proposed in this Chapter, the methodological literature proposes that certain tests are applied to ensure that bias is not present in the research study due to the research methods deployed Podsakoff, MacKenzie, Lee and Podsakoff, 2003), the spread and timing of responses received for quantitative surveys (Armstrong and Overton, 1977) and within the data collected from multiple sites (Raudenbush and Bryk, 2002). Respectively, common method variance, non-response bias and intra-construct correlation are discussed and their respective tests are recommended for inclusion in the proposed research methodology of this study.

4.8.1 Common method variance

To reduce the potential for common method bias (CMB) in this study, we implemented two proactive measures based on the recommendation by Podsakoff et al. (2003). First, we ensured the anonymity of responses in our survey, which encouraged participants to answer honestly and avoid giving responses they perceived as socially acceptable. Second, we will employ Harman’s single-factor test along with a Variance Inflation Factor (VIF) analysis to thoroughly examine the presence of CMB. The results from

Harman's test will indicate if there is or no single factor dominating the variance, with no factor explaining more than 50% of it. Additionally, we will check for multicollinearity among the constructs to verify that the VIF scores are all below the threshold of 3.3 as recommended by Hair et al. (2013), which will further confirm the absence of multicollinearity and CMB. These rigorous steps will enhance the credibility of this study, ensure that the findings are free from bias and set a high standard for future research in similar fields.

4.8.2 Non-response bias

Even though this study does not involve mailing potential respondents, having to then optimize the response over a period, it remains that a proportion of potential respondents may not complete the survey instrument. Such non-response potentially may lead to non-response bias, a form of non-sampling error that occurs when some of the respondents included in the sample do not respond (Malhotra, 1993 p.106). The concern is that non-response may lead to a non-sampling error introduced when a segment of the defined population is either not represented or under-represented in the data collected (Hair, Bush and Ortinau, 2000). Non-response bias is to be tested in this study, as data was collected from thirty-two (32) healthcare facilities over three weeks. In their formative journal article, Armstrong and Overton (1977) propose that late respondents have more in common with non-respondents than early respondents. Therefore, a sample of late respondents' data is to be compared in a t-test with a sample of early respondents' data, for all the constructs contained in the study's theoretical model, to establish if there are differences between the two groups.

4.8.3 Intra-construct correlation

Data collected from multiple sites, even though it is collected from the same research subjects at the same level, i.e., healthcare facilities, cannot be automatically pooled into one data set. In the case of the proposed study, before the pooling of the data, it must first be established if the calculated variance between constructs is different from the variance present between factors. Such an intra-construct correlation measures the degree of similarity between the two clusters, for each construct, and if the ICC test indicates a score of ≤ 0.10 for each construct then the clusters are dis-similar (Raudenbush and Bryk, 2002). Calculated by estimating a MANOVA, if the facility level variance represents less than 10% of the combined variance, for each construct, then the data for all thirty-two facilities may be pooled (Raudenbush and Bryk, 2002).

4.9 Methodology summary and conclusions

This chapter first debated the underlying research philosophy to be adopted in the proposed study and concluded that the study significantly leaned towards adopting a scientific realist philosophy. Having discussed the relative merits and implications of the exploratory, descriptive and causal research designs, it is concluded that the proposed research design comprises both exploratory and descriptive elements. In following previous supply chain research, an extensive literature review to determine a model of SSCMP is proposed as the exploratory research element of the proposed study's research design. The hypotheses are to be tested as the descriptive element of the research design to determine the relationships between SSCMP constructs along with the frequency of occurrence of such relationships. In debating the relative merits of deploying either qualitative or quantitative methodologies for this stage of the proposed research study, both a qualitative research method and structural equation modeling, a mixed methods research method, are considered as potentially appropriate in meeting the requirements for the descriptive element of the research design. However, given the research context of researching multiple institutions, structural equation modeling (SEM), a quantitative methodology, is considered the most appropriate method to deliver the requirements of the descriptive element of the research design. In selecting SEM, it is also proposed that primary data is collected, using a survey instrument, based on a cross-sectional rather than longitudinal study. Having discussed the sampling methodology for the study it is concluded that a sample of healthcare organisations from the Ashanti region of Ghana is considered a representative sample of the overall population of Ghana health service. The operationalizing of the study is addressed by conceptually and operationally defining each of the latent constructs in the SSCMP theoretical model. The means of measuring the reliability and validity of the constructs concludes that each is tested for scale and construct reliability; their measurement items are purified via confirmatory factor analysis to ensure that their items effectively represent and load onto their latent constructs and that discriminant validity is also tested. The validity of both the measurement model and structural model are discussed, establishing that the goodness-of-fit for each is to be evaluated in the reporting of chi-square, degrees of freedom, RSMR and RMSEA absolute fit indices and the CFI and RFI measures of incremental fit. Finally, the empirical findings will be validated using focus group discussions.

CHAPTER FIVE - DATA ANALYSIS AND RESULTS

5.1 Introduction

This chapter presents the results of the analyses results of the study that was conducted using the statistical technique discussed in Chapter 4. This chapter follows the widely accepted reporting style of PLS analysis as suggested by past academic studies (Chin, 2010). The validity and reliability of the measurement model are assessed and the structural model is validated. It comprises five sections with a concluding summary. Different hypotheses were proposed to evaluate the relationship between predictors on the outcome and they are as follows:

Hypothesis 1: Sustainability-oriented leadership positively and significantly impacts sustainable supply chain practices.

Hypothesis 2: Supply chain capabilities have a positive and significant relationship with sustainable supply chain practices.

Hypothesis 3: Sustainable supply chain practice has a positive and direct effect on sustainable healthcare performance.

Hypothesis 4: Sustainable healthcare performance positively and significantly impacts economic performance.

Hypothesis 5: Sustainable healthcare performance significantly and positively impacts environmental sustainability.

Hypothesis 6: Sustainable healthcare performance is positively and significantly related to social performance in an organisation.

Hypothesis 7: Sustainable supply chain practices positively and significantly impact sustainable economic performance.

Hypothesis 8: Sustainable supply chain practices positively and significantly impact environmental sustainability.

Hypothesis 9: Sustainable supply chain practices positively and significantly influence sustainable social performance.

Hypothesis 10: Sustainability-oriented leadership has a positive and significant impact on sustainable economic performance.

Hypothesis 11: Sustainability-oriented leadership positively and significantly influences environmental sustainable performance.

Hypothesis 12: Sustainability-oriented leadership has a positive and significant influence sustainable social performance.

Hypothesis 13: Supply chain capabilities positively and significantly impact sustainable economic performance.

Hypothesis 14: Supply chain capabilities have a positive and significant impact on environmental sustainable performance.

Hypothesis 15: Supply chain capabilities positively and significantly influence sustainable social performance.

Hypothesis 16: Sustainability-oriented leadership positively and significantly influences sustainable healthcare performance.

Hypothesis 17: Supply chain capabilities positively and significantly impact sustainable healthcare performance.

Firstly, the data is screened for missing data and descriptive statistics are reported in (5.2). Within the subsequent section (5.3) confirmatory factor analyses are estimated for all constructs within the construct groupings of the measurement model: SOL, SCC, SSCP and SEP and the triple bottom lines (economic, environmental and social). Each grouping is assessed for scale reliabilities and construct reliability and poor-performing items are extracted from each construct scale to meet the requirements set for each of reliability. Next, each construct's measures are purified to increase CFA overall goodness-of-fit by disregarding the item's excessive standardised residuals and theta-delta modification indices. Finally, discriminant validity is assessed to arrive at a set of constructs and their associated measurement items that comprise the final measurement model. Common method bias, non-response bias and intra-construct correlation are then tested and reported (5.4), before estimating and reporting the study measurement model (5.5). Finally, the study's structural model and its results are reported, including the goodness-of-fit indices and the significance of the hypothesised structural model paths (5.6). The chapter is summarised and concluded in section (5.7).

5.2 Data screening, descriptive statistics, and data testing

SmartPLS version 4.0.1.0.6 and SPSS version 28.0 were adopted to first analyse the research data, before exporting the data to SEM data analysis package to estimate the reliability, validity, CFAs, measurement model and structural model.

5.2.1 Data screening

Before the analysis, the data under study was screened for missing data. The data collection from the thirty-three healthcare facilities, conducted within three weeks, resulted in the submission of 660 responses. After a careful review, 55 cases contained over 20% missing data and were rejected, leaving a final sample of 605 cases. Of the final sample of 605 cases, 65 contained missing values ranging from one missing value per case to a maximum of three missing values per case. The data was assumed to be 110 missing at random across the data set as the values were missing completely at random for all cases and all variables. Per section 4.5.2 of this thesis, the Expectation-Maximisation (EM) algorithm method (Dempster, Laird and Rubin, 1977) was used within SPSS to impute and replace missing values to finally arrive at 550 eligible data.

Table 5.1 Missing values

Values missing	1	2	3
Number of cases	40	20	10

5.2.2 Descriptive statistics

Descriptive statistics for the demographic variables and indicators of the latent constructs are presented in Table 5.2 below. The respondents are characterized as both male and female in the public service with females having the majority in terms of numbers. Respondents within the age group of 30-39 recorded the highest responses while respondents between 50 and 60 recorded the lowest. Regarding roles, nurses dominate with administrative managers having the least. With experience in the majority spanning up to twenty-six years length of service, only one supply/procurement officer recorded that tenure while one nurse had a year of experience. The type of facility that recorded the highest number of respondents was the district hospital and the least was health service administration. The sample adequacy test result using KMO is .969 and p-value = <.001 as shown in Table 5.2 below.

Table 5.2 KMO sampling adequacy

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.969
Bartlett's Test of Sphericity	Approx. Chi-Square	41646.263
	df	5356
	Sig.	.000

Gender

The sample of the total sustainable healthcare supply chain participants consisted of 229 (41.6%) male and 321 (58.4 %) female respondents, hence the total sample (N=550).

Table 5.3 Demographics of survey respondents

Category	Specific Category	Respondents (n)	Respondents (%)
Gender	Male	229	41.6%
	Female	321	58.4%
Age Groups	18-29	177	32.2%
	30-39	212	38.5%
	40-49	131	23.8%
	50-60	30	5.5%

Age Groups / Gender	Male	Female		
18-29	42	135	177	32.2%
30-39	121	91	212	38.5%
40-49	57	74	131	23.8%
50-60	9	21	30	5.5%

Gender / Role			
	Medical Officer	16	2.9%
	Male 9		
	Female 7		
	Pharmacist	34	6.2%
	Male 20		
	Female 14		
	Admin. Manager	11	2%
	Male 7		
	Female 4		
	Supply/Procurement Officer	139	25.3%
	Male 86		
	Female 53		
	Nurse	331	60.2%
	Male 92		
	Female 239		
	Others	19	3.4%
	Male 15		
	Female 4		

Facility / Size	Medium (50-249)	Large (>250)	Total
Reg. Medical Store	27	0	27
District Hospital	76	125	201
Municipal Hospital	96	25	121
Metro. Hospital	65	58	123
Teaching Hospital	7	47	54
Health Admin.	6	11	17
Other	5	2	7
Total	282	268	550

Facility / Role	Medical Officer	Pharmacist	Admin. Manager	Supply / Procurement Officer	Nurses	Others	Total
Reg. Medical Store	0	12	0	14	0	1	27
District Hospital	5	10	4	22	150	10	201
Municipal Hospital	4	5	0	44	66	2	121
Metro. Hospital	2	7	0	42	72	0	123
Teaching Hospital	3	1	1	14	33	2	54
Health Admin.	0	0	6	2	7	2	17
Other	1	0	0	1	3	2	7
Total	15	35	11	139	331	19	550

Age groups / Role	18-29	30-39	40-49	50-60
Medical Officer	3	3	8	1
Pharmacist	3	15	14	3
Admin. Manager	0	8	1	2
Supply/Procurement Officer	14	77	44	4
Nurse	152	97	62	20
Others	5	12	2	0
Total	177	212	131	30

1.3 Multicollinearity, reliability, and validity

When using SEM qualitative measures such as face validity are not considered sufficient evidence of validity. Instead, researchers should draw on quantitative measures that allow for more precise assessments. Internal consistency reliability and convergent and discriminant validity must be established to assess reflective measurement models. Internal consistency reliability was traditionally assessed using Cronbach's alpha. Composite reliability is recommended as more appropriate, however, since it considers the indicators' differential weights (Chin, 1998; Dijkstra and Henseler, 2015), whereas Cronbach's alpha weights the indicators equally (tau equivalence). Convergent validity is evaluated by examining the outer loadings of the indicators to determine the average variance extracted (AVE) from each construct. The outer loadings should exceed 0.708 because the square of that number indicates the construct score includes at least 50% of the variable's variance (Henseler et al., 2015). AVE is a summary indicator of convergence calculated from the variance extracted for all items loading on a single construct (Hair et al., 2010). The rule of thumb for adequate convergence is an AVE > 0.50, indicating that more than half of the indicator variance is included in the construct score (Hair et al., 2017c).

5.3.1 Introduction

This section of the data analysis estimates seven confirmatory analyses in preparation for the estimation of the study's measurement model. In preparation for the estimation of the study's measurement model, it is necessary to assess the reliability of the measures for each latent construct, testing to assess if the variance in each item is explained by its associated construct (scale reliability). In addition, it is also necessary to establish if the measurement items of a construct load satisfactorily on their hypothesised construct. This ensures that those measures that do not measure adequately are removed to purify a latent construct's measurement items. Such measure purification is iteratively estimated to a standard that renders them useful for subsequent analysis (Iacobucci and Churchill, 1979). Finally, before inclusion in the estimation of the study's measurement model, it is also necessary to establish if each latent construct explains more of the variance in its measurement items than it does in the measurement items of other constructs (discriminant validity). From the above, it is necessary seven confirmatory factor analyses for seven groups of constructs, sustainability-oriented leadership (5.3.2), supply chain capabilities (5.3.2), sustainable supply chain practice (5.3.4), sustainable performance (5.3.5), economic performance (5.3.6), environmental performance (5.3.7) and social performance (5.3.8).

5.3.2 Multicollinearity assessment of the outer model

Structural model coefficients for the relationships between constructs are derived from estimating a series of regression equations. As the point estimates and standard errors can be biased by strong correlations of each set of predictor constructs (Sarstedt and Mooi, 2019; Chap. 7), the structural model regressions must be examined for potential collinearity issues. Variance Inflation factors (VIF) above are indicative of potential collinearity issues among the predictor constructs, but collinearity can also occur at a lower VIF of 3 - 5 (Becker, Ringle and Sarstedt and Vololckner, 2015; Mason and Perreault, 1991). If collinearity becomes a problem, a commonly used option is to create a higher-order construct (Hairer, Risher, Sarstedt and Ringle, 2010; Hair Sarstedt, Ringle and Gudergan, 2018, Chap.2, Sarstedt et al.,2019). Table 5.4

below shows that collinearity is not a critical issue since the respective VIF meets the thresholds of < 3 or < 5. According to Hair et al. (2016), multicollinearity is not a serious issue if the VIF value is below 5.

Table 5.4 Multicollinearity Statistics (VIF) for indicators

Factor loadings	VIF
SOL2	1.574
SOL3	1.565
SOL6	1.428
SCC2	1.495
SCC3	1.512
SCC7	1.584
SSCP1	2.024
SSCP2	2.095
SSCP3	1.782
SSCP6	1.759
SSCP7	1.746
SHP1	1.518
SHP2	1.808
SHP3	1.673
ESP1	1.700
SEP2	1.464
SEP3	1.497
SEP5	1.392
SEP7	1.537
ESP2	1.560
ESP3	1.549
ESP7	1.478
SSP3	1.545
SSP5	1.389
SSP7	1.314
SSP8	1.384

5.3.2.1 Construct reliability

Table 5.5 Construct reliability statistics

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
ESP	0.790	0.802	0.864	0.613
SCC	0.758	0.764	0.860	0.673
SEP	0.761	0.767	0.847	0.582
SHP	0.784	0.785	0.874	0.699
SOL	0.753	0.760	0.858	0.669
SSCP	0.860	0.864	0.900	0.642
SSP	0.737	0.740	0.835	0.560

According to Mark (1996) ''Reliability is defined as the extent to which a measuring instrument is stable and consistent. The essence of reliability is repeatability. If an instrument is administered over and over, will it produce the same results?'' (p.285). The two most commonly used methods for establishing reliability include Cronbach Alpha (α) and Composite Reliability (CR). The results for both Cronbach Alpha and composite reliability are presented in Table 5.5. The Cronbach's Alpha ranged from 0.753 to 0.860 whereas Composite Reliability statistics ranged from 0.835 to 0.900. Both indicators of reliability have reliability statistics over the required threshold of 0.70 (Hair et al., 2017). Hence, construct reliability is established.

For the initial group of conceptual model comprising SOL, SCC, and SSCP, the estimated scale reliabilities are assessed in the form of Cronbach alpha (α), composite reliability (rho_c) and Average Variance Extracted (AVE). SOL construct showed (α = 0.753, rho_c = 0.858, AVE = 0.669), SCC (α = 0.758, rho_c = 0.860, AVE = 0.673) and SSCP (α = 0.860, rho_c = 0.900, AVE = 0.642), indicating that more than 50% of the variance in each item within the SOL, SCC and SSCP construct are explained by its associated construct (Hair *et al*., 2017). According to the standardized result matrix, measurement items SOL1, SOL4 and SOL5 were disregarded from the SOL construct, resulting in an AVE of 0.699 to meet the ≥ 0.50 AVE threshold. Removing SCC1, SCC 4, SCC5 and SCC6 resulted in 0.673 AVE for the SCC construct. Deleting measurement items SSCP1, SSCP2, SSCP3 and SSCP7 led to an AVE of 0.642 for the SSCP construct and exceeded the AVE threshold of ≥ 0.50. The estimated composite reliability report for SOL is (0.858) which is above the compost reliability threshold of ≥ 0.70, indicating an acceptable relationship between the SOL latent construct and the measurement items. The estimated composite reliability for the SCC construct is 0.860 which is also above the reliability threshold and thus indicates a good relationship between the items while the estimated composite reliability for the SSCP construct is 0.900 also above the reliability threshold ≥ 0.70 (Hair *et al*, 2010). The final stage of the conceptual model including SHP, SEP, ESP and SSP recorded the following: SHP (α = 0.784, rho_c = 0.874, AVE = 0.699), SEP (α = 0.761, rho_c = 0.847, AVE = 0.582), ESP (α = 0.753, rho_c = 0.858, AVE = 0.699), ESP (α = 0.790, rho_c = 0.864, AVE = 0.613) and SSP (α = 0.737, rho_c = 0.835, AVE = 0.560).

Demonstrating that more than 50% of the variance in each item within the SHP, SEP, ESP and SSP are explained by its associated construct (Hair *et al*., 2017). Factors such as SHP4, SHP5, SHP6 and SHP7 were omitted to achieve the AVE of 0.699 to meet the criteria of ≥ 0.50 for the SHP construct. Again, the deletion of measurement items SEP1, SEP4 and SEP6 resulted in the AVE of 0.582 to meet the threshold of ≥ 0.50. ESP4, ESP5 and ESP6 manifest items were removed from the ESP construct to achieve the AVE OF 0.613 meeting the criteria of ≥ 0.50. Finally, manifest items SSP1, SSP2, SSP3, SSP5 and SSP6 were disregarded to obtain the AVE of 0.560 to meet the threshold of ≥ 0.50 for the SSP construct as recommended by Hair et al. (2017).

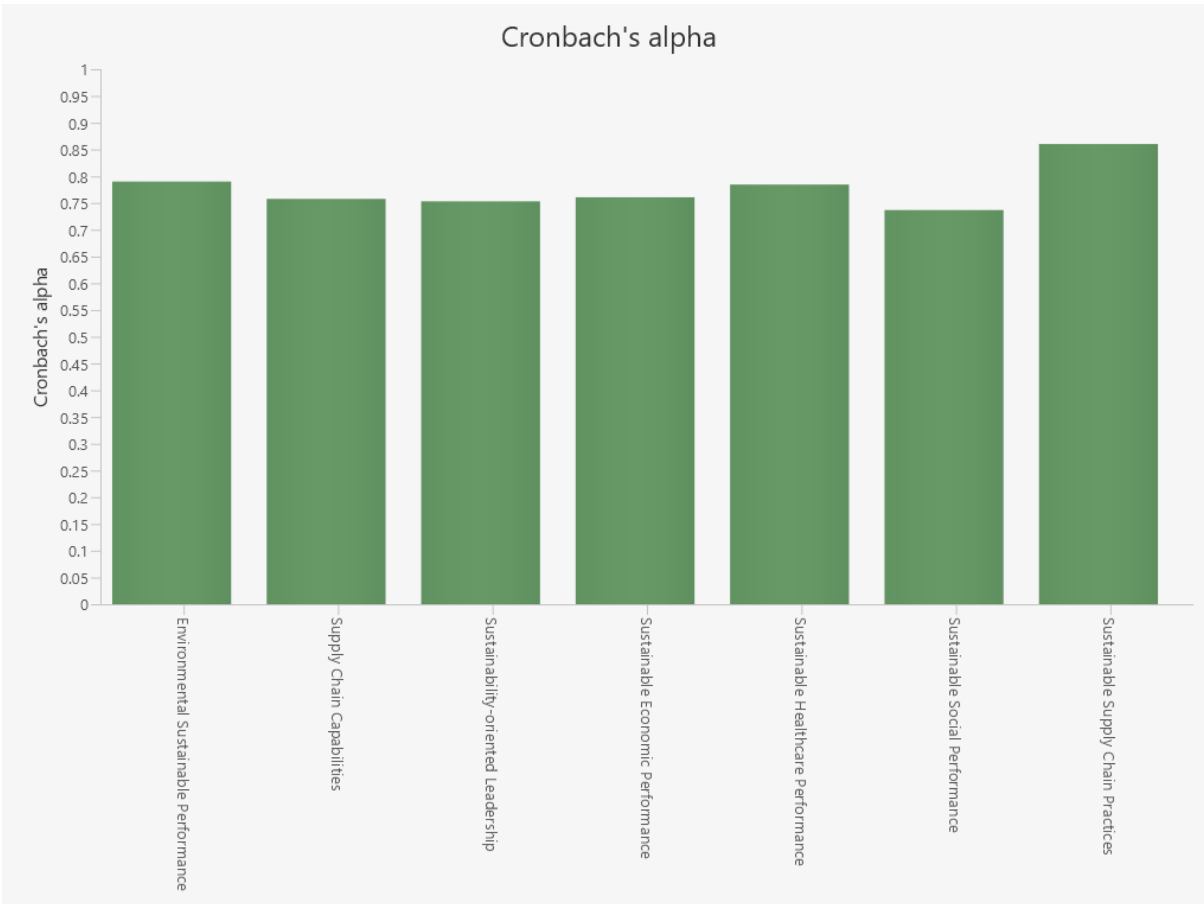

Figure 5.1 Construct reliability bar chart – Cronbach's alpha

5.3.2.2 Construct Validity

Statistically applying PLS-SEM, construct validity is established when there is convergent validity and discriminant validity.

5.3.2.3 Convergent Validity

"Convergent is the degree to which multiple attempts to measure the same concept are in agreement. The idea is that two or more measures of the same thing should covary highly if they are valid measures of the concept'' (Bagozzi et al., 19991, p.425). When the AVE value is greater than or equal to the recommended value of < 0.50, items converge to measure the underlying construct and hence establish convergent validity (Fornell and Larcker, 1981). Convergent validity results based on the AVE statistics in this study show that all constructs passed the AVE threshold of < 0.50. Table 5.6 shows the AVE for each of the constructs.

Table 5.6 Construct convergent validity (AVE)

	Average Variance Extracted (AVE)
ESP	0.613
SCC	0.673
SEP	0.582
SHP	0.699
SOL	0.669
SSCP	0.642
SSP	0.560

5.3.2.4 Discriminant validity

Table 5.4 below reports the discriminant validity for the constructs, post-measure purification, showing average variance extracted for each on the diagonal with construct correlations below the diagonal and squared construct correlations above the diagonal. Discriminant validity denotes that a construct is empirically unique from the other constructs in the SEM (Hair et al., 2010). That is, establishing discriminant validity means that each construct captures a unique phenomenon not represented by any other construct in the model (Hair et al., 2017c). A common approach to assess discriminant validity is the Fornell-Larcker criterion (1981), which compares the AVE (shared variance within) of the constructs to the squared correlation between the constructs (shared variance between). For variance-based SEM (PLS-SEM), a more precise measure of discriminant validity, the heterotrait-monotrait ratio of correlations (HTMT), was recently proposed (Henseler et al., 2015). In contrast, the Fornell-Larcker criterion continues to be the most widely applied discriminant validity approach with CB-SEM, although Voorhees et al. (2016) recommend HTMT

Table 5.7 Discriminant Validity Statistics: Fornell and Larcker criterion

	ESP	SCC	SEP	SHP	SOL	SSCP	SSP
ESP	***0.783***						
SCC	0.614	***0.820***					
SEP	0.738	0.628	***0.763***				
SHP	0.752	0.681	0.720	***0.836***			
SOL	0.588	0.788	0.601	0.684	***0.818***		
SSCP	0.706	0.776	0.679	0.789	0.761	***0.801***	
SSP	0.745	0.644	0.683	0.740	0.629	0.734	***0.748***

Table 5.7 shows the discriminant validity for all constructs. The AVEs for the initial part of the conceptual model are as follows: SOL is 0.818, SCC is 0.820 and SSCP is 0.801. Below diagonal figures show construct inter-correlations and diagonal figures show squares of construct inter-correlations. The squares of construct inter-correlations for SOL, SCC and SSCP are greater than their respective individual AVE, indicating a more acceptable degree that each distinctive construct differs from each other (Hair *et al,* 2010). Likewise, the squares of SHP, SEP, ESP and SSP recorded the following in their respective order: 0.86, 0.763, 0.783 and 0.748. All the constructs are closely correlated, with each significantly contributing to and explaining the variance in their respective latent construct measurement.

5.3.2.5 Discriminant Validity – Cross Loadings

To establish discriminant validity using the Fornell-Larcker criterion the square root of AVE of each construct should be greater than the correlation with any other construct in the framework (Fornell & Larcker, 1981), whereas to establish discriminant validity using the cross-loadings method, the outer loading of each item on its associated construct should be greater than the loading of the item on other constructs (Chin, 1998). There are two methods to assess discriminant validity using HTMT; comparing with the threshold of either 0.85 or 0.9 (Henseler et al., 2015), and using inference statistics to test the hypothesis that HTMT=1 (Franke & Sarstedt, 2019). Using suggested thresholds, the value of HTMT should not be lower than 0.85 or 0.9, whereas to apply inference statistics the hypothesis HTMT=1 should be rejected. Fornell-Larcker criterion, cross-loading method, and the HTMT can only be used to reflect constructs to establish discriminant validity. The full collinearity test to assess discriminant validity was suggested by Rasoolimanesh et al. (2017), which can be applied to both reflective and formative constructs. The literature has proposed calculating variance inflation factors (VIFs) as measures of collinearity for each construct and then comparing these VIFs with a threshold of 10, 5, or the more conservative threshold of 3.3 (Kock, 2020; Kock & Lynn, 2012). Table 5.8 below shows the discriminant validity cross-loadings to support the argument in this study.

Table 5.8 Discriminant validity - cross-loading

	ESP	SCC	SEP	SHP	SOL	SSCP	SSP
ESP1	**0.835**	0.538	0.635	0.696	0.548	0.642	0.652
ESP2	**0.775**	0.429	0.583	0.563	0.404	0.516	0.551
ESP3	**0.780**	0.498	0.535	0.572	0.447	0.551	0.586
ESP7	**0.740**	0.449	0.554	0.500	0.428	0.481	0.534
SCC2	0.492	**0.813**	0.506	0.565	0.673	0.642	0.522
SCC3	0.576	**0.837**	0.553	0.614	0.663	0.689	0.575
SCC7	0.429	**0.811**	0.480	0.484	0.597	0.567	0.479
SEP2	0.530	0.494	**0.766**	0.547	0.472	0.516	0.525
SEP3	0.602	0.540	**0.793**	0.627	0.541	0.577	0.567
SEP5	0.540	0.403	**0.712**	0.474	0.373	0.471	0.478
SEP7	0.576	0.466	**0.776**	0.535	0.429	0.500	0.506
SHP1	0.633	0.570	0.640	**0.825**	0.592	0.706	0.670
SHP2	0.624	0.586	0.589	**0.854**	0.575	0.644	0.588
SHP3	0.627	0.550	0.574	**0.829**	0.547	0.623	0.592
SOL2	0.527	0.688	0.552	0.618	**0.847**	0.670	0.551
SOL3	0.471	0.603	0.472	0.562	**0.825**	0.610	0.507
SOL6	0.440	0.642	0.443	0.492	**0.781**	0.584	0.481
SSCP1	0.561	0.683	0.564	0.664	0.664	**0.826**	0.596
SSCP2	0.621	0.682	0.583	0.703	0.673	**0.841**	0.668
SSCP3	0.508	0.574	0.500	0.573	0.547	**0.778**	0.516
SSCP6	0.550	0.588	0.548	0.586	0.603	**0.781**	0.599
SSCP7	0.581	0.568	0.521	0.622	0.550	**0.777**	0.549
SSP3	0.614	0.518	0.541	0.598	0.507	0.584	**0.801**
SSP5	0.572	0.451	0.517	0.537	0.448	0.507	**0.736**
SSP7	0.523	0.506	0.538	0.523	0.472	0.546	**0.712**
SSP8	0.516	0.450	0.447	0.553	0.451	0.555	**0.741**

5.4 Method, response and sampling biases

Chapter four, which presented the research methodology, identified three potential biases that require testing before progressing to the estimation of the study's measurement model. They are common method variance, non-response bias and inter-construct correlation.

5.4.1 Common method bias

To reduce the potential for common method bias (CMB) in this study, we implemented two proactive measures based on the recommendation by Podsakoff et al. (2003). First, we ensured the anonymity of responses in our survey, which encouraged participants to answer honestly and avoid giving responses they perceived as socially acceptable. Second, we employed Harman's single-factor test along with a Variance Inflation Factor (VIF) analysis to thoroughly examine the presence of CMB. The results from Harman's test indicated that there was no single factor dominating the variance, with no factor explaining more than 50% of it. Additionally, we checked for multicollinearity among the constructs and found that the VIF scores were all below the threshold of 3.3 as recommended by Hair et al. (2013), which further confirmed the absence of multicollinearity and CMB. These rigorous steps improved the credibility of this study, ensuring that the findings are free from bias and set a high standard for future research in similar fields.

5.4.2 Non-response bias

Emphasizing the significance of accounting for non-response bias is crucial in research and data collection pursuits, as Chen and Paulraj (2004) underscored. This highlights the relevance of ensuring that the sampled subset reflects the entire demographic in question and that proactive measures are initiated to recognize and mitigate potential biases stemming from non-responses. The collected responses were separated into two primary clusters (early 137 respondents as against late 137 respondents). The analysis indicates t-values greater than the critical value 1.96 and p-values <.05, maintaining a 95% confidence threshold. Consequently, the research findings remain unmarred by the effects of non-response bias aligning with the guidelines proposed by Armstrong and Overton (1977).

Table 5.9 Non-response bias test

	Early Respondents n (137)		Late Respondents n (137)		95% Confidence Interval		
Variable	Mean	Std. Deviation	Mean	Std. Deviation	t-test	One-Sided p	Two-Sided p
SOL	4.1189	.87368	4.6032	.53667	5.285	<.001	<.001
SCC	4.0091	.83832	4.6661	.53814	7.531	<.001	<.001
SSCP	3.8871	.78873	4.5631	.67220	7.225	<.001	<.001
SHP	4.0416	.72282	4.6025	.63205	6.477	<.001	<.001
SEP	3.9677	.76264	4.5130	.63361	6.152	<.001	<.001
ESP	3.7708	.88212	4.4285	.67825	6.761	<.001	<.001
SSP	4.0927	.73898	5.07713	.67920	6.771	<.001	<.001

5.5 Measurement model estimation

The quality of constructs in this study is assessed based on the evaluation of the measurement model. The assessment of the quality criteria starts with the evaluation of the factor loadings which is followed by establishing the construct reliability and construct validity. Factor loadings refer to the ''extent to which each of the items in the correlation matrix correlates with the given principal component. Factor loadings can range from -1.0 to +1.0, with higher absolute values indicating a higher correlation of the item with the underlying factor'' (Pett et al., 2003, p.299). None of the items in the study had a factor loading less than the recommended value of 0.50 (Hair et al., 2016). Hence, no items were further removed.

5.5.1 Measurement model constructs

The results of a confirmatory factor analysis for the study's measurement model are presented and assessed in this section. The study's measurement model comprises the following constructs:

Sustainability-oriented leadership (SOL)
Supply chain capabilities (SCC)
Sustainable supply chain practice (SSCP)
Sustainable healthcare performance (SHP)
Sustainable economic performance (SEP)
Environmentally sustainable performance (ESP)
Social sustainable performance (SSP)

The above constructs are contained in the theoretical model that facilitates sustainable performance. Each of the construct's measurement items was purified in section 5.3 to the extent that each construct demonstrated acceptable scale reliability, construct reliability and discriminant validity issues. In total seven constructs were estimated, totalling 26 measurement items for 550 complete cases. First, the completely standardised factor loading (Lambda-X), and their associated standard error (Theta-Delta) and t-values are reported for each item, supported with an overview of the estimated t-values. Subsequently, the correlations of latent constructs are presented including their squared multiple correlations. Finally, the goodness-of-fit of the study's measurement model is assessed.

5.5.2 Estimated measurement model

As indicated in Table 5.7, all the reported standardised factor loadings (Lambda-X) are above a minimum of 0.50, with a significant number reporting above 0.70, and all are significant with t-values ranging from 3.479 to 17.25 indicating significance at $p < .001$.

Table 5.10 Standardised Lambda-X and Theta Delta for the measurement model

	SOL	SCC	SSCP	SHP	SEP	ESP	SSP
SOL2	0.847						
SOL3	0.825						
SOL6	0.781						
SCC2		0.813					
SCC3		0.837					
SCC7		0.811					
SSCP1			0.826				
SSCP2			0.841				
SSCP3			0.778				
SSCP6			0.781				
SSCP7			0.777				
SHP1				0.825			
SHP2				0.854			
SHP3				0.829			
SEP2					0.766		
SEP3					0.793		
SEP5					0.712		
SEP7					0.776		
ESP1						0.835	
ESP2						0.775	
ESP3						0.780	
ESP7						0.740	
SSP3							0.801
SSP5							0.736
SSP7							0.712
SSP8							0.741

1. Sustainability-oriented Leadership (SOL)
2. Supply Chain Capabilities (SCC)
3. Sustainable Supply Chain Practice (SSCP)
4. Sustainable Healthcare Performance (SHP)
5. Sustainable Economic Performance (SEP)
6. Environmental Sustainable performance (ESP)
7. Sustainable Social performance (SSP)

5.6 Structural model estimation

This section of the data analysis applies SEM to estimate the study's structural model. Firstly, the structural model results are reported, the goodness of fit is assessed and finally, the hypotheses contained in the study's theoretical model are assessed for structural model support.

5.6.1 Structural model hypothesised relationships

The structural model adopts sustainability-oriented leadership, supply chain capabilities sustainable supply chain practice and sustainable performance constructs as presented in the study's theoretical model. Having identified the constructs, the model tests the hypotheses developed and presented in the study's literature review. It tests the constructs classified as the enablers of sustainable practice as construct groups and sustainable performance with its sub-group triple bottom line as another group of constructs with sustainable supply chain practice playing a mediating role. Through the process of measuring purification and the testing of each construct for scale reliability, construct reliability and discriminant validity, some measuring items within the constructs study's theoretical model that performed poorly were removed as depicted earlier based on the CFA estimation of the measurement model because of their potential negative influence upon measurement model goodness-of-fit performance.

5.6.1 The structural model with full paths

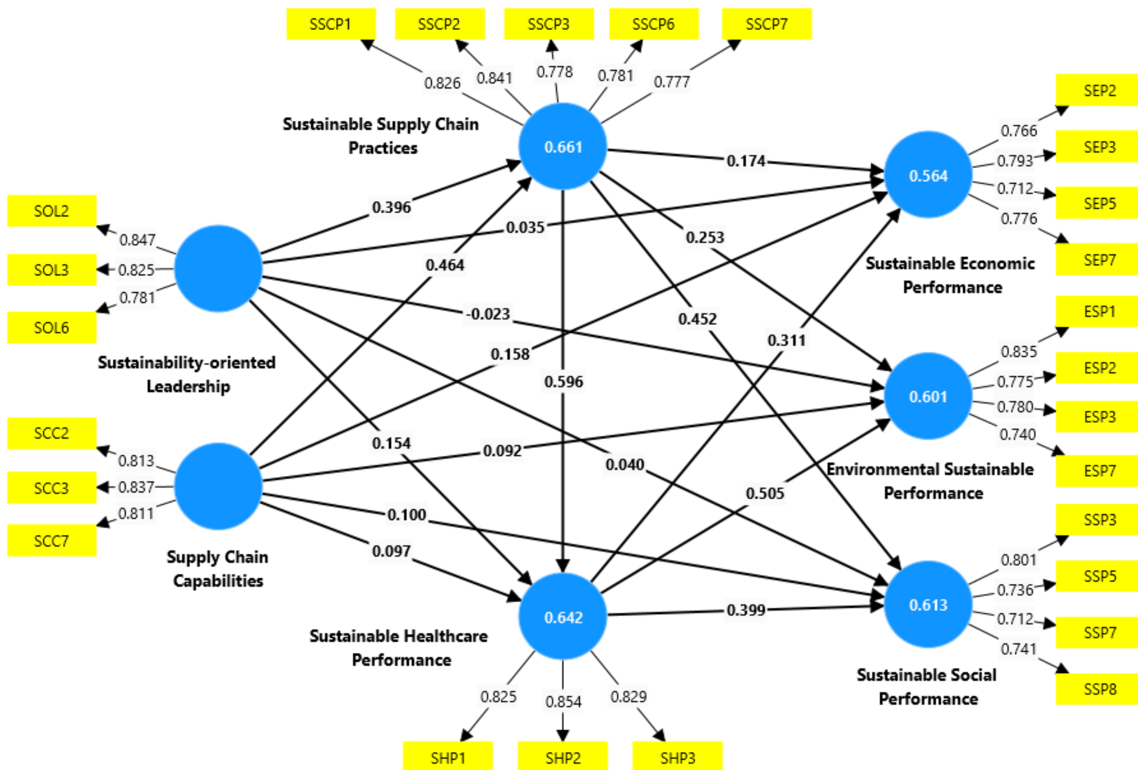

Figure 5.2 Structural model

5.6.2. Structural model goodness-of-fit

A structural equation model generated through AMOS was used to test the relationships among the study's constructs. A good fitting model is accepted if the value of the chi-square degrees of freedom (CMIN/DF) is < 0.5, the goodness-of-fit (GFI) indices are> 0.90; the Tucker and Lewis (1973) index (TLI) is > 0.90, the confirmatory fit index (CFI) (Bentler, 1990) is > 0.90 (Hair *et al.*, 2010). In addition, an adequate-fitting, model was accepted if the AMOS computed value of the standardized root mean square residual (SRMR) < 0.05 (Hair *et al.,* 2010), and the root mean square error of approximation (RMSEA) is between 0.05 and 0.08 (Hair *et al*., 2010). Thus, the study's results as shown in Table 5.11 are acceptable.

Table 5.11 The goodness of fit model test

Fitting Index	CMIN/DF	GFI	AGFI	CFI	TLI	RMSEA	SRMR	P-Value
Test value	< 5	>.9	>.8	>.9	>.9	< 0.08	< .05	
Evaluation Criterion	2.485	.903	.885	.940	.934	.05	.0338	< .001

5.6.3 Structural model path and hypotheses assessment

This section examines the strength and significance of the paths specified between constructs in the study's structural model and their support of the hypotheses proposed in the study's theoretical model. The completely standardised path estimate (Gamma or Beta) and the associated t-value is reported for each path. A summary of the path results for the structural model and a structural model path diagram with completely standardised path estimates and levels of significance are presented in Table 5.12.

The squared multiple correlation (R^2) for sustainable supply chain practice is 0.661, this shows that 66% of variance in sustainable supply chain practice is explained by sustainability-oriented leadership, supply chain capabilities and sustainable performance. The R^2 for sustainable performance is 0.642, this indicates that 64.2% variance of sustainable performance is explained by sustainable supply chain practice. Additionally, the R^2 for economic performance, environmental performance and social performance were respectively 0.564, 0.601, and 0.613. These R^2 values indicate that 56.4% of the variance in economic performance is accounted for by sustainable performance, 60.1% of the variance in environmental performance is accounted for by sustainable performance and finally, 61.3% of the variance in social performance is explained by sustainable performance. The study assessed the impact of sustainability-oriented leadership on sustainable supply chain practice, the impact of supply chain capabilities on sustainable supply chain practice, the impact of sustainable supply chain practice on sustainable performance as well as the impacts of sustainable performance on its triple sub-group termed as triple bottom line (TBL) which are economic performance, environmental performance and social performance.

The impact of sustainability-oriented leadership on sustainable supply chain practice was positive and significant (β = 0.396, stdev = 0.054, t-value = 7.345, p-value < .001). Hence, supporting hypothesis 1. The impact of supply chain capabilities on sustainable supply chain practice was positive and significant (β = 0.464, stdev = 0.049, t-value = 9.486, p-value < .001). Thus, supporting hypothesis 2. The impact of sustainable supply chain practice on sustainable healthcare performance was positive and significant (β = 0.596, stdev = 0.055, t-value = 10.853, p-value < .001). Therefore, supporting hypothesis 3. The impact of sustainable healthcare performance on economic performance was positive and significant (b = 0.452, stdev = 0.056, t-value = 8.122, p-value <.001). Hence, supporting hypothesis 4. The impact of sustainable healthcare performance on environmental performance was positive and significant (β = 0.505, stdev = 0.059, t-value = 8.601, p-value = < .001). Hence, supporting hypothesis 5. Furthermore, the impact of sustainable healthcare performance on social performance was also positive and significant (β = 0.399, stdev = 0.068, t-value = 5.861, p-value = < .001). Thus, supporting hypothesis 6.

The impact of sustainability-oriented leadership on sustainable healthcare performance showed (β = 0.154, stdev = 0.072, t-value = 2.155, p-value = 0.031). The correlation shows both positive and significant impacts. The impact of sustainability-oriented leadership on sustainable economic performance showed (β = 0.035, stdev = 0.055, t-value = 0.636, p-value = 0.525). Although the impact was positive it was insignificant and therefore not supported since the t-value is less than 1.96 according to Hair et al. (2017). The impact of sustainability-oriented leadership on environmental sustainable performance is negative and insignificant (β = -0.023, stdev = 0.064, t-value = 0.356, p-value = 0.722). The impact of sustainability-oriented leadership on sustainable social performance was positive but insignificant (β = 0.040, stdev = 0.064, t-value = 0.635, p-value = 0.526). The impact of supply chain capabilities on sustainable healthcare performance is positive but insignificant (β = 0.097, stdev = 0.069, t-value = 1.395, p-value = 0.163), thus the correlation is unsupported. Supply chain capabilities have a positive and significant impact on sustainable economic performance (β = 0.158, stdev = 0.060, t-value = 2.649, p-value = 0.008), thus the correlation is therefore supported. There is a positive but insignificant impact from supply chain capabilities to environmental sustainable performance (β = 0.092, stdev = 0.060, t-value = 1.539, p-value = 0.124). Thus, the correlation is therefore not supported. The impact of supply chain capabilities on sustainable social performance denotes positive but insignificant (β = 0.100, stdev = 0.066, t-value = 1.515, p-value = 0.130), hence, the correlation is not supported. There is a positive and significant impact of sustainable supply chain practices on sustainable economic performance (β = 0.174, stdev = 0.065, t-value = 2.676, p-value = 0.007). As a result, the correlation is supported. sustainable There is also a positive and significant impact of sustainable supply chain practices on environmental sustainable performance (β = 0.253, stdev = 0.065, t-value = 3.898, p-value = < .001). Again, there is a positive and significant impact of sustainable supply chain practices on sustainable social performance (β = 0.311, stdev = 0.068, t-value = 4.579, p-value = < .001). Hence, the correlation is supported. Also, the impact of sustainable healthcare performance on sustainable economic performance (β = 0.452, stdev = -0.001, t-value = 0.344, p-value = < 0.560). The result rendered the correlation unsupported. Furthermore, the impact of sustainable healthcare performance on environmental sustainable performance was assessed but showed positive and insignificant (β = 0.505, stdev = -0.003, t-value = 0.385, p-value = 0.614) and as a result could not be supported. Finally, sustainable healthcare performances impact on sustainable social performance proved positive but insignificant (β = 0.399, stdev = -0.000, t-value = 0.267, p-value = < 0.528).

The model fit indices and hypotheses results are presented in Table 5.11. Although there are no commonly agreed thresholds for individual goodness-of-fit indices in the literature, all the reported indicators show a very good fit between the model and the data (Hair et al., 2010). PL-SEM analysis of the structural model reported a significant chi-square of 1689.491, SRMR = 0.65, d_G of 568, NFI = 0.788, d_ULS = 1.483). Accordingly, it is concluded that the goodness of fit indices contained in Table 5.11 suggests that there is a very good fit between the study's structural model and its data. A diagrammatic representation of the full structural model with goodness-of-fit indices and completely standardised path estimates is depicted below in Table 5.

Table 5.12 Model fit indices and hypotheses results

Hypothesized Relationship	Original sample (O = β)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	Decision
Sustainability-oriented Leadership -> Sustainable Supply Chain Practices	0.396	0.396	0.054	7.345	0.000	Accepted
Sustainability-oriented Leadership -> Sustainable Healthcare Performance	0.154	0.155	0.072	2.155	0.031	Accepted
Sustainability-oriented Leadership -> Sustainable Economic Performance	0.035	0.037	0.055	0.636	0.525	Rejected
Sustainability-oriented Leadership -> Environmental Sustainable Performance	-0.023	-0.021	0.064	0.356	0.722	Rejected
Sustainability-oriented Leadership -> Sustainable Social Performance	0.040	0.040	0.064	0.635	0.526	Rejected
Supply Chain Capabilities -> Sustainable Supply Chain Practices	0.464	0.464	0.049	9.486	0.000	Accepted
Supply Chain Capabilities -> Sustainable Healthcare Performance	0.097	0.097	0.069	1.395	0.163	Rejected
Supply Chain Capabilities -> Sustainable Economic Performance	0.158	0.158	0.060	2.649	0.008	Accepted
Supply Chain Capabilities -> Environmental Sustainable Performance	0.092	0.094	0.060	1.539	0.124	Rejected
Supply Chain Capabilities -> Sustainable Social Performance	0.100	0.103	0.066	1.515	0.130	Rejected
Sustainable Supply Chain Practices -> Sustainable Healthcare Performance	0.596	0.596	0.055	10.853	0.000	Accepted
Sustainable Supply Chain Practices -> Sustainable Economic Performance	0.174	0.174	0.065	2.676	0.007	Accepted
Sustainable Supply Chain Practices -> Environmental Sustainable Performance	0.253	0.253	0.065	3.898	0.000	Accepted
Sustainable Supply Chain Practices -> Sustainable Social Performance	0.311	0.309	0.068	4.579	0.000	Accepted
Sustainable Healthcare Performance -> Sustainable Economic Performance	0.452	0.451	0.056	8.122	0.000	Accepted
Sustainable Healthcare Performance -> Environmental Sustainable Performance	0.505	0.502	0.059	8.601	0.000	Accepted
Sustainable Healthcare Performance -> Sustainable Social Performance	0.399	0.398	0.068	5.861	0.000	Accepted

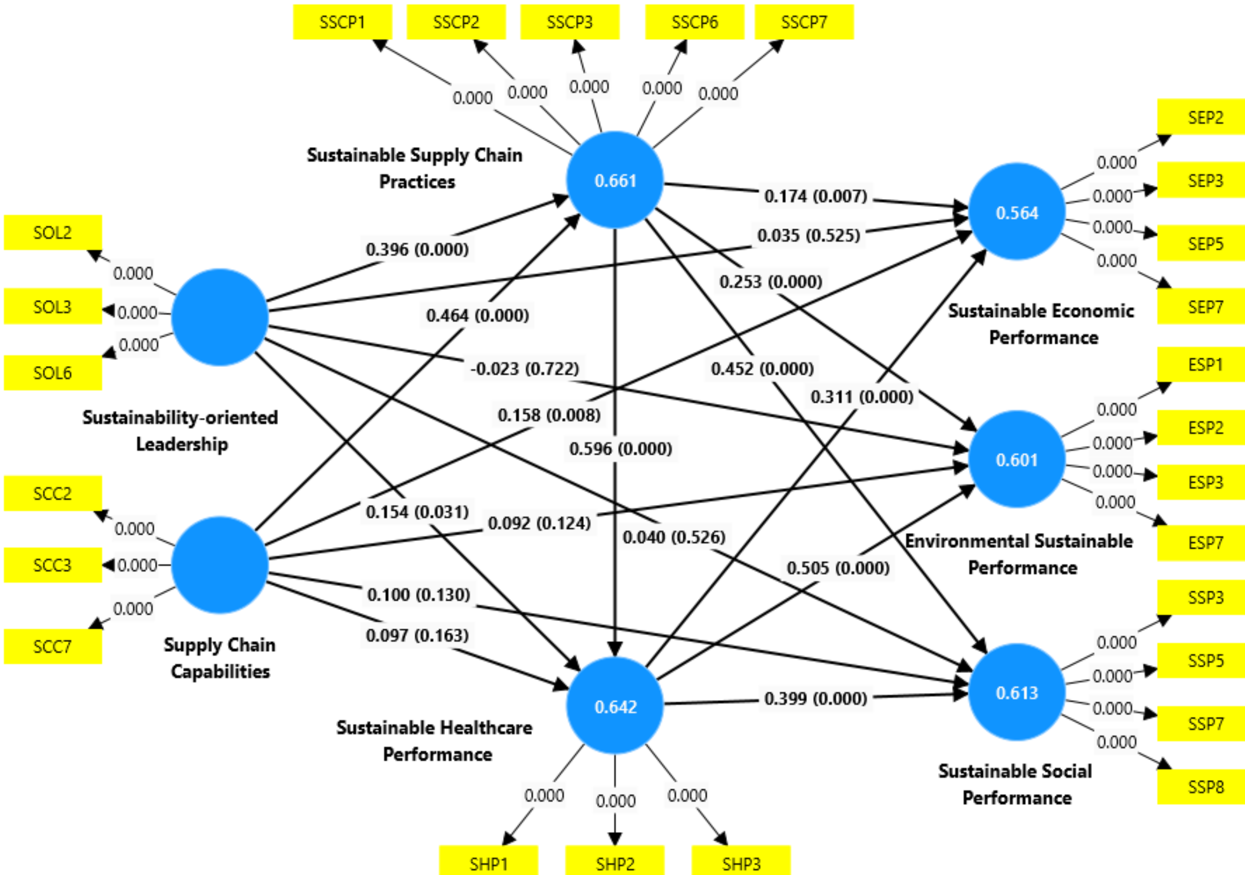

Figure 5.3 Mediating structural model

5.6.4. Mediating effect – outer loading

The mediated paths findings proved significant, however, the following direct paths were insignificant because the t-statistics were below 1.96: Sustainability-oriented Leadership -> Sustainable Healthcare Performance -> Sustainable Social Performance (β = 0.062, t-value = 1.899, p-value = 0.058), Supply Chain Capabilities -> Sustainable Healthcare Performance -> Environmental Sustainable Performance (β = 0.049,t-value = 1.410, p-value = 0.158), Supply Chain Capabilities -> Sustainable Healthcare Performance -> Sustainable Economic Performance (β = 0.044,t-value = 1.358, p-value = 0.174), and finally Supply Chain Capabilities -> Sustainable Healthcare Performance -> Sustainable Social Performance (β = 0.039, t-value = 1.381, p-value = 0.167).

Table 5.13 Bootstrapped path coefficients - outer loading

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P-values
Supply Chain Capabilities -> Environmental Sustainable Performance	0.092	0.094	0.060	1.539	0.124
Supply Chain Capabilities -> Sustainable Economic Performance	0.158	0.158	0.060	2.649	0.008
Supply Chain Capabilities -> Sustainable Healthcare Performance	0.097	0.097	0.069	1.395	0.163
Supply Chain Capabilities -> Sustainable Social Performance	0.100	0.103	0.066	1.515	0.130
Supply Chain Capabilities -> Sustainable Supply Chain Practices	0.464	0.464	0.049	9.486	0.000
Sustainability-oriented Leadership -> Environmental Sustainable Performance	-0.023	-0.021	0.064	0.356	0.722
Sustainability-oriented Leadership -> Sustainable Economic Performance	0.035	0.037	0.055	0.636	0.525
Sustainability-oriented Leadership -> Sustainable Healthcare Performance	0.154	0.155	0.072	2.155	0.031
Sustainability-oriented Leadership -> Sustainable Social Performance	0.040	0.040	0.064	0.635	0.526
Sustainability-oriented Leadership -> Sustainable Supply Chain Practices	0.396	0.396	0.054	7.345	0.000
Sustainable Healthcare Performance -> Environmental Sustainable Performance	0.505	0.502	0.059	8.601	0.000
Sustainable Healthcare Performance -> Sustainable Economic Performance	0.452	0.451	0.056	8.122	0.000
Sustainable Healthcare Performance -> Sustainable Social Performance	0.399	0.398	0.068	5.861	0.000
Sustainable Supply Chain Practices -> Environmental Sustainable Performance	0.253	0.253	0.065	3.898	0.000
Sustainable Supply Chain Practices -> Sustainable Economic Performance	0.174	0.174	0.065	2.676	0.007
Sustainable Supply Chain Practices -> Sustainable Healthcare Performance	0.596	0.596	0.055	10.853	0.000
Sustainable Supply Chain Practices -> Sustainable Social Performance	0.311	0.309	0.068	4.579	0.000

Table 5.14 Bootstrapped confidence intervals bias corrected

	Original sample (O)	Sample mean (M)	Bias	2.5%	97.5%
Supply Chain Capabilities -> Environmental Sustainable Performance	0.092	0.094	0.002	-0.031	0.205
Supply Chain Capabilities -> Sustainable Economic Performance	0.158	0.158	-0.000	0.043	0.279
Supply Chain Capabilities -> Sustainable Healthcare Performance	0.097	0.097	-0.000	-0.040	0.229
Supply Chain Capabilities -> Sustainable Social Performance	0.100	0.103	0.004	-0.031	0.228
Supply Chain Capabilities -> Sustainable Supply Chain Practices	0.464	0.464	0.001	0.370	0.559
Sustainability-oriented Leadership -> Environmental Sustainable Performance	-0.023	-0.021	0.002	-0.153	0.098
Sustainability-oriented Leadership -> Sustainable Economic Performance	0.035	0.037	0.002	-0.074	0.143
Sustainability-oriented Leadership -> Sustainable Healthcare Performance	0.154	0.155	0.001	0.017	0.296
Sustainability-oriented Leadership -> Sustainable Social Performance	0.040	0.040	-0.001	-0.085	0.163
Sustainability-oriented Leadership -> Sustainable Supply Chain Practices	0.396	0.396	-0.000	0.286	0.496
Sustainable Healthcare Performance -> Environmental Sustainable Performance	0.505	0.502	-0.003	0.385	0.614
Sustainable Healthcare Performance -> Sustainable Economic Performance	0.452	0.451	-0.001	0.344	0.560
Sustainable Healthcare Performance -> Sustainable Social Performance	0.399	0.398	-0.000	0.267	0.528
Sustainable Supply Chain Practices -> Environmental Sustainable Performance	0.253	0.253	-0.001	0.125	0.380
Sustainable Supply Chain Practices -> Sustainable Economic Performance	0.174	0.174	-0.000	0.043	0.298
Sustainable Supply Chain Practices -> Sustainable Healthcare Performance	0.596	0.596	0.000	0.482	0.700

Sustainable Supply Chain Practices -> Sustainable Social Performance	0.311	0.309	-0.002	0.175	0.445

Table 5.15 Specific indirect effect

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P-values
Sustainability-oriented Leadership -> Sustainable Healthcare Performance -> Sustainable Economic Performance	0.070	0.070	0.033	2.083	0.037
Sustainability-oriented Leadership -> Sustainable Supply Chain Practices -> Sustainable Social Performance	0.123	0.122	0.033	3.781	0.000
Supply Chain Capabilities -> Sustainable Healthcare Performance -> Sustainable Social Performance	0.039	0.038	0.028	1.381	0.167
Sustainable Supply Chain Practices -> Sustainable Healthcare Performance -> Environmental Sustainable Performance	0.301	0.300	0.049	6.089	0.000
Sustainability-oriented Leadership -> Sustainable Healthcare Performance -> Sustainable Social Performance	0.062	0.062	0.032	1.899	0.058
Sustainable Supply Chain Practices -> Sustainable Healthcare Performance -> Sustainable Economic Performance	0.269	0.269	0.040	6.808	0.000
Sustainable Supply Chain Practices -> Sustainable Healthcare Performance -> Sustainable Social Performance	0.238	0.238	0.048	4.951	0.000
Supply Chain Capabilities -> Sustainable Supply Chain Practices -> Sustainable Healthcare Performance -> Sustainable Social Performance	0.110	0.111	0.026	4.257	0.000
Sustainability-oriented Leadership -> Sustainable Supply Chain Practices -> Sustainable Healthcare Performance -> Sustainable Social Performance	0.094	0.094	0.022	4.288	0.000
Supply Chain Capabilities -> Sustainable Supply Chain Practices -> Sustainable Healthcare Performance -> Sustainable Economic Performance	0.125	0.125	0.022	5.564	0.000
Sustainability-oriented Leadership -> Sustainable Supply Chain Practices -> Sustainable Healthcare Performance -> Sustainable Economic Performance	0.107	0.106	0.021	5.125	0.000
Supply Chain Capabilities -> Sustainable Supply Chain Practices -> Sustainable Healthcare Performance -> Environmental Sustainable Performance	0.140	0.140	0.028	4.898	0.000
Sustainability-oriented Leadership -> Sustainable Supply Chain Practices -> Sustainable Healthcare Performance -> Environmental Sustainable Performance	0.119	0.118	0.024	5.016	0.000

Supply Chain Capabilities -> Sustainable Supply Chain Practices -> Environmental Sustainable Performance	0.117	0.117	0.032	3.681	0.000
Sustainability-oriented Leadership -> Sustainable Supply Chain Practices -> Environmental Sustainable Performance	0.100	0.100	0.030	3.384	0.001
Supply Chain Capabilities -> Sustainable Healthcare Performance -> Environmental Sustainable Performance	0.049	0.048	0.035	1.410	0.158
Supply Chain Capabilities -> Sustainable Supply Chain Practices -> Sustainable Economic Performance	0.081	0.081	0.031	2.564	0.010
Sustainability-oriented Leadership -> Sustainable Healthcare Performance -> Environmental Sustainable Performance	0.078	0.077	0.036	2.149	0.032
Supply Chain Capabilities -> Sustainable Supply Chain Practices -> Sustainable Healthcare Performance	0.276	0.277	0.039	7.033	0.000
Sustainability-oriented Leadership -> Sustainable Supply Chain Practices -> Sustainable Economic Performance	0.069	0.068	0.027	2.537	0.011
Supply Chain Capabilities -> Sustainable Healthcare Performance -> Sustainable Economic Performance	0.044	0.044	0.032	1.358	0.174
Supply Chain Capabilities -> Sustainable Supply Chain Practices -> Sustainable Social Performance	0.144	0.143	0.033	4.315	0.000
Sustainability-oriented Leadership -> Sustainable Supply Chain Practices -> Sustainable Healthcare Performance	0.236	0.235	0.037	6.368	0.000

Table 5.16 Total indirect effect

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P-values
Supply Chain Capabilities -> Environmental Sustainable Performance	0.306	0.305	0.049	6.255	0.000
Supply Chain Capabilities -> Sustainable Economic Performance	0.249	0.249	0.043	5.760	0.000
Supply Chain Capabilities -> Sustainable Healthcare Performance	0.276	0.277	0.039	7.033	0.000
Supply Chain Capabilities -> Sustainable Social Performance	0.293	0.292	0.046	6.390	0.000
Sustainability-oriented Leadership -> Environmental Sustainable Performance	0.297	0.296	0.047	6.366	0.000
Sustainability-oriented Leadership -> Sustainable Economic Performance	0.245	0.245	0.044	5.540	0.000
Sustainability-oriented Leadership -> Sustainable Healthcare Performance	0.236	0.235	0.037	6.368	0.000
Sustainability-oriented Leadership -> Sustainable Social Performance	0.279	0.279	0.047	5.995	0.000
Sustainable Supply Chain Practices -> Environmental Sustainable Performance	0.301	0.300	0.049	6.089	0.000
Sustainable Supply Chain Practices -> Sustainable Economic Performance	0.269	0.269	0.040	6.808	0.000
Sustainable Supply Chain Practices -> Sustainable Social Performance	0.238	0.238	0.048	4.951	0.000

5.6.5 Validation of statistical findings

1. Sustainability-oriented leadership

Healthcare organisations need leadership that is focused on sustainability if they are to adopt sustainable practices. But when leaders don't put sustainability first, healthcare systems have a lot of difficulties. In this instance, there was a gap between operational objectives and long-term environmental and social performance due to a lack of a leadership vision that was sustainability-focused. When a leadership team is not committed to sustainability, environmental issues are frequently addressed in a reactive manner, which increases resource consumption and waste. An increasing amount of research attests to the significance of leadership in accomplishing sustainability objectives. According to research by Aragón-

Correa et al. (2022), healthcare institutions that lack sustainability-oriented leadership run the risk of experiencing subpar performance outcomes. This is because such leadership is directly linked to enhanced environmental performance and resource management. In this instance, ineffective leadership contributed to poor environmental and healthcare outcomes by failing to put policies that prioritised waste reduction, energy efficiency, and sustainable procurement into practice.

2. Supply chain capabilities

Supply chain capabilities are essential for managing logistics and delivering medical supplies, which are crucial for the smooth functioning of healthcare systems. In this instance, the inadequate skills in inventory control, strategic sourcing, and transportation led to an unsustainable supply chain. The healthcare organisation experienced difficulties obtaining necessary medical supplies because of ineffective procurement procedures and a deficiency of backup plans. In the end, this had an impact on healthcare performance since supply delays caused service disruptions and poor patient care. According to Ramos et al. (2023), resilient healthcare systems depend on supply capabilities including modern inventory systems, rapid logistics, and effective procurement techniques. Kokofu General Hospital risks operational cost increases, inefficiencies, and bottlenecks in the absence of these competencies. This case demonstrated how frequent overordering and inappropriate storage of perishable medical goods led to increased waste, inefficiency, and environmental damage; these outcomes were caused by inadequate supply chain skills.

3. Sustainable supply chain practices

The implementation of sustainable supply chain practices is essential for mitigating the environmental impact of healthcare operations. This case demonstrated a significant shortfall in sustainable supply chain practices, with the Kokofu General Hospital relying heavily on unsustainable procurement strategies. For instance, suppliers were chosen based on cost rather than environmental standards, resulting in an over-reliance on non-recyclable materials and energy-intensive production methods. Moreover, the organization's supply chain failed to incorporate green logistics, leading to higher carbon emissions from transportation and distribution. Walker and Jones (2023) emphasized the need for sustainable supply chain practices, such as eco-friendly sourcing, green transportation, and waste minimization, to enhance overall healthcare sustainability. In this case, the failure to adopt these practices increased the environmental footprint of the healthcare facility, while also raising costs associated with waste disposal and inefficient supply management.

4. Sustainable healthcare performance

Sustainable healthcare performance includes social and environmental sustainability in addition to financial viability. In this instance, the organization's capacity to deliver sustainable healthcare performance was significantly impacted by the unsustainable supply chain. Procurement methods and sustainability goals were not aligned, which resulted in high energy usage, increased greenhouse gas emissions, and excessive waste generation. Due to increased waste and hazardous material exposure, healthcare personnel's safety and well-being at work declined as a result of these inefficiencies, which also had societal ramifications. Gupta et al. (2022) highlight that sustainable healthcare performance is enhanced by reducing environmental impact through waste reduction, energy conservation, and the adoption of circular economy principles. In this case, the healthcare organization's unsustainable supply chain practices resulted in poor environmental performance, with increased operational costs and negative health outcomes for both patients and staff. The lack of sustainable procurement, energy inefficiency, and high waste levels all contributed to the overall decline in healthcare quality and performance.

The high operating costs are one of the main conclusions from the study of supply chain operations. Healthcare facilities risk significantly increasing their resource costs if they do not implement green procurement, waste minimisation, and energy-efficient logistics. For instance, a study by Aravind and Ramanathan (2022) showed that hospitals saw a 15% decrease in supply chain expenses over three years when they optimised their supply chain through sustainable methods. Reduced waste production, less energy use, and more efficient logistical procedures are the main causes of this cost savings. Stockout of medical commodities continues to impede quality healthcare. The quality of healthcare services has been associated with advancements in sustainable supply chain management. Hospitals that use sustainable logistics and environmentally friendly medical product sourcing report reduced supply chain interruptions, guaranteeing timely access to vital medical supplies. Smith et al. (2023) found that hospitals that included sustainability in their supply chains experienced a 10% rise in patient satisfaction as a result of regular access to essential medical supplies and a decrease in service delays. The growing environmental impact is another important finding from the case study of the healthcare supply chain research. Hospitals have been unable to reduce their carbon emissions and trash creation due to their incapacity to implement recycling, green packaging, and renewable energy projects. According to a case study by Wu et al. (2023), a sizable hospital system used sustainable procurement practices, such as converting to biodegradable medical supplies and utilising electric vehicles for transportation, to cut its carbon footprint by 20%. Waste disposal at the Kokofu General Hospital needs to be environmentally friendly because gathering garbage and setting it ablaze only pollutes the environment and causes additional health challenges. Unsustainability in the healthcare supply chain also contributes to high-risk management and weak supply chain. The COVID-19 pandemic exposed the vulnerabilities of global supply chains, particularly in healthcare. By adopting local sourcing and ethical procurement practices, healthcare organizations will be better equipped to handle supply chain disruptions. Rana and Shukla (2023) found that healthcare institutions with a focus on sustainability were able to recover more quickly from supply chain disruptions during the pandemic, due to diversified supplier bases and the use of eco-friendly alternatives.

Key Findings:

- **Leadership**: Without sustainability-oriented leadership, healthcare organizations are unlikely to prioritize or integrate environmental and social sustainability into their operations.
- **Supply Capabilities**: Weak supply chain capabilities exacerbate inefficiencies, leading to increased waste, higher operational costs, and disruption in patient care.
- **Sustainable Supply Chain Practices**: Failing to adopt sustainable practices throughout the supply chain increases the environmental footprint and affects the long-term viability of healthcare performance.
- **Sustainable Healthcare Performance**: The lack of integration between supply chain sustainability and healthcare performance negatively impacts environmental and social outcomes, including patient care and employee well-being.

In conclusion, this case study highlights the significance of aligning supply chain management with sustainability goals to ensure the effective delivery of healthcare services. Sustainability-oriented leadership, enhanced supply capabilities, and the adoption of sustainable supply chain practices are critical to achieving sustainable healthcare performance. Healthcare organizations must adopt holistic strategies that prioritize environmental and social sustainability to improve operational efficiency and healthcare outcomes.

5.6.5.1 Credibility

Credibility, the extent to which the study measures what it is intended to has been enhanced by adopting focus group discussion with experts in the field in this study. The use of descriptive phenomenology to explore the lived experience of phenomena is a well-recognized approach for inductively exploring phenomena. The credibility of the statistical findings was further enhanced with participants who played crucial roles. Shenton (2004) demonstrates this as an important aspect of any study's credibility, in ensuring that the researcher's representation gives a true reflection of the meanings as presented through the words and stories of the experts engaged. Analysed findings were returned to participants for validation. Analysed discussion transcripts (with the formulated meaning generated from the significant statements) were sent to five participants who were chosen at random to confirm whether the results presented were credible according to the true representation of their experience. There is always the potential that participant's stories may change with time and asking them to revisit the same event later may change their perception of what occurred (Ferrari, 2006). However, returned analyses did not yield any changes to the findings as it was presented as all the participants strongly validated the statistical findings. Below is the transcription:

Facilitator: Is there any question? Is there any contribution? Is there any idea? The question I want to ask is do we believe the empirical findings reflect in our practices as supply chain practitioners?

Speaker 1: I believe that when the leaders, in the organisation are sustainability-oriented and when we can get the necessary capabilities we perform better.

Speaker 2: For organisations, yes personally I also believe the empirical findings are a true reflection of the roles that we play in our organisations. I also support the empirical findings.

Speaker 3: That's when the leaders are sustainably inclined and they provide everything that needs to be provided, I think it helps the work to go on well and maximum benefit is achieved at the facility. I know that so like I am following you.

Speaker 4: Thank you very much. Very well noted. I perfectly agree with the empirical findings.

Speaker 5: From where I sit also I agree with the empirical findings because you can have the orientation right that's fine but that consists of several dynamics and therefore capability itself is critical when it realizes these outcomes that we are talking about so capability in terms of how responsive the supply chain can be, in terms of the flexibility, in terms of agility, resilience which are required to me yes. The supply chain operations from the context of things like these are required for the supply chain and more effective dynamic in this operation so I think the sustainability leadership and capabilities are important when it comes. In conclusion, the participants disclosed that the findings are a true reflection of the current situation.

5.7 Multigroup model analysis

Table 5.17 Multigroup model analysis result

Model	DF	CMIN	P	NFI Delta-1	IFI Delta-2	RFI rho-1	TLI rho2
Measurement weights	22	71.334	.000	.007	.008	.002	.002
Structural weights	28	109.832	.000	.011	.012	.004	.005
Structural covariances	31	134.868	.000	.013	.014	.006	.007
Structural residuals	36	199.374	.000	.020	.021	.012	.013
Measurement residuals	65	629.348	.000	.062	.067	.047	.051
Constraint_1	1	.526	.468	.000	.000	.000	.000
Constraint_2	1	7.836	.005	.001	.001	.001	.001
Constraint_3	1	.348	.555	.000	.000	.000	.000
Constraint_4	1	5.850	.016	.001	.001	.000	.000
Constraint_5	1	2.964	.085	.000	.000	.000	.000
Constraint_6	1	5.943	.015	.001	.001	.000	.000

The result for the "Constraint 1" model as shown in Table 5.17 above is not significant (.468) >.05 meaning that the difference between female and male respondents has no significant impact on the relationship of sustainability-oriented leadership to sustainable supply chain practices is not significantly different between female and male respondents. The result for the "Constraint 2" model shows a difference of .085, which is significant with a p-value of .005 indicating a significant difference between female and male respondents regarding supply chain capabilities to sustainable supply chain practices. The findings of the "Constraint 3" model which is sustainable supply chain practices to sustainable performance demonstrated an insignificant difference between female and male respondents with a p-value of .555 greater than .05. The results for the "constraint 4" model with a p-value of < .01 mean that the relationship of sustainable of performance to economic performance is significantly different between female and male respondents with female respondents having higher impact. The model for "constraint 5" also shows an insignificant difference in terms of responses with a p-value of .085 between female and male respondents. Finally, the model for "constraint 6" resulted in a p-value of .015 showing a significant difference in responses between female and male respondents when it comes to the relationship between sustainable performance to social sustainability with female responses having the highest impact regarding supply chain capabilities to sustainable supply chain practices. However, male responses show a higher impact of sustainability-oriented leadership on sustainable supply chain practice.

5.8 Data analysis summary and conclusions

This chapter of the study reported 550 usable cases out of a total collected sample of 660, collected from thirty-three public healthcare facilities specifically Ghana Health Service and a tertiary hospital in the Ashanti region of Ghana. Missing data accounted for 0.001% of the usable samples' total items and was replaced with values generated from data imputation using the Expectation-Maximisation (EM) algorithm method (Dempster, Laird and Rubin, 1977). The data, when tested, did not contain common method bias, or non-response bias permitting the data from each of the thirty-three institutions to be combined into one data set. Confirmatory factor analyses were estimated for seven construct groupings. The construct groupings were sustainability-oriented leadership, supply chain capabilities, sustainable supply chain practice, sustainable performance and its triple bottom line economic performance, environmental performance as well as social performance. The sustainability-oriented leadership construct and supply chain capabilities construct were grouped as the antecedents. Sustainable supply chain practice construct mediated between the enablers and the sustainable performance group of constructs. After testing each construct's measures for scale and construct reliability, measurement items were disregarded to exceed the threshold set for scale reliability. After measurement purification each of the CFAs reported acceptable goodness-of-fit indices, having reviewed the standardised residuals and modification indices for each.

The results of estimating the measurement model indicated a good fit between the model and the data. The structural model when estimated, demonstrated a good fit with the data, estimating significance level at $p < .001$ in most of the hypothesised standardised paths between constructs. The mediation analysis also indicated partial mediation of the role of sustainable supply chain practice and sustainable healthcare performance as shown in Table 5.16. The bootstrapped path coefficient results are shown in Tables 5.13 and 5.9. The mediation analysis also indicated partial mediation of the role of sustainable supply chain practice and sustainable performance as shown in Table 5.16. The multigroup model analysis result is shown in Table 5.17. The next chapter discusses the results of the research study

CHAPTER SIX - FINDINGS / OUTCOMES

6.1 Introduction

This chapter presents the findings/outcome of the data analysis and how the research question objectives address the research question; 6.2 Addresses the research question set one (RQ1); 6.2.2 Addresses research question two (2) and (6.2.3) Addresses research question three (3) and 6.3 presents a summary of the chapter.

6.2 Addressing research question set RQ1, RQ2 and RQ3.

6.2.1 Research question set one (RQ1)

Research question set (RQ1) asks: What framework could be developed to identify the determinants of SSCMP? Many relevant literatures regarding sustainability in supply chain management practices were reviewed in detail to identify the research gaps which enabled a grounded framework to be developed for this study. The participants who are practitioners of the Ashanti region branch of Ghana Health Service were asked questions to solicit their anonymous opinions on several determinants discovered from the gap established in the literature. Based on the responses a new framework was developed for this study consisting of seven constructs discussed earlier including sustainability-oriented leadership (SOL); supply chain capabilities (SCC); sustainable supply chain practices (SSCP); sustainable hospital performance (SHP); sustainable economic performance (SEP); environmental sustainable performance (ESP) and social sustainable performance (SSP).

6.2.2 Research question set two (RQ2)

Research question set RQ2 asks: How the framework developed could be used to measure the determinants of sustainable healthcare supply management practices? Having identified the determinants of sustainable supply chain by reviewing the relevant literature, this study in the form of its estimated structural equation model, successfully and empirically measured the determinants identified for the SSCMP framework. The scale measurement results contain both significant and insignificant findings which could be adopted to advance SSCMP literature as shown in Figure 5.2. The positive and significant influence of sustainability-oriented leadership (SOL) and supply chain capabilities (SCC) upon sustainable supply chain practices (SSCP) (0.52, 0.38), with a significance level (p-value <.001) and R^2 of (0.661) representing about 66.1% gives evidence that one unit change in SOL and SCC can cause about 66.1%

in SSCP. The positive beta coefficient of (0.596) correlation of sustainable supply chain practices (SSCP) and sustainable healthcare performance (SHP) with a significance level of (p-value <.001) and with R^2 of (0.642) equivalent to 64.2% empirically shows that a unit change in sustainable supply chain practices can influence sustainable healthcare performance by 64.2%. The positive beta coefficient (0.311) with a significance value of (p<.001) and R^2 of (0.564) indicates about 56.4% a unit change in sustainable healthcare performance (SHP) can lead to 56.4% change in sustainable economic performance (SEP). The study empirically shows that sustainable healthcare performance positively impacts environmental sustainable performance (ESP) and social sustainable performance (SSP) with beta coefficients of (0.505) and (0.399) respectively with a significance level of (p-value <.001) and R^2 of 0.601 and 0.613 equivalent to 60.1% and 61.3% demonstrate that one unit change in SHP can result in about 60.1% and 61.3% changes in environmental performance and social performance respectively.

Moreover, the positive beta coefficient of (0.035) regarding the correlation between sustainability-oriented leadership (SOL) and sustainable economic performance indicated an insignificant p-value of (0.525). Also, the association between sustainability-oriented leadership (SOL) and environmental sustainable performance (ESP) showed a negative beta coefficient of (-0.023) proved insignificant with a p-value of (0.532) representing an inverse correlation that is a one-unit increase in SOL will be associated with a decrease in ESP. The correlation between sustainability-oriented leadership (SOL) and sustainable social performance (SSP) indicated a positive beta coefficient of (0.040) and an insignificant p-value of (0.722). The beta coefficient values of 0.090, t-value of 1.539, and p-value = 0.124 for supply chain capabilities and environmental sustainable performance (ESP) rendered the correlation insignificant. Finally, supply chain capabilities and sustainable social performance correlation (SSP) recorded (β = 0.100, t-value = 1.515, p-value = 1.30) and thus became insignificant. To conclude, by using the proposed framework of the study, the determinants have been empirically measured thereby conforming to the research question set RQ2.

6.2.3 Research question set three (RQ3)

In response to RQ3, the results established a set of determinants for the SSCM practice hypothesised paths that were not supported and therefore needed to be addressed as set out in Figure 5.2 and Table 5.12 in the complete structural equation model and paths of the study. This study adopted both exploratory and descriptive research design and by administering a questionnaire, a sample of 550 respondents who are healthcare supply chain practitioners from the 32 healthcare facilities in the Ashanti region of Ghana participated in this study. Using structural equation modelling, the analysis was conducted to measure the impact of determinants of sustainability in healthcare facilities using the proposed framework.

Subsequently, a focus group discussion with six experienced supply chain practitioners within the healthcare industry in the region was organised to validate the empirical findings. To offer strategies to improve the sustainability of the supply chain performance in healthcare within the region, using the results from the analysis, especially the hypotheses that were not supported, a case study was employed to assist in diagnosing the bottlenecks and offer solutions to be implemented. Strategies were formulated to improve SSCM performance resulting from the case study at Kokofu General Hospital which managers/leaders at the various healthcare facilities referred to as budget management committee (BMC) could embark on for improvement. Value for money procurement process through fair competition as much savings could arise from that function if healthcare institutions want to achieve sustainability. The American Medical Supply Chain Association reported that centralised procurement can save 10-35% of procurement expenditure for medical institutions every year (Baker, Bromley and Chan, 2020). Finally, the study seeks to make practical and theoretical contributions elaborated in sections 1.4.5, 1.4.5.1 and 1.4.5.2 of chapter one of this thesis.

6.3 Summary

Research questions one and two are addressed in this chapter. However, research question three will be addressed using a case study to develop an impactful strategy to reengineer the healthcare supply chain system to be more sustainable for improvement. Major improvements in the healthcare supply chain system have been discussed, challenges currently facing the healthcare supply chain system in the region similar to other parts of the country and proposed solutions for remedy have been outlined. The next chapter introduces the discussion section of this study.

CHAPTER SEVEN – DISCUSSION

7.1 Introduction

This thesis has introduced and presented the impact of sustainable supply chain management practice on sustainable performance in organisations, especially healthcare. The process of achieving sustainability in the supply chain setting according to this study comprises sustainability-oriented leadership, supply chain capabilities, and sustainable supply chain practices in that order which leads to sustainable performance is further developed into a theoretical model for the constructs. Having reviewed numerous relevant empirical literature in operations and supply chain management, it was evident that sustainability-oriented leadership was missing from the various studies. However, to achieve sustainability in an organisation, leadership must play a major role in championing that objective and it is when the leaders are sustainability-oriented that other members of the organisation can follow. Therefore, in this study sustainability-oriented leadership equipped with the required supply chain capabilities are the related constructs to first address the sustainable supply chain initiative. The research design proposed empirically testing the sustainable supply chain model and employs a mixed methods research study in thirty Ghana health service facilities and a tertiary hospital in the Ashanti region of Ghana, adopting structural equation modeling to analyse the research results of the study. This is a novel study, as it is the first of its kind to empirically research sustainable supply chain impact in that context, tests the hypothesised relationships between the theoretical model constructs, and as a result, generates a series of new variables for measuring newly developed constructs. The new measurement for sustainable supply chain practice is the central construct of the theoretical model. Its antecedents the sustainability-oriented leadership and supply chain capabilities constructs, also have new measurement scales. The hypothesised relationships between these new constructs and sustainable performance empirically contribute to the literature. This chapter subsequently discusses two key aspects of the research findings of the study. First, the new measurement variables deployed in the research study are discussed (7.2.), followed by addressing each of the hypotheses estimated in the study's structural model and discussing how the findings of each relate to the existing literature, the current state of the healthcare supply chain is discussed (7.4) and subsequently, 7.5 concludes the chapter.

7.2 Sustainability-oriented leadership set of measurement variables

The study estimated acceptable construct reliability and validity for the sustainability-oriented leadership, and supply chain capabilities constructs. The author developed new variables upon reviewing the literature to measure sustainability-oriented initiatives and applied them in the SOL context as new variables that effectively measure SOL. The measurement variables were significant because leaders formulate and direct the implementation initiatives or policies in an organisation. The researcher discovered that there is no set of measurement variables for sustainability-oriented leadership in the supply chain domain. The empirical results have demonstrated leadership as a critical factor shaping organisational performance in the context of healthcare. This is consistent with the study by (Wu and Wang, 2021; Li and Jia, 2022; Schilling and Brunner, 2021; Hussen and Rashid, 2023; Vachon and Klassen, 2022) demonstrated that healthcare institutions with sustainability-focused leadership experience improved overall performance and reduced costs due to their proactive approach to resource management. Strong sustainability leadership is associated with increased brand equity and customer loyalty, which boosts financial and operational performance, according to research by Singh et al. (2021). Organisations with leadership that prioritises sustainability report higher employee engagement, which raises overall performance, according to Kim et al. (2019). According to Linnenluecke and Griffiths (2010), companies led by sustainability-focused individuals are better equipped to weather crises because their long-term planning takes resource diversification and flexibility into account. Ahmed et al. (2023), for instance, showed that companies with sustainability-focused executives are more likely to foster a robust sustainability culture, which improves performance in terms of social, governance, and environmental outcomes. Sustainability-oriented leaders foster innovation, which results in long-term sustainable performance and a competitive edge in the market, according to Martinez-Conesa et al. (2022). According to Wang and Chen (2021), businesses run by executives who prioritised sustainability outperformed others in terms of financial performance as a result of their emphasis on long-term value creation and sustainability-related cost-saving measures. Sustainability-focused executives are more likely to cultivate strong relationships with stakeholders, which improves ESG performance, according to Freeman et al. (2022). According to Jackson and Liao (2023), leaders prioritizing sustainability are more adept at handling risks that may jeopardise their ability to achieve sustainable performance. According to Hart and Dowell (2022), organisations that have leadership that prioritises sustainability continuously beat their competitors in terms of creating long-term value that improves both financial and non-financial performance. Jones et al. (2023) argue that organisations with leaders prioritizing sustainability are better equipped to promptly adjust to changes in rules and market demands, leading to improved sustainability performance. According to Ramirez and Cruz (2022), organisations run by sustainability-focused executives see notable gains in stakeholder trust and brand image, translating into more sustainable performance.

Our empirical results demonstrate a direct positive impact of sustainability-oriented leadership on all the constructs except for environmental sustainable performance but with SSCP as a mediator SOL has a positive correlation with ESP. It confirms the crucial role sustainable leaders play in achieving sustainable performance in organisations. To further support the argument, Gupta and Singh (2022) found that sustainable leadership leads to higher levels of innovation, which enhances long-term sustainable performance. Our study also contributes to clarifying the importance of leadership in adopting impactful technologies and achieving resilience in industries (Bag and Pretorius, 2022). The empirical results confirm the hypotheses set for sustainability-oriented leadership in this study.

7.2.1 Supply chain capabilities set of measurement variables

The acceptable construct reliability and validity assessment of the supply chain capabilities constructs indicate that the scales developed by Fosso-Wamba and Akter (2019), and originally applied at a management level, effectively translate to SSCP to measure SSCP impacts in organisations. The manufacturing industry is challenged with ever-evolving IT, which is getting embedded and diffused across operational and managerial processes. The use of advanced IT resources enables organisations to realise sustainable processes, enhanced product life cycles, and digitisation of activities linking suppliers to customers (Hahn, 2020; Kerin & Pham, 2019; Szalavetz, 2019). Organizations should manage their resources and strategies to aid them in developing SC capabilities (Miemczyk & Luzzini, 2019). Mandal (2015) noted that proficient and well-organised demand and supply activities result in improvements in SC capabilities and performance. Mabrouk et al. (2020) identified that flexibility and information exchange in SCs are the major factors that contribute to enhancing SC performance. Flexibility in SCs is found to be a preferred choice for firms being confronted by changing customer needs, disruptions, innovations, and changes in technologies (Manders et al., 2016). Studies have reported that sharing information with the SC partners helps to increase accessibility, better decision-making, planning related to material requirement, SC coordination, and SC performance (Chang et al., 2019; Chengalur-Smith et al., 2012). However, it was proposed that the influence of IT capabilities on information exchange and the other SC capabilities such as production flexibility, supplier flexibility and SC coordination needs to be explored further. De Mattos and Laurindo (2017). Mabrouk et al. (2020) identified flexibility and communication tools for sharing information with suppliers as major factors impacting SC performance. The study also indicated that SC capabilities, such as production flexibility and information exchange, are key factors in realising SC performance. Jin et al. (2014) observed that IT has a major influence on SC flexibility (SCF), leading to better supply chain performance. IT aids the organisations affiliated with an SC in exchanging information with its suppliers and customers (Chang et al., 2019; Drnevich & Croson, 2013). This information exchange helps in responding and adapting to changes in the market environment, thus making the SC flexible (Manders et al., 2017). IT capabilities are a complex package of IT skills, knowledge and resources that are employed across business processes empowering organisations to coordinate their business processes to derive expected goals (Stoel & Muhanna, 2009). IT capabilities were found to be associated with production flexibility and agility in manufacturing industries (Banker et al., 2006; Giannakis et al., 2019; Wu and Wang, 2019). Our empirical results demonstrate a direct positive impact of supply chain capabilities on SSCMP, SHP, SEP, ESP and SSP constructs. It also confirms the critical role SCC plays in organisations. SC capabilities represent the organisation's ability to identify, utilise and assimilate information and resources, internal or external, to assist the activities of the SC (Asamoah et al., 2019). Based on the extended resource-based view (ERBV), Xu et al., (2014) state that organisations need to integrate their resources and capabilities, both internal and external, to develop superior capabilities and eventually leading to improvements in performance. Previous studies examined that an agile SC could be realised through flexibility and would ultimately lead to an increase in performance (Chiang et al., 2012; Dhaigude & Kapoor, 2017; Ivanov et al., 2018; Swafford et al., 2006). Mabrouk et al. (2020) identified two SC capabilities, production flexibility and information exchange, as key factors of SC performance. Jin et al. (2014) discovered the dimensions of supply chain flexibility and defined production flexibility (PF) as the ability of a firm to deliver different products and a combination of mix and volume flexibility. PF can facilitate the firm in the production of new products and to rapidly respond to fluctuations in the demand of customers (Alamro et al., 2018; R. K. Singh & Acharya, 2013; Martínez et al., 2016). By employing the best capabilities in supply chain practices, will be able to make data-driven decisions, embark on lean and agile practices to be more resilient.

7.2.2 Sustainable supply chain practice measurement variables

The acceptable construct reliability and scale reliability assessment of the sustainable supply chain practice construct indicates that the scale developed by Dey *et al.* (2020;2022), to measure organisation sustainable practices, is successfully altered to create new variables that measure the sustainable supply chain practices in an organisation. The measuring variables for SSCP are in line with the findings of Carvalho and Cruz-Machado (2022) which showcased an organization's dedication to sustainability and obtaining a competitive edge in the market depending on supply chain transparency through sustainability reporting. According to Silvestre (2022), measuring sustainability spurs innovation, which in turn improves supply chain operations over time and improves sustainable performance. According to Tseng et al. (2022), complying with regulations and avoiding fines or penalties depend on the precise monitoring of sustainability indicators. The measuring variables can help healthcare facilities choose suppliers that support sustainability objectives, and reduce risks and improve overall sustainability, as demonstrated by Foerstl et al.'s (2023) research on supply chain sustainability measures and supplier evaluation. These variables provide a quantitative basis for monitoring performance, identifying gaps, and implementing sustainable practices across the entire supply chain. According to Sodhi and Tang (2022), supply chain measurement helps businesses identify and reduce risks early on, which is especially important in complex and international supply networks. This helps businesses become more resilient. According to Liu et al. (2022), businesses that had strong sustainability monitoring systems saw notable gains in their environmental performance and regulatory compliance. Xu et al. (2023) found businesses that regularly monitor and improve these KPIs often beat their rivals in terms of client retention and satisfaction. According to Kumar and Zindani (2023), assessing supply chain practices aids businesses in better placing themselves in the market by assisting them in matching short-term tactical goals with long-term strategic goals.

7.2.3 Economic performance resulting from sustainability, measurement variables

The acceptable construct reliability and validity assessment of the economic performance construct shows that the variables developed by the researcher with some adaptation from Dey *et al.* (2020;2022), have been effectively altered to create new variables that measure the economic performance of an organisation.Hospitals that implement sustainability programs, according to Towers and Chai (2022), benefit from lower costs and increased operational resilience over time, which improves their financial performance. According to Touboulic and Walker (2022), assessing economic indicators in supply chains can help find areas where money can be saved and boost long-term profitability by promoting sustainability. An empirical study found that the economic dimension of the SSCM has correlations with economic performance (Svensson and Wagner, 2015; Hamdy, Elsayed, and Elahmady, 2018; Hourneaux, Gabriel, and Gallardo-Vázquez, 2018; Solovida and Latan, 2021; Rajesh, Rajeev, and Rajendran, 2022; Sachin and Rajesh, 2022). Based on theories (DCT theory, RBV theory), it has been stated that the main objective of any business, company, or organisation is to generate profits and satisfy the demands of stakeholders. Therefore, SSCM should be integrated to ensure profits while effectively protecting the environment and society; corporate organisations should consider implementing sustainable practices to enhance profitability to maintain long-term improvements and financial stability of the company (Carter and Easton, 2011). Companies wishing to implement sustainable practices in their supply chains must balance the conflicting goals of generating profits, reducing negative environmental impacts, and creating. Thus, economic sustainability endeavours to achieve greater economic benefits including financial performance, competitive advantage, cost minimisation, and profitability. Attaining these benefits comes with a commitment to knowledge sharing, optimisation of logistics, and cost-efficiency strategies (Winter and Knemeyer, 2013).

7.2.4 Environmental performance due to sustainability, measurement variables

The acceptable construct reliability and scale reliability assessment of environmental performance construct shows that the scale developed by Dey *et al.* (2020; 2022), to measure an organisation's economic performance, is successfully revised to compose a new set of variables to measure the environmental performance in an organisation. McGain et al. (2022), resource management improvements made by healthcare organisations that adopted sustainability strategies resulted in more effective operations and smaller environmental footprints. According to Chung and Hong's (2021) research, healthcare workers employed in hospitals that prioritise environmental sustainability expressed more job satisfaction and engagement, which in turn led to lower employee turnover and enhanced workplace culture. Desmond et al. (2023), sustainability encourages innovation in healthcare, leading to state-of-the-art treatments that are advantageous to patients as well as the environment.
Gualandris and Kalchschmidt (2021) emphasize the relevance of monitoring environmental indicators to drive eco-efficiency in supply chains and reduce carbon footprints. Because healthcare operations generate a lot of waste, the measuring variables could enable healthcare facilities to minimise waste and also to properly dispose of the generated waste without endangering the environment. An empirical study demonstrated that environment dimension of the SSCM has relationship with economic performance (Ageron, Gunasekaran, and Spalanzani, 2012; Wang and Sarkis, 2013; Das, 2018; Hourneaux, Gabriel, and Gallardo-Vázquez, 2018; Solovida and Latan, 2021; Rajesh, Rajeev, and Rajendran, 2022; Sachin and Rajesh, 2022). Inferring from stakeholder theory, the authors contended that the environmental dimension of SSCM focuses primarily on protecting the operating environment of the supply chain. Increased pressure from stakeholders to address environmental issues has led organisations to raise a wide range of environmental issues. However, the very nature of the process allows some companies to adopt sustainable practices (Bevilacqua et al. 2014). Companies should require their suppliers to adopt and adapt sustainability measures, such as sustainable use of natural resources, ethical behaviour, and reduction of greenhouse gas emissions. Greater attention should be paid to measures to manage different waste streams, as hazardous waste and emissions from different

companies are the main causes of pollution and environmental damage. The environmental dimension of sustainable development is an important area of research for the SSCM. Environmental considerations provide more tangible benefits than social benefits (Banerjee, 2003). The environmental dimensions of the triple bottom line of sustainable development encompass goals, plans, tools, and technologies to increase environmental responsibility and promote clean and green technologies (Klassen, 2001; Varnäs, Balfors, and Faith-Ell, 2009).

7.2.5 The social performance due to sustainability, measurement variables

The acceptable construct reliability and validity assessment of the social performance construct shows that the scale developed by Dey *et al*. (2020; 2022), to measure organisation economic performance, is successfully revised to compose a new set of variables to measure the social performance in an organisation. The variables will assist health facilities in ensuring that their suppliers adhere to ethical labour practices, provide fair wages, and maintain safe working conditions. Beske and Seuring (2022) emphasize the role of social performance indicators in enhancing transparency and accountability, thus improving the social sustainability of supply chains. According to White et al. (2022), healthcare facilities that include social sustainability in their daily operations report better health and patient satisfaction, especially for marginalised groups. Better patient care and reduced recruitment costs are directly impacted by healthcare personnel in socially sustainable organisations experiencing lower burnout, more job satisfaction, and increased retention (Allisey et al., 2023). Bauer et al. (2022) report that healthcare institutions that implemented social sustainability practices like health outreach initiatives saw increased community support and trust, improving patient loyalty and public health outcomes. According to Phelan et al. (2023), healthcare organisations prioritising social justice witness decreased inequities associated with healthcare access, especially for vulnerable and marginalised groups. A study empirically discovered that the social dimension of the SSCM correlates with environmental performance (Sharma and Ruud, 2003; Paulraj and Blome, 2017; Solovida and Latan, 2021; Rajesh, Rajeev, and Rajendran, 2022; Sachin and Rajesh, 2022). The social dimension relates to advancing strong, vibrant and healthy communities, creating housing that meets the needs of current and future generations, and ensuring quality development through the provision of accessible local services that reflect the needs of the community and promote health, social and cultural well-being. This applies to all areas of development, including urbanisation, agriculture, infrastructure, energy, water and transport (Baah and Jin, 2019; Fantazy and Tipu, 2019; Carter et al. 2020). The Social dimension of sustainability has evolved to include important elements such as social equity, poverty reduction, human rights, women's and children's rights protection and general workers' well-being. The proponents of social sustainability further argue that firms that operate in a socially acceptable manner stand the higher possible chance of winning the solidarity of the people, and subsequently enhance its market share. Social sustainability has been regarded as a precondition for human survival and development. To conclude, in the process of practicalizing the theoretical model of the study, all the new sets of measurement variables in total demonstrated acceptable construct reliability and validity with each set of variables measuring above the required threshold.

7.2.6 Estimated hypothesised relationships

The structural model for the research study estimated paths for H1, H2, H3, H4, H5, H6, H7, H8, H9, H10, H11, H12, H13, H14, H15, and H16. Each of these paths is discussed below, in hypothesis order.

Table 7.1 Antecedents of SSCP

Hypotheses	Antecedents	Outcome	Coefficient	t-value	Sig
H1	Sustainability-oriented leadership ->	Sustainable supply chain practice	0.396	7.345	< .001
H2	Supply chain capabilities ->	Sustainable supply chain practice	0.464	9.486	< .001

Sustainability-oriented leadership and supply chain capabilities were both found to be positively and significantly related to the sustainable supply chain construct (H1 and H2). Both hypotheses support Avery and Bergsteiner (2011) and McCann and Sweet (2014) who propose that association can be championed by the performance of organizational managers through the vision of sustainable leadership, which establishes shared values that impact workers' ethical conduct and improve stakeholder relations. considering the organisation's corporate identity. As Julia Schwarzkopf, the supply chain manager of Volkswagen Group, said, "Without establishing sustainable development at the strategic level, executing relevant policies of sustainable development in practices is unsustainable." Dynamic capabilities are defined as higher-order capabilities that organize resources to improve the performance of an organization in a transforming context (Teece, 2014). The findings empirically support that dynamic capabilities help in achieving sustainability. The findings of both hypotheses support the fact that SOL and SCC play a critical role in the achievement of sustainable practice. Additionally, this study provides empirical evidence that both SOL and SCC have a significant and positive relationship with SSCP.

7.2.7 Summary

The significant empirical findings support the fact that SOL promotes a corporate responsibility strategy that should be key in sustainable business activities as well as in corporate social investments and programs (Labuschagnea and Brent, 2003). SCC can sense, seize and reconfigure operations by rendering them more agile (Fosso-Wamba and Akter, 2019). According to Chowdhury *et al.* (2023) in the field of HRM, SCCs such as AI help to reliably understand and predict human behaviour within an organisation, which in turn, has a massive impact on managing productivity. AI has a significant potential to support organizational research because of its capacity to analyse multiple streams of big data and support decision-making (Chowdhury *et al.* (2023).

Table 7.2 The antecedents of SSCM performance

Hypotheses	Antecedent	Outcome	Coefficient	t-value	Sig
H3	Sustainable supply chain practices ->	Sustainable performance	0.596	10.853	< .001

Several scholarly studies have examined the mechanisms by which SSCM practices can improve business performance. Dey *et al*. (2020) corroborated the fact that sustainable supply chain practice positively and significantly impacts on sustainable performance of SMEs and many other firms. To support the empirical findings, research by Dey et al. (2020), and Chowdhury *et al.* (2022) also demonstrated how circular economy practices facilitate sustainable performance in organisations. Zailani *et al.* (2012) surveyed 400 Malaysian manufacturing companies and examined that SSCM practices (environmental-friendly purchase and sustainable packaging) have a positive effect on sustainable performance, especially from the economic and social perspective. Hasan (2013) studied five typical firms, such as Coca-Cola Company and Eastman Chemical Company, and evidenced the positive impact of SSCM on environmental and operational performance. Wang and Sarkis (2013) buttressed the fact that an organisation's SSCM activities positively impact economic performance measured by return on assets and return on equity, and the positive influences can have a duration of at least two years. Perry et al. (2013) adopted explorative methods to find the positive impact of SSCM on firm brands as well as social responsibility performance in the Scottish cashmere industry. Using the mobile industry in India as a subject, Luthra *et al.* (2015) empirically demonstrate the impact of the green supply chain on an organisation's environmental, economic, social and operational performance to be positive. Norazlan *et al*. (2014) reveal that SSCM, coupled with environmental, technological, cultural and risk management, positively affects the health industry in Malaysia. Hsu *et al.* (2016) thoroughly investigated manufacturing companies in emerging economies and reported that implementing SSCM can facilitate positive reverse logistics outcomes and the promotion of competitiveness.

7.2.8 Summary

The findings empirically show that organisations must realize the importance of SSCMP and how it practices impact an organisation's sustainable performance. Every organisation should initiate and develop an understanding of the entire supply chain process and collaborate with the supply chain partners to reach a consensus on sustainable goals in SCM practices. The findings further encourage organisations to implement SSCM practices effectively since it can lead to the adoption of better SC dynamic capabilities and enhance sustainable performance. Silvestre (2015) argues that the poor conditions of SSCMP in developing countries prevent supply chain practitioners from learning and innovating (the accumulation of dynamic capabilities), thus hindering sustainability performance improvement. Second, our findings also show the mediating impact of SSCP in the relationship between SOL, SCC and sustainable performance.

7.3 Antecedents of sustainable performance (triple bottom line)

Table 7.3 The antecedents of economic, environmental and social performance

Hypotheses	Antecedent	Outcome	Coefficient	t-value	Sig
H4	Sustainable Healthcare performance ->	Sustainable Economic Performance	0.452	8.122	< .001
H5	Sustainable Healthcare performance ->	Environmental Sustainable Performance	0.505	8.601	<.001
H6	Sustainable Healthcare Performance ->	Sustainable Social Performance	0.399	5.861	<.001
H7	Sustainable supply chain practices ->	Sustainable economic performance	0.174	2.676	0.007
H8	Sustainable supply chain practices ->	Environmental sustainable performance	0.253	3.898	<0.001
H9	Sustainable supply chain practices ->	Sustainable social performance	0.311	4.579	<0.001
H10	Sustainability-oriented leadership ->	Sustainable economic performance	0.035	0.636	0.525
H11	Sustainability-oriented leadership ->	Environmental sustainable performance	-0.023	0.356	0.722
H12	Sustainability-oriented leadership ->	Sustainable social performance	0.040	0.635	0.526
H13	Supply chain capabilities ->	Sustainable economic performance	0.158	2.649	0.008
H14	Supply chain capabilities ->	Environmental sustainable performance	0.092	1.539	0.124
H15	Supply chain capabilities ->	Sustainable social performance	0.100	1.515	0.130
H16	Sustainability-oriented Leadership ->	Sustainable healthcare Performance	0.154	2.155	0.031
H17	Supply chain capabilities	Sustainable healthcare performance	0.097	1.395	0.163

Planning and coordinating operations are critical to ensure sustainability in Supply Chains (SCs) (Bag *et al*., 2020). Usually, operations management is predominantly concentrated on the efficiency, effectiveness, and economy of SCs. However, increasing concerns from governments and SC stakeholders are pushing organizations to adjust their operations strategies to include environmental and social sustainability perspectives. There is significant motivation since the proposed Sustainable Development Goals (SDGs) for 2030 by the United Nations (United Nations Development Programme, 2015). Research in operations management has also started embracing sustainability from an operational excellence perspective in SCs (Mani and Gunasekaran, 2018; Sehnem *et al*., 2019). The procurement and supply chain management function plays an important role in the availability of medicines and healthcare delivery in hospitals (Kanyoma and Khomba, 2013). Practices, decisions, and archives target in function’s performance are also crucial in procurement operations. Other than that, the major roles of procurement in the supply chain determine the availability, cost, and quality of materials and provide strategic planning in the flexibility of the organization in managing customer needs and expectations. However, failure by the function to monitor the availability of supplies could lead to shortages or stock-outs of medical supplies which can have fatal consequences on patients, and the organization's function and finally result in total failure of healthcare delivery systems (Bickham, 2002).

Sustainable Supply Chain (SSC) is a concept that concurrently integrates ecological, economic, and societal measures of operations in an SC. The Triple Bottom Line (TBL) concept combines all three metrics of sustainability. Organizations need to evaluate not just their operations, but also operations across the supply chains, considering all three metrics of sustainability. A localized and short-term approach to sustainability is not appropriate (Jabbour *et al*., 2019). The operational performance of the SCs needs to be evaluated based on their trade-offs with the TBL model of sustainability. The IChemE and United Nations approaches have been used as a basis to define the criteria relevant for this dimension, for which the aim is to evaluate the business’s short-term and long-term financial stability and survival capabilities. The following four criteria are used for the economic purpose: (a) Financial health: The criterion entails those aspects assessing the internal financial stability of a company and includes traditional financial sub-criteria such as profitability, liquidity, and solvency; (b) Economic performance: The criterion assesses the company’s value as perceived by shareholders, top management, and government and includes sub-criteria such as share profitability, contribution to gross domestic product (GDP) as well as market share performance; (c) Potential financial benefits: The criterion assesses financial benefits other than profits, e.g., national and/or international subsidies based on the environmental, social, and/or technological improvements due to business initiatives. For example, projects that are potentially eligible for clean development mechanism (CDM) funding under the Kyoto Protocol; (d) Trading opportunities: The criterion assesses the vulnerability of the company’s trade network as well as the risks it is exposed to by the network it is embedded in by considering the number of national and/or international companies in the trade network.

7.3.1 Environmental sustainability

Healthcare organisations that used energy-efficient solutions experienced a significant decrease in operating expenses and power bills (Kaplan et al., 2021). Burgess et al. (2022) highlight the significance of waste management in the healthcare industry, pointing out that environmentally and financially beneficial recycling and sustainable practices lower the amount of garbage that ends up in landfills.

Healthcare institutions that implemented green practices reported improved indoor air quality and a decrease in hospital-acquired infections, which had a direct influence on patient health and recovery rates (Thiel et al., 2022). A scholarly study demonstrated that apart from operational benefits, SSCM practices can facilitate strategic importance which enables organisations to fulfil their responsibilities to society, the environment, and other stakeholders (Hoejmose and Adrien-Kirby, 2012; Paulraj *et al*., 2015; Esfahbodi *et al.,* 2016). According to an empirical study, during the supply-side reform in China, the implementation of SSCM helps eliminate highly polluting and energy-efficient products through the choice of downstream firms (Yang, 2016). It can facilitate the environmental protection compliance of organisations and help actively improve their environmental performance. In this way, it can accelerate the transformation and upgrading of Chinese firms in global value chains (Wei and Yang, 2016). Esfahbodi et al. (2016) also arrive at a similar conclusion that SSCM in emerging economies results in better environmental performance but does not necessarily better cost performance. The view that SC dynamic capability positively affects environmental performance has been backed by many researchers (Zhu and Sarkis, 2006; Sharfman and Fernando, 2008). By enhancing the overall dynamic capability, the activeness and innovativeness of key organisations on the chain can be boosted, and their utility of monitoring the environment can be achieved.

7.3.2 Social sustainability

Although the possible causes and effects of industry activities on the natural state of the four resource groups have been well documented, it must be noted that there is, as yet no consensus on a consistent methodology to measure these causes or effects. However, many quantitative and qualitative methodologies have been proposed (Brent, 2003; Azapagic and Perdan, 2007). The strive towards arriving at a consensus is highlighted in the ongoing work of the Life Cycle Impact Assessment (LCIA) workgroup of the United Nations Environmental Programme (UNEP) global life cycle initiative (www.uneptie.org/pc/sustain/lcinitiative). As a first observation, stakeholders exist within and outside the company (Levett, 1998). Social business sustainability therefore has definite internal and external focuses. The internal focus concerns the health and well-being of employees, disciplinary practices and equity and human rights aspects in employee sourcing. Training and development opportunities for employees are also included. The external focus concerns the impacts of the operational initiative on three different levels of society: local community, regional and national level. In certain cases, these impacts include those on or contributions to a community, region or nation's economic activities. In the case of the GRI, these impacts are addressed as economic sustainability criteria. The second observation is the vital role played by communication and interaction with stakeholders within social sustainability. Stakeholders and society have been defined as two of the five key corporate sustainability performance principles [35]. Stakeholder participation is also a social sustainability criterion within most of the frameworks or guidelines developed with a business perspective, the Dow Jones Sustainability Group Index.

7.3.2.1 Internal human resources

The internal aspects of social sustainability, excluding internal stakeholder relationship management, are grouped under this criterion. It thus focuses on the company's social responsibility towards its workforce and consists of four sub-criteria: (a) Employment stability: The criterion addresses a business initiative's impact on work opportunities within the company, the stability thereof as well as evaluating the fairness of compensation; (b) Employment practices: Disciplinary and secrecy practices as well as employee contracts are addressed under this criterion. These are evaluated to ensure that it complies with the laws of the country, international human rights declaration as well as other human rights and fair employment practice standards. The gender and racial equity inside the company is also addressed under this criterion as well as the legitimacy of labour sourcing practices, e.g., child labour, etc.; (c) Health and safety: This focuses on the health and safety of the workforce and evaluates preventive measures as well as the occurrence and handling of health and/or safety incidents; (d) Capacity development: The criterion addresses two different aspects, namely research and development, and career development. Research and development evaluate the company's contribution to sustainable product development through its research and development program as well as its innovativeness. Career development focuses on the training of employees and the provision of career guidance and higher-education opportunities.

7.3.2.2 External population

The external dimension of social sustainability is divided between this criterion and the criterion ''macro-social performance''. External populations focus on the impact of the company's operations on the community in which it operates, i.e., communities close to any of the company's operations. The criterion consists of three sub-criteria: (a) Human capital: Human capital refers to an individual's ability to work to generate an income and encompasses aspects such as health, psychological well-being, education, training and skill levels. The criterion addresses health and education separately. Health focuses on the additional strain or beneficiation of a company's activities on local medical facilities. Education considers the impact on education facilities the effect of possible training opportunities and the sharing of information on the community's level of education; (b) Productive capital: Productive capital entails the assets and infrastructure an individual needs to maintain a productive life. The criterion measures the strain on these assets and infrastructure availability by the business initiatives. The following groups are addressed separately: housing; service infrastructure, which entails water and electricity supply and sewage and waste services; mobility infrastructure, which considers public transport and the quantity, quality and burden on transport networks, e.g. public roads; and regulatory and public services; (c) Community capital: This criterion considers the effect of an operational initiative on the social and institutional relationships and networks of trust, reciprocity, and support as well as the typical characteristics of the community. Six groups are addressed separately: sensory stimuli (aesthetics, noise and odour levels); cultural properties; social pathologies (induced or increased); security (induced or increased crime); economic welfare (induced business opportunities, impacts on poverty) and social cohesion (networks, demographics and equity aspects).

7.4 Current state of the supply chain system

7.4.1 Financial Challenges

The first concern of all healthcare facilities is limited funds to enable them to operate effectively. This is because the National Health Insurance Scheme sometimes does not reimburse the facilities on time after submitting claims for reimbursement. This is due to many reasons stemming from delays in releasing the money from the finance ministry or submitting claims more than required leading to cancellation. There is also a delayed review of prices of medicines and consumables although prices quoted by suppliers far exceed what the NHIS pays leading to loss of revenue.

7.4.2 Impact of the burnt central medical store

The current state of the healthcare supply chain system shows that healthcare facilities and the regional medical stores no longer receive healthcare commodities from the central medical store (CMS) which used to be the primary source of commodities for all public hospitals in the country since the CMS was engulfed in fire on 13th January 2015 as a result $27 million worth of medical supplies were burnt into ashes. It is reported that the medical supplies were delivered by the United States Agency for International Aid (USAID) (https://www.theafricareport.com/3501/ghana-medical-supplies-estimated-at-237-million-lost-to-fire). The central medical store holds stock of every conceivable medicine, consumables and medical supplies imported by the government for onward distribution to all the regions in the country. Currently, the regional medical stores which should be the first port of call when it comes to procurement of medical supplies for public hospitals across the country procure their requirements from both local and foreign suppliers operating in the country. The hospitals are mandated to procure from the respective regional medical store which sells on credit to the hospitals to enable them to operate without being cash-trapped. Stockouts at the regional medical store prolong the lead times of the hospitals in replenishing the needed medicines and consumables and it becomes worse when there are frequent stockouts. Most of the regional medical stores have production units that produce limited quantities of fast-moving medicines such as paracetamol tablets and multivitamin tablets, however, these production units are not well equipped to meet demand and that is a big challenge in the supply chain. Equipping the production units means that medicines produced will be relatively affordable and readily available because of economies of scale and proximity. This is one of the areas if improved will benefit the people, hospitals, communities as well as the entire country in terms of revenue generation, profitability, jobs and foreign exchange to procure medicines from the developed countries.

7.4.3 Drone medical supplies

Ghana's healthcare supply chain practice has been boosted with drone medical supplies in addition to the traditional flow of medicines and commodities to save lives. The drone supplies have been instrumental in the delivery of emergency medicines, vaccines and blood to health facilities in the country and operate 24-hour service. The partnership between the Ghana Health Service and Zipline Technologies was launched on 24th April 2019, and it has been the game-changer in the country’s healthcare delivery. The service currently has six distribution centres at designated places in different regions in the country specifically located at Omenako, Mpanya, Vobsi, Sefwi Wiawso, Keta Krachi and Anum, making it the largest aerial logistics delivery network in the world (https://www.moh.gov.gh/ghanas-medical-drone-delivery-system-takes-off). According to the president of the republic in his address to the parliament, President Akuffo Addo emphasised that “Zipline through the medical delivery system has delivered 14.8 million units of lifesaving medicines, vaccines and blood products to health facilities by the end of 2022” (https://www.graphic.com.gh/news/health/ghana-has-the-largest-medical-drone-delivery-hub-in-the-world-prez-akufo-addo.html).

7.4.4 Last Mile Distribution

Since 2016, the USAID Global Health Supply Chain Project-Procurement and Supply Management

(GHSC–PSM) project has worked in more than 30 countries including Ghana to partner with ministries of health, central medical stores, and others to strengthen public health supply chains. Making quality health products available to clients and patients at the last mile has been central to this work. The purpose is to ensure the availability of public health commodities at the last mile meaning that medical supplies will be transported from centralised warehouses to the reach of clients. Hitherto, healthcare facilities would send vehicles to the respective regional medical store for the supplies they need but with the last-mile project, the medical supplies needed would rather be transported to the hospitals after placing the order saving them from the hustle of driving miles upon miles for goods. The definition of "the last mile" increasingly includes locations beyond public health facilities, such as private-sector pharmacies, village markets served by community health workers, specialized laboratory hubs, and even homes, bars, and hotels. The supply chain and logistics fields are progressively professionalizing, permitting increased efficiency and for trained clinicians to focus on their clinical work. The private-sector distribution systems for non-health commodities are increasingly robust and private-sector healthcare provision is growing as well. As a result, governments are now more open to leveraging the private sector to provide warehousing and distribution services, particularly delivery, to extend the reach of the public sector. USAID's private-sector engagement policy encourages an intentional shift toward market-based solutions where possible. For USAID and GHSC-PSM, reaching the last mile encompasses far more than commodity delivery; it includes an array of services for commodity procurement supply, systems strengthening technical assistance and even advocacy: any activity that helps provide a reliable supply of health commodities to the facilities and workers who use them.

7.4.5 Automation of the ordering process

The public healthcare supply chain system is being automated using the Ghana Integrated Management System (GIMES) and it is being piloted at some facilities. This is important because healthcare facilities can place orders electronically to the regional medical store unlike hitherto when requisition books had to be sent. This is crucial because it saves considerable time and money rather than travelling far distances to procure medical supplies. Adopting telemedicine in the public sector is long overdue and the government must implement that to curb the long queues patients go through in receiving medical care at the various healthcare facilities.

7.4.6 Digitalisation of medical records and pharmacies across the country

The government as of September 2024, had digitalized patients' medical records in all tertiary hospitals, regional hospitals, and metropolitan, municipal and district hospitals across the country. The government had also begun digitalizing patients' medical records in polyclinics and community-based health planning and services (CHPS). Another great achievement by the government was the successful creation of an electronic pharmacy platform where 2,456 pharmacies in the country had been electronically amalgamated and centralised on a platform. This ensures visibility and also enables prescribers and patients to easily locate nearby pharmacies where prescribed medications can be purchased quickly rather than wasting time finding a pharmacy with the availability of a particular medication to save lives. These novelties in a low and middle-income country like Ghana are a great achievement in healthcare delivery.

Key challenges in the healthcare supply chain:

1. Limited funds: the primary source of funds is the NHIS and whenever they do not reimburse the healthcare facilities then the facilities will struggle to operate leading to stockouts of essential medical supplies.

2. Managerial challenges: The budget management committee (BMC) at the various healthcare facilities is confined to the status quo making it practically impossible to innovate other means of generating income to operate effectively.

3. Inadequate staffing: Currently skilled procurement and supply chain practitioners in healthcare are not enough and as a result, people with no supply chain background are manning the supply chain in some facilities.

4. Lack of warehouses: Most of the hospitals were built without a proper warehouse to store the medicines and consumables in the right order.

5. Inadequate storage facilities: Related to the point above is the lack of proper storage facilities in some facilities. Medicines and some consumables such as reagents must be safely kept at the right temperature to preserve them, that is they must be refrigerated and monitored regularly but some facilities do lack the needed storage facilities, or they are medicines are not monitored as required.

6. Lack of supply chain technological adoption: Technological adoption continues to be a great challenge in healthcare supply chain practices since most healthcare facilities still operate using the traditional manual and paper processes.

7.5 Summary and conclusions

Chapter seven discussed the research findings of the study from the perspective of existing theory and research. The paths of the estimated structural model, and its related hypotheses, support their theoretical foundations developed in chapters 2 and 3 of this study, thus making empirical research contributions in successfully developing new measurement scales and establishing new relationships between constructs. Only one hypothesis was found to be insignificant (SoL ->ESP). Each path and hypothesis are explained by either the underlying theory or the research perspective of the study. In the next chapter, the theoretical implications of the study for sustainability-oriented leadership, supply chain capabilities, sustainable supply chain practices, and sustainable performance literature are discussed, along with the managerial implications of the study.

CHAPTER EIGHT – RESEARCH IMPLICATIONS AND CONCLUSION

8.1 Introduction

This chapter discusses the research findings of the study in the context of existing theory and research. The study has several implications for strategic management and organisation science research. In the following, it is established that the research study makes three important theoretical contributions:

RQ1. Developing a framework to reveal the determinants of sustainable public health care supply chain system in Ghana.

RQ2. Measuring the determinants of sustainable supply chain management practices of the public health care supply chain system in the Ashanti region of Ghana using the proposed framework.

RQ3. Develop a strategy to re-engineer a sustainable public healthcare system supply chain in the region.

This chapter, therefore, presents the theoretical (8.2) and managerial implications (8.3) of the research study. First, the chapter presents the research study's implications for and contribution to sustainable supply chain management practices. Second, the managerial implications are addressed for sustainability-oriented leadership (8.3.1), supply chain capabilities (8.3.2), sustainable supply chain practices (8.3.3), and sustainable performance in general (8.3.4). Finally, the chapter is summarised and concluded (8.4).

8.2 Theoretical Implications

The current findings shed new light on the impact of sustainability-oriented leadership and supply chain capabilities in facilitating sustainable initiatives to drive sustainable supply chain management practices in organisations, especially the healthcare industry. The findings support Dey *et al.* (2020) framework for lean management practices; sustainability-oriented innovation on sustainability performance; Hong, Zhang and Ding (2018) model of sustainable supply chain management practices' relevant findings highlighting empirical impacts of supply chain management practices on organisations sustainable performance but with different constructs. This study is the first to provide empirical evidence of introducing sustainability-oriented leadership and supply chain capabilities as antecedents in the SSCMP conceptual framework which future researchers can adopt and or expand the constructs. As such, the findings contribute to theory and research on sustainable supply chain management practices impacting sustainable performance.

As an important first step, the current study attempts to provide guidelines for future research on sustainable supply chain management practice through the proposed conceptual model. The author acknowledges that some terms are generic, nevertheless, the conceptual framework offers a supportive framework for further investigation of sustainable supply chain management practices. Future studies could identify additional determinants relevant to the framework. Secondly, the study demonstrates new insights into the question of why, how and when leadership/managerial characteristics impact organisations' sustainable performance specifically the strategic decisions towards formulating and implementing sustainable policies. The study examined that when leaders are sustainability-oriented and have the requisite capabilities, they will be able to drive the organisational activities to achieve the expected sustainable performance or competitive advantages. Having leaders who are sustainability-inclined would mean that policies will focus on long-term economic, environmental and social performance refraining from concentrating only on economic performance. This idea was highlighted by Elkington (1997) who first introduced the triple bottom line (TBL) that was subsequently adopted by the United Nations in the sustainability agenda in 2015 which many scholars supported. This study empirically establishes the facts discussed above.

Thirdly, the results showed that measurement of the variables exhibited influences consistent with supply chain management theories (see, eg., Hong *et al.,* 2018; Dey et al., 2020; Carter and Rogers, 2008; Carter and Washispack, 2018; Kotzab, Mikkola and Skjøtt-Larsen, 2007). That is, sustainable supply chain practices influence sustainable performance not only in healthcare supply chain systems but also across industries. This pattern of influence has been observed by many researchers over a long time and mostly shows a highly positive and significant relationship. Moreover, the findings of all the proposed constructs were in the expected direction (Dey *et al*., 2020; 2022; Hong, 2018). The third theoretical contribution is that the study explored in detail the interrelatedness of sustainable supply chain management practices and sustainable performance. Given this, the study reports that sustainable supply chain management practices and sustainable performance should not be considered in an “either/or” manner, but as complementary strategies that leaders and subordinates may simultaneously pursue to manage and achieve positive sustainable outcomes. In addition, the fourth theoretical contribution is that the research presents a new construct of the antecedents of sustainable performance background. Importantly, the study provides empirical evidence that sustainable goals could be achieved when leadership first understands and realises the importance of supply chain sustainability and its corresponding organisational performance.

8.3 Practical Implications

The practical field of supply chain management (SCM) is constantly changing, as the competitiveness of international organisations is predominantly dependent on their capability to produce and deliver quality, customized and sustainable products and services fast and efficiently all over the world. Concurrently, an increasing percentage of the value creation occurs outside the boundaries of the individual organisation (Bruce *et al*., 2004). This induces higher complexity and diversity in management decisions regarding the structure of the operations, the positioning of activities and processes, the role and power of the participants, and the most efficient forms of collaboration between all stakeholders in a transformative chain between production and consumption, which we call a supply chain sustainability.

8.3.1 Managerial Implication – sustainability-oriented leadership

For managerial practices, organisations can help existing leaders change their approaches and become green transformational leaders through training. Through unified training and external learning opportunities, organisations can encourage managers to benchmark other organisations' experiences or relevant knowledge (Farrukh et al., 2022), understand implementation measures of green transformational leaders, and gradually change their leadership styles. Continuous professional development and promotion, so that members of the organization can have the willingness to pursue the modern environmental trends (Nurwahdah and Muafi, 2022). Also, organisations can select green transformational leaders. Organisations can change their leadership style by engaging employees with relevant green transformational leadership characteristics from external and subordinate employees to champion their goals. Additionally, a study demonstrated that green organizational climate plays a mediating role between green transformational leadership and employee organisational citizenship behaviour for the environment. The study reported that green organizational climate can explain 45% of the relationship between green transformational leadership and employee OCBE, which informs organizations of the significance of green transformational leadership on employee green behaviours. This study suggests a significant number of contributions to which supply chain managers can benefit.

First, developing appropriate strategic priorities is crucial to the successful implementation of supply chain management practices. The results from the focus group conducted with experts and practitioners suggest that sustainability-oriented leadership drive better sustainable performance. In so doing, when managers prioritise sustainability in their organisations, the organisations will benefit in many ways than otherwise. The conceptual framework could help managers in structuring the sustainability initiative in their organisation. The study also indicates that neglecting either one of the processes in the framework may lead to suboptimal outcomes. Secondly, although the relevance of sustainability-oriented leadership has been advocated, some managers still believe that it is not a critical matter and therefore such managers must undergo training to be abreast with the contemporary managerial. Nevertheless, the proposed conceptual model suggests that the implementation of supply chain management practices must encompass various functional areas within and across organisations and requires the incorporation of all stakeholders at every step. Sustainable leadership seeks to maintain an appropriate balance between economy, society and environment while achieving high performance, resilience and sustainability (Burawat, 2019) and goes beyond the concept of green and social responsibility in organisations. Only when all stakeholders are inclined can supply chain sustainability create value for an organisation and yield the desired performance outcomes for the organisation.

8.3.2 Managerial implications – Supply chain capabilities

Many believe that it is time to redesign our health system to reduce inefficiency and waste and to improve healthcare quality. One of the methods to solve this challenge is effective and efficient SCM capabilities. Alan *et al*. (2004) argued that automating operations in logistics and inventory management can save time and cost, contributing to maintaining and improving organizational competency and attaining managerial goals. Chandra *et al.* (2004) emphasized the importance of standardizing informational technology and the decision-making process in healthcare SCM to boost efficiency and remove unnecessary expenses in logistics. This study suggests that with effective use of SCM capability systems such as Enterprise Resource Planning (ERP), Big Data Analytics, Blockchain, Artificial Intelligence, Drones, and 3D Printing, managers of healthcare facilities will be able to make accurate forecasting will help to reduce various elements of inefficiency and procure the required resources that would enhance operational performance. Managers use big data analytics (BDA) which has been defined as “a holistic process that involves 5V (volume, velocity, variety, value, and veracity) in terms of collection, analysis, use, and interpretation of data for various functional divisions, to gain actionable insights, create business value, and establishing competitive advantages” (Fosso-Wamba *et al*., 2015, p. 235). As a result, the patients who patronise these healthcare facilities will be able to receive the quality services needed. The facilities will also benefit from judicious resources and the community in general will benefit from environmentally friendly healthcare activities.

8.3.4 Managerial implications – Sustainable performance

Sustainability has advanced from a peripheral topic to a significant supply chain management (SCM) research agenda (Brockhaus *et al*. 2013). The findings determine that innovation has significant effects on suppliers, customers, internal sustainable business processes and the growth and learning of SSCM. Previous studies also report that product and manufacturing process innovations are highly associated with the competitive advantage of organisations. In detail, sustainability-oriented leaders can think outside the box and make effective decisions regarding resource allocation, reliability, effectiveness of the master production and service schedule, lead-time reduction and demand forecasting. Significant evidence of sustainable performance encouraged organisations to practise supply chain management that concentrates on green innovation to improve their environmental performance and enhance competitive advantage (Chen *et al*., 2006; Chen, 2008; Chiou et al., 2011). In the traditional analysis, innovation can be classified into four main categories: managerial innovation, product innovation, process innovation and technological innovation (Tseng *et al*., 2013). Being dynamically flexible in operations is becoming a competitive necessity for organisations in SSCM. The achievement of a multiple set of competitive priorities (e.g., quality, dependability, cost, profit, growth) could be the best way to position the fundamental operations capabilities of organisations to be proactive and achieve competitive advantage. A stable foundation of innovation needs to be built to improve the basic operational capabilities of the organisations and further enhance their SSCM to create the unique competitiveness required.

8.4 Summary of implications

This chapter outlines the specific contribution of the research study to the sustainable supply chain management literature as well as the practicality, especially in the healthcare sector. The implications of this study for each domain of the literature have been briefly elaborated and in addition, the study presents some implications and practical challenges for practising sustainable supply chain management. These include the need to consider the triple bottom lines in all decisions and not concentrate only on economic performance. The principal contribution of this study is the empirical evidence of the impacts of sustainability-oriented leadership, supply chain capabilities, sustainable supply management practices and sustainable performance which establishes the SSCM construct influence in organisations' management approach. The study further empirically demonstrates that sustainability-oriented leadership helps the top executives in organisations to develop sustainable innovations to improve the performance of the organisation towards achieving economic, environmental, and social sustainability using the required capabilities. The study recommends that supply chain leaders invest more in dynamic capabilities, such as developing technologies, as history has shown (blockchain, automation, big data analytics etc.), digitization of supply chains, resilient transportation systems, and health protocols (Liao *et al.,* 2020; Kilpatrick and Barter, 2020). The next chapter elaborates on the study's main contribution, along with whether the stated purposes and research objectives have been met, along with presenting the limitations of the research study and potential future areas of further research.

8.5 CONCLUSION

8.5.1. Introduction

This study has developed and presented the determinants for sustainable supply chain management practice and performance (chapter 2). Reviewing the SSCM literature (chapter two) led to the development of a theoretical model for the construct (chapter three). The sustainability-oriented leadership and supply capabilities (antecedents) and sustainable supply chain practices and their related theoretical model are the determinants in achieving sustainable performance in organisations.
The proposed research design, which empirically tests the SSCM theoretical model, deploys a quantitative research study in thirty-two of Ghana's public health service facilities (Chapter Four), utilising structural equation modeling to analyse the study's research results (Chapter Five). The results of the study are discussed with existing theory and research (chapter six), as are the study's implications for and contributions to the SSCM (chapter seven). This chapter first concludes the research study by establishing that the research study in the majority addresses its research questions (8.2.1), meets the stated purpose (8.2.2), and accurately examines the SSCM construct partly modified to take account of the study's empirical findings (8.2.3). Next the limitations of the research study are presented (8.3), followed by suggestions for future research (8.4). Finally, the research study is summarised (8.5).

Table 8.1 Summary of research study questions and objectives

RESEARCH PURPOSE	
The overall purpose of the study is to develop a framework for measuring the sustainability of supply chain management practices to improve organizational performance, productivity, and quality in organisations, especially the public healthcare sector.	
Research Questions	**Research Objectives**
RQ1 What are the determinants of sustainability of the supply chain practice in the public health sector?	RO1 To identify the determinants of sustainability of the public healthcare supply chain system in Ghana.
RQ2 What framework could be developed to measure the determinants of sustainable supply chain management practice in the health sector?	RO2 To measure the determinants of sustainable supply chain management practice in healthcare using a framework.
RQ3 Which sustainable strategies will be necessary for the supply chain management practices to achieve the stated objectives?	RO3 To develop strategies to re-engineer a sustainable public healthcare system supply chain in the region.

8.3.3 Managerial implications – Sustainable supply chain practices

According to Elmuti (2013), many studies have reiterated the effectiveness of SCM in the manufacturing industry and other sectors of the economy (Stevenson, 2007; Youngdahl, 2000; Gryna, 2001). Nonetheless, the implementation of SCM in the healthcare sector does not have a vivid description and framework for analysis. Compared to manufacturing, the healthcare industry is lagging in the effective utilization of the benefits that could be derived from effective SCM (Rai, Patnayakuni, and Seth, 2006; Sing, 2006; Long, 2005). Their findings concluded that sustainable supply chain practices enable organisations to be effective through better managerial directions focusing on sustainability outcomes. Effective capabilities such as information technology, for instance, 3D printing, power BI and big data analytics could help managers to be able to forecast and make the best decisions with real-time data. This study's framework further supports the relevancy of supply capabilities in achieving sustainability in organisations coupled with sustainability-oriented leadership.

In the manufacturing industry, supply chain capabilities help to control lead times (e.g., like in Just-In-Time management) and require the elimination of inventories along the entire supply chain. Again, the adoption of the required capabilities in the healthcare supply chain can help managers practise vendor-managed inventory (VMI). Translated to the healthcare sector, the elimination of inventories along the supply chain refers to the abolition of crowded waiting rooms filled with patients waiting to be “processed”. One significant intervention of capabilities is the elimination of stockouts which sometimes makes it difficult for the clinical personnel to discharge their duties satisfactorily. Ideally, patients deliver their inputs (i.e., themselves) directly to that point in the activities where they are needed. Furthermore, patients should enter the operating room ready for treatment exactly when the physicians are ready to start. All stages of the chain, or parts of the network involved, can be organised like this for the optimal effect: i.e., minimum waiting times and smooth transfers between health care providers. However, the special nature of health care and its inputs pose constraints to SCM thinking. Although for healthcare providers it may seem that they are performing one standard procedure after the other, for their patients even the smallest procedure is emotionally charged; they do not want to feel like a product on an assembly line. Moreover, because of the limited medical knowledge of most patients, it is too risky to make patients themselves responsible for a part of the service delivery process.

8.5.2 The research questions, research purpose and SSCMP

First, the study’s sets of research questions RQ1 to RQ3 are addressed in section 8.2.1. It proposes that most research questions posed for the study, introduction in chapter one, and as presented in table 8.1 above, are addressed by the research study. Table 8.1 indicates in bold text those sets of research questions addressed by the study. Next section 8.2.2 establishes that the research study fully addresses the purpose of the research study in identifying determinants of SSCMP, empirically measuring the determinants using a framework and re-engineering strategies for improvement. The principal contribution of the research study is presented. Finally, in section 8.2.3, the initially proposed definition of SSCMP is slightly modified and re-stated to take account of the research studies empirical results.

8.5.2.1 The research questions

By adopting the structure model below

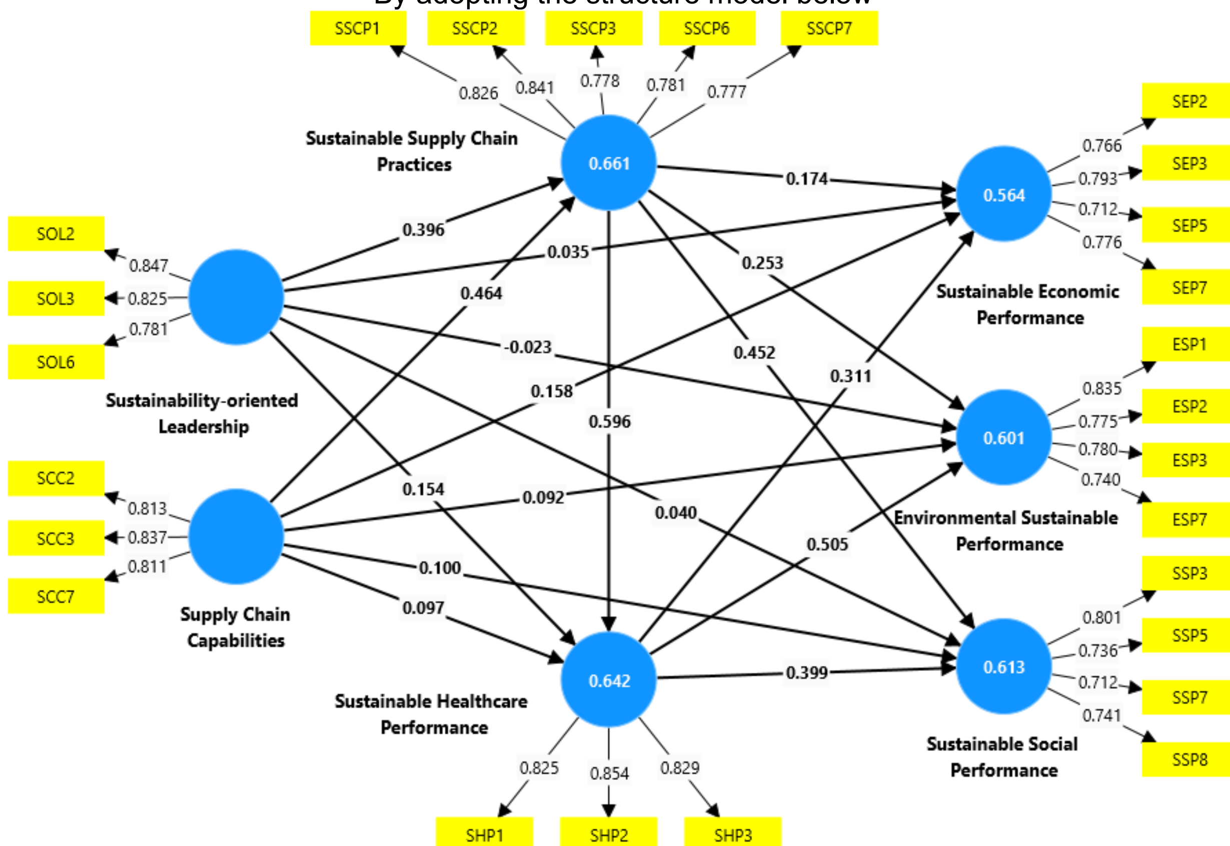

Figure 8.1 Structural model result

8.5.2.2 Research question set RQ1, RQ2 and RQ3.

Research question set (RQ1) asks: What framework could be developed to identify the determinants of SSCMP? Many relevant literatures regarding sustainability in supply chain management practices were reviewed in detail to identify the research gaps which enabled a grounded framework to be developed for this study. The participants who are practitioners of the Ashanti region branch of Ghana Health Service were asked questions to solicit their anonymous opinion on some determinants discovered from the gap established in the literature. Based on the responses a new framework was developed for this study consisting of seven constructs discussed earlier including sustainability-oriented leadership (SOL); supply chain capabilities (SCC); sustainable supply chain practices (SSCP); sustainable hospital performance (SHP); sustainable economic performance (SEP); environmental sustainable performance (ESP) and social sustainable performance (SSP).

Research question set RQ2 asks: What framework could be developed to measure the determinants of sustainable healthcare supply management practices? This study in the form of its estimated structural equation model, successfully and empirically measured the determinants identified for the SSCMP framework. The scale measurement results contain both significant and insignificant findings which could be adopted to advance SSCMP literature as shown in Figure 8.2 above. However, the results for the sub-structural model shown in Figure 5.2 were all positive and significant and could also be adapted for future research. The positive and significant influence of SOL and SCC upon SSCP (β = 0.396, β = 0.464, p-value <.001) and R^2 of (0.661) representing about 66.1% give evidence that SOL and SCC can influence SSCP. The positive and significant influence of SSCP (β = 0.596) at a significant level of (p-value <.001) with R^2 of (0.642) indicating about 64.2% empirically shows that sustainable supply chain practices can influence sustainable performance. The strong positive (β = 0.311) at a significant value of (p-value <.001) and R^2 of (0.564) representing about 56.4% demonstrates that sustainable healthcare performance can influence sustainable economic performance. The study empirically shows that sustainable performance can strongly and positively influence environmental performance and social performance with beta coefficients of (0.505) and (0.399) a significance level of (p-value <.001) and R^2 of 60.1% and 63.1%. To conclude, by using the proposed framework of the study, the determinants have been empirically measured thereby conforming to the research question set RQ2.

In response to RQ3, the results established a set of determinants for the SSCM practice hypothesised paths that were not supported and therefore needed to be addressed as set out in Figures 5.1 and Table 8.2, of the study. As a result, the following strategies were formulated to improve SSCM performance: managers/leaders at the various healthcare facilities should embark on a value-for-money procurement process through fair competition as much savings could arising from that function since procurement accounts for about 60-70% of organisation's resources. There is the need to periodically assess and rate suppliers to ensure the hospitals' contract certified suppliers/contractors. There must be strict measures/policies aimed at abating pollution. Supply chain partners should be encouraged to invest in renewable products rather than non-renewable products. Manufacturers and suppliers of hospital products and equipment must significantly and rapidly reduce energy and raw materials consumption to meet the needs of future generations. Healthcare facilities must endeavour to transition to recycled materials which is part of limiting the material content of growth. The government must empower environmental agencies to demand steady improvement in the waste generation and disposal at the various hospitals to ensure environmentally friendly practices are embarked upon (SDG 2015, MacNeill, 1989).

Table 8.2 Hypothesised paths not supported

Hypothesized Relationship	Standardized Estimates	t-value	p-value	Decision
Sustainability-oriented Leadership -> Sustainable Economic Performance	0.035	0.636	0.525	Rejected
Sustainability-oriented Leadership -> Environmental Sustainable Performance	-0.023	0.356	0.722	Rejected
Sustainability-oriented Leadership -> Sustainable Social Performance	0.040	0.635	0.526	Rejected
Supply Chain Capabilities -> Sustainable Healthcare Performance	0.097	1.395	0.163	Rejected
Supply Chain Capabilities -> Environmental Sustainable Performance	0.092	1.539	0.124	Rejected
Supply Chain Capabilities -> Sustainable Social Performance	0.100	1.515	0.130	Rejected

Table 8.2 depicts the unsupported paths from the structural model analysis. Although sustainability-oriented leadership -> sustainable economic performance, sustainability-oriented leadership -> environmental sustainable performance, and sustainability-oriented leadership -> sustainable social performance paths were not supported due to the respective p-values (0.525, 0.722 and 0.526), several empirical studies, however, report otherwise (Zhu et al., 2020; Dubey et al., 2022; Günzel-Jensen et al., 2020; Golicic and Smith, 2021 Chowdhury et al., 2021). These empirical findings reported significant correlations of sustainability-oriented leadership in achieving sustainable economic performance, environmental sustainable performance and sustainable social performance. Again, while the impact of supply chain capabilities on sustainable healthcare performance proved positive but insignificant (p-value = 0.163), many authors (Shang et al., 2022; Carter and Rogers, 2021; Choi et al., 2023; Kaur and Singh, 2023) empirically examine that supply chain capabilities positively and significantly influence sustainable healthcare performance. Supply chain capabilities -> environmental sustainable performance and supply chain capabilities -> sustainable social performance showed positive but insignificant correlation as per table 8.2, however, some authors (Walker and Seuring's, 2022; Johnson et al., 2023; Mena and Whipple, 2021; Dubey et al., 2022; Gölgeci and Kuivalainen, 2020; Golicic and Smith, 2021) have empirically argued contrary to that demonstrating positive and significant impact. This also stresses the relevance of supply chain capabilities in the achievement of environmental sustainable performance and sustainable social performance.

Notwithstanding the limitations, this study has important implications for practice. Firstly, as our findings suggest, leadership plays a critical role in directing the affairs of the organisation's performance. As such, it is recommended that managers tackle sustainability seriously and focus their decisions on the triple bottom line for the subordinates to follow. Focusing decisions on the triple bottom line and ensuring adherence will lead to greater task engagement across the organisation. Managers must exercise caution against the neglect of one of the components of the triple bottom line as this may lead to a debilitating outcome. Secondly, as the results suggest regarding the mediating role of supply chain practices, managers have an active role to play in enabling their personnel to handle sustainable initiatives with high importance and with the needed capabilities. Managers should encourage lean management practices and sustainability-oriented initiatives to drive sustainability (Dey *et al*., 2020). Effective supply chain capabilities as indicated Hong, Zhang and Ding (2018) have also proven to facilitate faster sustainable performance outcomes and managers should not lose sight of that. Managers should institute a framework for performance measurement to assess if the operations are working according to plan (Gunasekarana, Patel and McGaughey, 2003).

8.6. Implications for healthcare sustainable supply chain

The study's framework presents a different dimension of SSCM to supply chain managers at various healthcare facilities. Although several managers have heard of the term sustainability, our engagement with the supply chain practitioners suggests that most supply chain personnel have very different perspectives on what sustainability is. According to Carter and Rogers (2008) "much like the blind men who touch an elephant only to describe it as a thick rope (the trunk), a large leaf (the ear), a tree (the leg), etc. so too do supply chain managers appear to view sustainability primarily as environmental management, as a synonym for social responsibility, as long-term economic viability, or in some cases as the triple bottom line." The SSCM framework therefore delivers an initial integration and extension of all these perspectives into a managerially significant and theoretically derived conceptualization. The SSCMP framework also suggests a business case for the managerial adoption and integration of SSCMP. While prior research has alluded to the economic benefits of SSCMP, the SSCMP framework accounts for long-term economic performance. We hope that the business case that has been developed for SSCMP through the introduction of the paper's propositions will lead to greater acceptance and adoption of SSCM in practice. The research reports will be made available to the leaders of the healthcare facilities to consider adopting the findings and recommendations of the study. Consequently, the facilities are likely to benefit from the research due to their active participation throughout the study. The findings will be communicated to policymakers to facilitate them to adopt or enhance sustainability in healthcare supply chain practice. Furthermore, with follow-up workshops and other communications through research articles and webinars, healthcare facilities and their supply chain practitioners across the country and beyond are likely to get further benefits.

More importantly, this study recommends a strategic model for healthcare delivery called value-based healthcare (VBCH) highlighted by Paiola (2023). Value-based healthcare is a healthcare delivery model that defines value as the patient health outcome per dollar invested, rather than simply minimizing expenditure (Kaplan and Porter, 2011, Kokshagina and Keränen, 2022; Porter and Teisberg, 2006). The model was introduced by M. Porter and E. Teisberg, the concept is now used to restructure provider organizations to enhance value for customers and improve the overall efficiency of healthcare systems. One of the principal objectives of VBHC is patient satisfaction, which is defined based on the patient's treatment experience, not solely on its medical effectiveness (Teisberg et al., 2020). VBHC is vital for treating patients with chronic diseases such as diabetes, cancer, high blood pressure, obesity, and rare diseases, as these treatments are often time-consuming and expensive. Furthermore, the treatment of such diseases requires significant patient participation (Berry, 2019; Légaré and Witteman, 2013). In Europe and other countries, the healthcare system is based on insurance, where the national healthcare system purchases services from providers, such as pharmaceutical companies, and the providers must ensure the efficiency of their services and medications. According to VBHC, which has now become a strategic model in many countries, pharmaceutical companies should offer services that reduce the risk of inefficient spending of state funds (WEF, 2018). Concerning rare and chronic diseases, therapies are only effective if patients adhere to them, periodically taking important measures and on a timely basis. In such circumstances, patient support systems (PSPs) will used to mitigate risks for the national health system (Wallace, 2020). Adopting a PSP significantly increases the complexity of interactions among all participants: the network of collaborated parties expands, the amount of data to be processed grows, and so forth. Communication and interaction occur through various digital and real-life channels, and consumers expect a seamless and personalized experience across broad. Many healthcare organizations are embracing new digital experiences and adopting new tools, but this often leads to the creation of silos when channels are disintegrated. All these complexities call for the application of the omnichannel approach, which can effectively and efficiently manage the system (Kraus et al., 2021, Schiavone et al., 2021).

Additionally, this study emphasizes the adoption of digital health which entails engaging patients for clinical purposes, such as collecting, organizing, interpreting, and using clinical medical data and managing results (AMA report). The significance of digitalization has provided an extraordinary opportunity for patients to have a wider range and more thoughtful healthcare choices. Therefore, to enhance healthcare quality and minimize costs, patients' greater access and engagement with digital information are crucial factors (Chérrez-Ojeda et al., 2018). The tools used in digital health include digital health information inquiries, electronic medical records, patient portals, mobile health, telemedicine, healthcare wearables, and other remote monitoring appliances. The COVID-19 pandemic has accelerated digital health and fitness application growth by integrating data science and intelligence technology into traditional healthcare. Healthcare wearable devices, for instance, wearables, are emerging as a crucial tool to track and manage individuals' health and provide more in-depth information about their behavior, guidance, and health information. It plays a vital role in omnichannel strategy in the new age's healthcare sector (Montgomery et al., 2018). Wearable technology also allows healthcare businesses to continuously improve their competitiveness and responsiveness and adapt their omnichannel operational approaches and technologies to real-time data (Ogbuke et al., 2022). Wearables range from daily fitness activity trackers such as Fitbit to more advanced medical technology managing and preventing disease. A breakthrough in wearable technology is expected to fuel the transformation in the health paradigm towards virtual and voluntary follow-up and diagnosis of sicknesses at home. Patients also admit that healthcare wearables offer healthcare service providers the opportunity to monitor and communicate with them anytime and anywhere and help patients engage more in health service interactions. Besides, driven by the scarcity of medical resources, many wearables such as VitalPatch have been officially permitted by the United States Food and Drug Administration to facilitate remote patients care and monitoring in the health sector (FDA, 2020). Other studies evaluated and found that managers should also communicate with suppliers and customers to better understand each other's environmental needs as it helps to improve the progress of green supply chain integration (Sheikh, 2021; Yim and Leem, 2013).

8.7 Proposed strategies for the antecedents of sustainable performance

8.7.1. Sustainability-oriented leadership strategies

Sustainability-oriented leadership is crucial for setting the vision, commitment, and organizational culture that propels sustainable practices throughout the healthcare supply chain. Leaders play a significant role in aligning supply chain goals with the broader sustainability goals of the organization. For instance, the Cleveland Clinic's leadership is a pioneer in sustainability efforts, implementing programs to reduce energy usage, water consumption, and greenhouse gas emissions while promoting sustainable procurement and community engagement.

Key strategies to achieve sustainability-oriented leadership:

I. Commitment to Sustainability Goals**:** It is recommended that leaders set specific sustainability goals for supply chain activities, with an emphasis on lowering carbon footprints, cutting waste, and improving social equality. Daddi et al. (2022) claim that leadership that is focused on sustainability encourages a dedication to the ongoing enhancement of environmental performance.

II. Cross-functional Collaboration: To implement sustainable programs holistically, leaders should encourage collaboration across departments, including procurement, logistics, and environmental services. Gonzalez et al. (2023) emphasise that by coordinating resources with environmental objectives, leadership and supply chain management may improve sustainable outcomes.

III. Leadership Training in Sustainability**:** Invest in sustainability-focused leadership development programs. This guarantees that leaders have the skills and resources necessary to support sustainability projects. According to Lozano et al. (2021), leadership development in sustainability enhances decision-making and fosters an environmental stewardship culture.

8.7.2 Supply chain capabilities strategies

Healthcare organisations may manage their operations more effectively, lessen their impact on the environment, and react swiftly to sustainability issues by improving their supply chain capabilities. For example, one of the biggest healthcare providers in the United States, Kaiser Permanente, has improved its supply chain capabilities by tracking the environmental impact of its supply chain using real-time data analytics, which has reduced waste and greenhouse gas emissions.

Key strategies to improve supply chain capabilities

I. Digital Transformation: To increase the visibility and traceability of commodities, use digital solutions like supply chain management software, blockchain, and real-time data analytics. These instruments guarantee sustainable sourcing, cut waste, and improve inventory management. According to Scholten et al. (2022), supply chains must achieve both operational efficiency and sustainability in order to fully utilise digital capabilities.

II. Supplier Development Programs: Improve your suppliers' sustainability practices by interacting with them. This can involve group projects like cutting down on packaging waste, switching to energy-efficient vehicles, or implementing the ideas of the circular economy. According to Walker and Jones' (2023) research, healthcare institutions that collaborate closely with suppliers to fulfil sustainability standards experience both cost and environmental savings.

III. Agile and Resilient Supply Chains: Create supply chains that are flexible and able to withstand shocks, particularly when it comes to procuring sustainable resources and handling erratic demand trends. According to Ramos et al. (2023), highly adaptive supply chains are better able to handle risks associated with sustainability, such as disruptions in ethical suppliers or shortages of environmentally favourable goods.

8.7.3 Sustainable supply chain practices strategies

Healthcare organisations must implement sustainable supply chain practices to mitigate their environmental impact and enhance their social and economic outcomes. For instance, to reduce waste and carbon emissions across its supply chain, the NHS Supply Chain in the UK has put in place sustainable procurement regulations. It also routinely audits suppliers to make sure sustainability criteria are being met.

I. Green Procurement: Make environmentally friendly goods and services a priority by imposing stringent sustainability requirements on suppliers. According to Lee et al. (2023), green procurement practices can help healthcare organisations promote ethical suppliers while cutting down on waste and energy use.

II. Waste Minimization and Circular Economy: Implement practices that lessen medical waste and encourage material recycling and reuse. Reusing surgical tools and recycling medical packaging, for instance, can significantly lower the amount of waste dumped in landfills. According to Khan and Gupta's (2022) research, hospitals that adopt the principles of the circular economy experience notable decreases in their environmental footprint and waste disposal expenses.

III. Energy Efficiency and Resource Optimization: Healthcare institutions could employ green vehicles or route optimisation software to reduce fuel usage to optimise energy use in logistics and transportation. Healthcare companies have lowered their carbon emissions and operating expenses by employing energy-efficient logistical solutions, like electric cars, according to Baloch et al. (2023).

IV. Sustainable Supplier Auditing: Conduct routine audits to make sure vendors follow sustainability guidelines, environmental laws, and ethical labour practices. Sustainable supplier audits, according to Sharma et al. (2023), lower the risks connected with unethical practices while assisting healthcare organisations in maintaining a socially conscious supply chain.

8.8 Research limitations

The research limitations of the study's survey are discussed in the following paragraphs. The limitations are linked to the COVID-19 pandemic, scope and duration of the research access agreed with the healthcare facilities. The agreement reached for the research access with the healthcare personnel was for the quantitative research to be conducted in the sector specifically thirty-two facilities in the Ghana health service Ashanti regional chapter, over a two-month duration. Participants' consents were sought before participating in the research. First, the pandemic could not permit the intended data collection plan and longitudinal study. Second, since data was collected once at a particular point in time from the healthcare facilities it could be a reflection of relationships between the variables that existed then (Iacobucci and Churchill, 2010). Due to the exploratory and descriptive nature of the study, rather than causal and experiment-based, the causal relationships between the variables in the study are limited to the inferences derived from the theories that underlie the hypotheses, rather than from the study's data (Rudenstam and Newton, 1992). Therefore, the interpretation of the study's findings is grounded on the theory developed in chapters two and three of this thesis. This limitation is common for a research design that does not incorporate an experimental dimension (Iacobucci and Churchill, 2010). Additionally, the constructs demonstrated discriminant validity issues, the absence of a qualitative research phase for scale development is not likely to have disadvantaged the study. The questionnaire design was tested on a small group of 5 healthcare facilities and modified according to their feedback, before a full pre-test of the revised questionnaire on a sample.

The confirmatory factor analysis for which the thresholds set were met for each of the structural equation modelling measurement indicators. Data gathered from the thirty-two facilities, with each of the latent variables and their associated measurement items, included in the successful estimation of the measurement model and the structural equation model, demonstrated acceptable average variance extracted, and composite reliability. This reflects a sound research instrument and effective measurement scales. Finally, SSCMP contains several stakeholder groups more importantly the patients who receive the services participants provide, however for safety and confidentiality concerns, this study did not engage patients who are at the receiving end. In other words, much of the clinical side is neglected. Despite the limitations of the study, the researcher strongly believes that these limitations can be overcome by conducting further research studies. The next chapter discusses further future research proposed, which could increase the validity and generalisability of the study; and empirically examine the SSCMP construct in a broader perspective.

8.8.1 Future research

This section proposes further research studies to expatiate the determinants and empirical research of SSCMP. First, future research on SSCMP should focus on empirically examining the impact of SSCMP on the clinical functions of healthcare facilities. Secondly, many determinants of SSCMP remain untested empirically and could be included to arrive at more generalised findings. Moreover, further studies could adopt a longitudinal approach to examine the relationship between the constructs. Finally, a detailed qualitative analysis could be adopted to examine the determinants.

8.8.2 Replication studies

Despite this study effectively defining the theoretical modeling, and empirically testing the SSCMP construct, it is recognised that the research access restrictions of the study require some further replication studies to increase the generalisation of the current studies' findings. Therefore, the ability to generalise and validate the study's findings is likely increased if the study is further replicated in three contexts. First, a replication study should be conducted, in the SME and large-scale commercial organisations, two years following the main study's point of data collection, to assess if the findings of the study change over time. Although it has been noted in the literature that SSCMP within service sector operations are significant and highly impactful (Hong, Zhang and Ding, 2017; Dey *et al.*, 2020), second, a replication study in the manufacturing sector in Ghana could provide an interesting finding. Replicating the study in both the service and manufacturing sectors in other parts of Africa, the UK and across the globe could also lead to a more generalizable finding.

8.9 Summary and conclusions

This research study significantly contributes to the SSCMP literature by extending it into a new area of discourse and research, that of healthcare. Firstly, the study's findings fundamentally show that sustainability in supply chain management practice could be achieved when leaders in originations are sustainability-oriented. When the leaders are sustainability-oriented, they will establish the capabilities needed for the supply chain to thrive. When the required capabilities are decided upon including its availability then the right supply chain practices must be implemented to achieve the desired economic, environmental and social performance. In conclusion, although a few limitations have been presented in this study, the research establishes an empirical argument and a platform to develop an understanding of sustainable supply chain management practice. The researcher considers that the findings of the study provide significant theoretical and management implications for supply chain management and believes that this thesis will encourage researchers, in the future, to build upon the findings of the study. The researcher considers that the findings of the study provide significant theoretical and management implications for supply chain practices in various sectors and hopes that this thesis will encourage researchers, in the future, to further expand the findings of the study. The next chapter presents a case study of Kokofu General Hospital's supply chain management practices in response to the three research questions of this study.

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APPENDICES

Overall Mean Score

Descriptive statistics for SP construct showed an overall mean score of 4.264 (SD = .835). This showed a positive perception of SP among the practitioners. SP3 had the highest mean value of 4.43, indicating that competitors require the organisation to provide effective healthcare services. The reliability test result was 0.856 and that is above the Cronbach's alpha threshold of 0.70.

Table 5A Overall statistics for SP construct

Items	N	Minimum	Maximum	Mean	Std. Deviation	Cronbach's Alpha
SP1	550	1	5	4.12	1.338	.856
SP2	550	1	5	4.24	1.255	
SP3	550	1	5	4.43	1.006	
SP4	550	1	5	4.41	.925	
SP5	550	1	5	4.34	1.030	
SP6	550	1	5	4.02	1.238	
SP7	550	1	5	4.28	1.131	
SP	550	1.29	5.00	4.264	.8355	
Valid N (listwise)	550					

Descriptive statistics for SOL construct showed an overall mean score of 4.2847 (SD = .8199). This showed a positive perception of SOL among the practitioners. SOL3 had the highest mean value of 4.37, indicating that managers have a strategic plan for supply chain sustainability. The reliability test result was 0.833 and that is above the Cronbach's alpha threshold of 0.70.

Table 5B Overall mean statistics for SOL construct

Items	N	Minimum	Maximum	Mean	Std. Deviation	Cronbach's Alpha
SOL1	550	1	5	4.19	1.345	.833
SOL2	550	1	5	4.32	1.078	
SOL3	550	1	5	4.37	1.009	
SOL4	550	1	5	4.27	1.010	
SOL5	550	1	5	4.34	.998	
SOL6	550	1	5	4.22	1.179	
SOL	550	1.17	5.00	4.2847	.8199	
Valid N (listwise)	550					

Descriptive statistics for SCC construct showed an overall mean score of 4.2529 (SD = .8068). This showed a positive perception of SCC among the practitioners. SCC6 had the highest mean value of 4.37, indicating that participants can work effectively with other entities for mutual benefit. The reliability test result was 0.852 and that is above the Cronbach's alpha threshold of 0.70.

Table 5C Overall statistics for SCC construct

Items	N	Minimum	Maximum	Mean	Std. Deviation	Cronbach's Alpha
SCC1	550	1	5	4.07	1.303	.852
SCC2	550	1	5	4.20	1.127	
SCC3	550	1	5	4.20	1.057	
SCC4	550	1	5	4.33	.974	
SCC5	550	1	5	4.25	1.151	
SCC6	550	1	5	4.37	1.018	
SCC7	550	1	5	4.34	1.092	
SCC	550	1.00	5.00	4.2529	.8068	
Valid N (listwise)	550					

Descriptive statistics for TA construct showed an overall mean score of 3.7361 (SD = .7751). This showed a positive perception of TA among the practitioners. TA8 had the highest mean value of 4.23, showing that decisions are made with regards to data rather than on instinct. The reliability test result was 0.844 and that is above the Cronbach's alpha threshold of 0.70.

Table 5D Overall mean statistics for TA construct

Items	N	Minimum	Maximum	Mean	Std. Deviation	Cronbach's Alpha
TA1	550	1	5	3.08	1.337	.844
TA2	550	1	5	3.19	1.204	
TA3	550	1	5	3.35	1.158	
TA4	550	1	5	3.10	1.426	
TA5	550	1	5	3.98	1.094	
TA6	550	1	5	4.02	1.139	
TA7	550	1	5	4.07	1.159	
TA8	550	1	5	4.23	1.120	
TA9	550	1	5	4.14	1.159	
TA10	550	1	5	4.21	1.117	
TA	550	1.10	5.00	3.7361	.77153	
Valid N (listwise)	550					

Descriptive statistics for SSCP construct showed an overall mean score of 4.203 (SD = .8176). This showed a positive perception of TA among the practitioners. SSCP4 had the highest mean value of 4.33, showing that order quantities of medical devices and pharmaceuticals (MDPs) are based on historical consumption data. The reliability test result was 0.884 and that is above the Cronbach's alpha threshold of 0.70.

Table 5E Overall mean statistics for SSCP construct

Items	N	Minimum	Maximum	Mean	Std. Deviation	Cronbach's Alpha
SSCP1	550	1	5	4.04	1.327	.884
SSCP2	550	1	5	4.10	1.146	
SSCP3	550	1	5	4.18	1.138	
SSCP4	550	1	5	4.33	1.001	
SSCP5	550	1	5	4.32	1.084	
SSCP6	550	1	5	4.22	1.110	
SSCP7	550	1	5	4.14	1.187	
SSCP8	550	1	5	4.19	1.130	
SSCP9	550	1	5	4.30	1.070	
SSCP	550	1.56	5.00	4.2033	.81759	
Valid N (listwise)	550					

Descriptive statistics for SCR construct showed an overall mean score of 4.137 (SD = .7886). This showed a positive perception of SCR among the practitioners. SCR5 had the highest mean value of 4.33, indicating that organisations have the right workforce to quickly boost output if needed. The reliability test result was 0.881 and that is above the Cronbach's alpha threshold of 0.70.

Table 5F Overall mean statistics for SCR construct

Items	N	Minimum	Maximum	Mean	Std. Deviation	Cronbach's Alpha
SCR1	550	1	5	3.83	1.295	.881
SCR2	550	1	5	3.99	1.063	
SCR3	550	1	5	4.20	.962	
SCR4	550	1	5	4.20	1.036	
SCR5	550	1	5	4.33	1.053	
SCR6	550	1	5	4.22	1.102	
SCR7	550	1	5	4.09	1.160	
SCR8	550	1	5	4.20	1.124	
SCR9	550	1	5	4.17	1.093	
SCR	550	1.44	5.00	4.1370	.78861	
Valid N (listwise)	550					

Descriptive statistics for SCA construct showed an overall mean score of 4.1701 (SD = .7694). This showed a positive perception of SCA among the practitioners. SCA5 had the highest mean value of 4.33, showing that agility of the supply chain enables speed/responsiveness. The reliability test result was 0.837 and that is above the Cronbach's alpha threshold of 0.70.

Table 5G Overall mean statistics for SCA construct

Items	N	Minimum	Maximum	Mean	Std. Deviation	Cronbach's Alpha
SCA1	550	1	5	3.92	1.282	.837
SCA2	550	1	5	4.10	1.069	
SCA3	550	1	5	4.16	1.036	
SCA4	550	1	5	4.32	.942	
SCA5	550	1	5	4.33	.961	
SCA6	550	1	5	4.17	1.130	
SCA7	550	1	5	4.19	1.113	
SCA	550	1.57	5.00	4.1701	.7694	
Valid N (listwise)	550					

Descriptive statistics for LSC construct showed an overall mean score of 4.1814 (SD = .7781). This showed a positive perception of LSC among the practitioners. LSC5 had the highest mean value of 4.29, indicating that the organisations have flexibility approach that focuses on process improvement by reducing/removing all waste. The reliability test result was 0.839 and that is above the Cronbach's threshold of 0.70.

Table 5H Overall Statistics for LSC construct

Items	N	Minimum	Maximum	Mean	Std. Deviation	Cronbach's Alpha
LSC1	550	1	5	3.98	1.244	.839
LSC2	550	1	5	4.07	1.119	
LSC3	550	1	5	4.28	.922	
LSC4	550	1	5	4.27	1.032	
LSC5	550	1	5	4.29	1.050	
LSC6	550	1	5	4.14	1.153	
LSC7	550	1	5	4.24	1.087	
LSC	550	1.57	5.00	4.1814	.7781	
Valid N (listwise)	550					

Descriptive statistics for RM construct showed an overall mean score of 4.1651 (SD = .8255). This showed a positive perception of RM among the practitioners. RM5 had the highest mean value of 4.30, indicating that they continually assess existing and potential risk that could disrupt their operations. The reliability test result was 0.808 and that is above the Cronbach's alpha threshold of 0.70.

Table 5I Overall mean statistics for RM

Items	N	Minimum	Maximum	Mean	Std. Deviation	Cronbach's Alpha
RM1	550	1	5	3.94	1.254	.808
RM2	550	1	5	4.14	1.126	
RM3	550	1	5	4.22	.986	
RM4	550	1	5	4.21	1.051	
RM5	550	1	5	4.30	1.052	
RM	550	1.60	5.00	4.1651	.8255	
Valid N (listwise)	550					

Descriptive statistics for SRM construct showed an overall mean score of 4.2546 (SD = .7775). This showed a positive perception of SRM among the practitioners. SRM5 had the highest mean value of 4.35, showing that the organisations work with suppliers to innovate and improve availability of sustainable products. The reliability test result was 0.866 and that is above the Cronbach's alpha threshold of 0.70.

Table 5J Overall mean statistics for SRM construct

Items	N	Minimum	Maximum	Mean	Std. Deviation	Cronbach's Alpha
SRM1	550	1	5	4.14	1.243	.866
SRM2	550	1	5	4.24	1.092	
SRM3	550	1	5	4.32	.967	
SRM4	550	1	5	4.21	1.049	
SRM5	550	1	5	4.35	.988	
SRM6	550	1	5	4.28	1.079	
SRM7	550	1	5	4.22	1.135	
SRM8	550	1	5	4.27	1.077	
SRM	550	1.88	5.00	4.2546	.7775	
Valid N (listwise)	550					

Descriptive statistics for SHP construct showed an overall mean score of 4.2624 (SD = .8121). This showed a positive perception of SHP among the practitioners. SHP4 had the highest mean value of 4.34, showing that over the past 2 years customer service level has improved. The overall mean showed that sustainable performance improves healthcare. The reliability test result was 0.856 and that is above the Cronbach's alpha threshold of 0.70.

Table 5k Overall mean statistics for SHP construct

Items	N	Minimum	Maximum	Mean	Std. Deviation	Cronbach's Alpha
SHP1	550	1	5	4.15	1.298	.856
SHP2	550	1	5	4.21	1.143	
SHP3	550	1	5	4.31	1.066	
SHP4	550	1	5	4.34	.961	
SHP5	550	1	5	4.29	1.024	
SHP6	550	1	5	4.22	1.124	
SHP7	550	1	5	4.31	1.117	
SHP	550	1.57	5.00	4.2624	.81212	
Valid N (listwise)	550					

Descriptive statistics for SEP construct showed an overall mean score of 4.1410 (SD = .8352). This showed a positive perception of SEP among the practitioners. SEP5 had the highest mean value of 4.26, showing that the overall productivity has increased. The reliability test result was 0.843 and that is above the Cronbach's alpha threshold of 0.70.

Table 5L Overall mean statistics for SEP construct

Items	N	Minimum	Maximum	Mean	Std. Deviation	Cronbach's Alpha
SEP1	550	1	5	4.17	1.278	.843
SEP2	550	1	5	3.97	1.243	
SEP3	550	1	5	4.13	1.133	
SEP4	550	1	5	4.23	.994	
SEP5	550	1	5	4.26	1.050	
SEP6	550	1	5	4.09	1.244	
SEP7	550	1	5	4.14	1.140	
SEP	550	1.43	5.00	4.1410	.83136	
Valid N (listwise)	550					

Descriptive statistics for ESP construct showed an overall mean score of 4.034 (SD = .8373). This showed a positive perception of ESP among the practitioners. ESP4 had the highest mean value of 4.25, showing that they have substantially reduced waste across production processes. The reliability test result was 0.859 and that is above the Cronbach's alpha threshold of 0.70.

Table 5M Overall statistics for ESP construct

Items	N	Minimum	Maximum	Mean	Std. Deviation	Cronbach's Alpha
ESP1	550	1	5	3.69	1.307	.859
ESP2	550	1	5	3.79	1.070	
ESP3	550	1	5	4.02	1.081	
ESP4	550	1	5	4.25	1.015	
ESP5	550	1	5	4.24	1.121	
ESP6	550	1	5	4.12	1.168	
ESP7	550	1	5	4.12	1.146	
ESP	550	1.29	5.00	4.0336	.83348	
Valid N (listwise)	550					

Descriptive statistics for SSP construct showed an overall mean score of 4.1989 (SD=.7617). This showed a positive perception of SSP among the practitioners. SSP5 had the highest mean value of 4.36, indicating that the organisations give priority to local sourcing. The reliability test result was 0.857 and that is above the Cronbach's alpha threshold of 0.70.

Table 5N Overall mean statistics for SSP construct

Items	N	Minimum	Maximum	Mean	Std. Deviation	Cronbach's Alpha
SSP1	550	1	5	4.03	1.191	.857
SSP2	550	1	5	4.03	1.074	
SSP3	550	1	5	4.15	.996	
SSP4	550	1	5	4.29	1.021	
SSP5	550	1	5	4.36	1.000	
SSP6	550	1	5	4.29	1.086	
SSP7	550	1	5	4.27	1.088	
SSP8	550	1	5	4.16	1.147	
SSP	550	1.25	5.00	4.1989	.76186	
Valid N (listwise)	550					

Figure I Confirmatory Factor Analysis

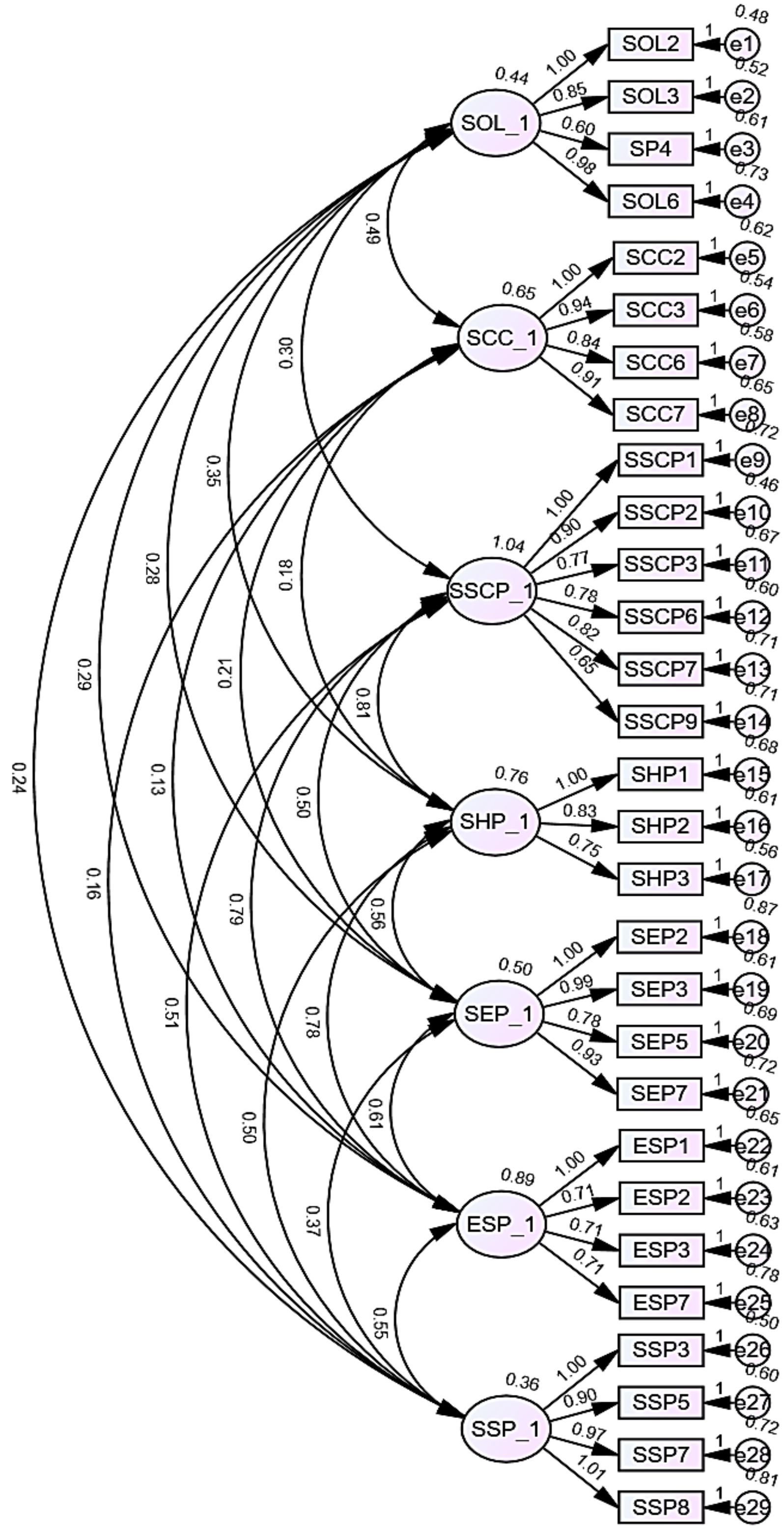

Figure J Herman’s single factor test

Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	42.647	41.006	41.006	42.084	40.465	40.465
2	3.631	3.491	44.497			
3	2.639	2.537	47.035			
4	2.100	2.019	49.054			
5	1.573	1.513	50.567			
6	1.458	1.402	51.969			
7	1.340	1.288	53.257			
8	1.328	1.277	54.534			
9	1.285	1.236	55.770			
10	1.252	1.204	56.974			
11	1.209	1.162	58.136			
12	1.182	1.136	59.272			
13	1.114	1.071	60.343			
14	1.079	1.038	61.381			
15	1.067	1.026	62.408			
16	1.039	.999	63.407			
17	1.030	.990	64.397			
18	.981	.943	65.340			
19	.965	.928	66.268			
20	.945	.909	67.177			
21	.916	.881	68.058			
22	.898	.864	68.922			
23	.864	.830	69.752			
24	.838	.806	70.558			
25	.830	.798	71.356			
26	.807	.776	72.132			
27	.788	.758	72.890			
28	.779	.749	73.639			
29	.758	.729	74.368			
30	.741	.713	75.081			
31	.723	.696	75.776			
32	.705	.678	76.455			
33	.695	.669	77.123			
34	.678	.652	77.775			
35	.674	.648	78.424			
36	.645	.620	79.044			
37	.642	.617	79.660			
38	.612	.588	80.249			
39	.591	.568	80.817			
40	.580	.558	81.375			
41	.579	.557	81.932			
42	.554	.533	82.464			
43	.552	.531	82.995			
44	.541	.520	83.515			
45	.530	.510	84.025			
46	.514	.494	84.519			
47	.509	.489	85.008			
48	.500	.481	85.489			
49	.496	.477	85.966			
50	.482	.464	86.430			
51	.467	.449	86.879			
52	.457	.439	87.318			
53	.451	.434	87.752			
54	.446	.429	88.181			
55	.434	.418	88.599			
56	.425	.409	89.008			
57	.407	.391	89.399			
58	.399	.384	89.783			
59	.392	.377	90.160			
60	.384	.369	90.529			
61	.377	.363	90.891			
62	.356	.342	91.233			
63	.350	.336	91.570			
64	.345	.331	91.901			
65	.340	.327	92.228			
66	.335	.322	92.550			
67	.326	.313	92.863			
68	.323	.311	93.173			
69	.311	.299	93.473			
70	.304	.292	93.765			
71	.298	.286	94.051			
72	.291	.280	94.331			
73	.285	.274	94.605			
74	.278	.268	94.872			
75	.270	.259	95.131			
76	.262	.252	95.383			
77	.254	.244	95.627			
78	.250	.241	95.868			
79	.239	.229	96.097			
80	.233	.224	96.321			
81	.228	.219	96.540			
82	.214	.206	96.746			
83	.212	.204	96.950			
84	.203	.195	97.145			
85	.200	.192	97.337			