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DIGITAL TECHNOLOGY ADOPTION, SUPPLY CHAIN INTEGRATION, SUPPLY CHAIN TRANSPARENCY, SUPPLY CHAIN TRACEABILITY IN GHANA'S HEALTH SECTOR

KENNETH ACHEAMPONG BOATENG

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BY

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DECLARATION

I hereby declare that this thesis is the result of my original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature …… Date ……..

Name: Kenneth Acheampong Boateng

Supervisor's Declaration

I herewith affirm that the preparation and presentation of the thesis were supervised under the guidelines on supervision of the thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature ……. Date …….

Name: Dr. Innocent Senyo Kwasi Acquah

ABSTRACT

This study examined Digital Technology Adoption (DTA), Supply Chain Integration (SCI), Supply Chain Transparency (SCTR), and Supply Chain Traceability (SCTB) in Ghana's Health Sector. The theoretical underpinnings of the study were the Network Theory (NT) and the Resource-Based Theory (RBT). Data were collected from 357 using survey procurement practitioners at the health facilities in the Central Region based on a post-positivism paradigm. The data was analysed using the partial least squares approach to structural equation modelling. The study found that DTA and SCI enhanced the achievement of SCTR, subsequently enhancing SCTB in Ghana's Health Sector. Moreover, SCI partially mediated the relationship between DTA and SCTR, DTA and SCTB. The study recommended that Ghana's Health Sector adopt digital technology that would enable them to integrate the supply chain at their various health facilities, enabling SCTR and SCTB. The study would comprehend the currently explored subjects, difficulties, and future headings concerning Digital technology innovation from the specialised perspective in the health care system. Moreso, the study was conducted in health facilities in the Central Region, hence the generalisability of the findings across the country may not be possible, hence further research should consider the health facilities in the country so that the results can be generalised for a developing country.

KEYWORD

Digital Technology Adoption

Supply Chain Integration

Supply Chain Transparency

Supply Chain Traceability

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DEDICATION

I dedicated this work to my lovely parents and siblings.

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LIST OF ACRONYMS

APS –	Advanced Planning Systems
DTA –	Digital Technology Adoption
SCI –	Supply Chain Integration
SC –	Supply Chain
SCM –	Supply Chain Management
SCTR –	Supply Chain Transparency
SCTB –	Supply Chain Traceability
GHS –	Ghana Health Sector
GHS –	Ghana Health Service
LHIMS –	Lightwave Health Information Management System
NT –	Network Theory
RBT –	Resource-Based Theory
SD –	Strongly Disagree
D –	Disagree
N –	Neutral
A –	Agree
SA –	Strongly Agree

CHAPTER ONE

INTRODUCTION

Background to the Study

The fourth industrial revolution, Industry 4.0, is changing how traditional supply networks are run (Satoglu, Ustundag, Cevikcan & Durmusoglu, 2018). Supply chains (SCs) are presently turning into an increasing number of interconnected, complex, and technologically focused. Supply chain management is being put under pressure to discern the way to cope with the ensuing upward thrust in complexity and modifications within the markets (Frank, Dalenogare & Ayala, 2019). A lot of factors are changing in the corporate environment as a result of technological improvement, economic growth, and adjustments to country-wide institutional systems.

Supply Chain Management (SCM) has been impacted by the rapid improvement of technology (Harris, Wang & Wang, 2015; Hsu, Liu, Tsou & Chen, 2019; Takano, Katayama, Amakawa, Yoshida & Fujishima, 2016; Schniederjans, Curado & Khalajhedayati, 2020). The paradigm of commercial enterprise is currently being adjusted using numerous technologies, such as blockchain, the Internet of Things (IoT), and Big Data. It alters operational tactics, commercial enterprise techniques, and business processes (Chang, Iakovou & Shi, 2020; Dolgui, Ivanov, Potryasaev, Helo & Hao 2019; Sokolov, Ivanova & Werner, 2020; Zhang et al, 2022).

Disruptive technologies considerably modified how businesses and sectors are characteristic in current years (Azzi, Chamoun & Sokhn, 2019). While to some extent this is true, businesses who fail to consider these technologies' consequences risk losing market share to rivals. Having stated

that it is essential for various sectors to extensively rely on their SC partners to deliver goods or services from an SC viewpoint. The main parties involved in the manufacturing SC are manufacturers, suppliers, shippers, distributors, and customers. According to Varma, Mangla and Lim (2021), manufacturing organisations are becoming more and more privy to how crucial supply chain transparency, traceability, and effectively managed supply chains are to staying competitive.

Practitioners, academics, researchers, and national development agencies have all given the trend of digitalisation in the information technology (IT) industry great attention. Due to the advancement of information and communications technologies (ICTs), the logistics and SCM industry lately experienced unheard-of disruptions (Frank, Mendes, Ayala & Ghezzi, 2019; Schniederjans, Curado & Khalajhedayati, 2020). Consumer needs in the expanding world are growing dramatically, and businesses are actively working to optimise their supply chains to meet all of these and manage their supply chains as efficiently as possible, organisations are heavily investing in various strategies (Büyüközkan & Göçer, 2018; Sanchez Rodrigues, Harris & Mason, 2015). One such strategy is the use of digitalised technology like automation.

According to McKinsey, a company may place sensors in everything, create networks everywhere, automate anything, and analyse everything to significantly improve performance, traceability, and customer satisfaction to optimise its supply chains (Dias, Ionutiu, Lhuer & Ouwerkerk, 2016). Industry 4.0, is a marvel correlated to digitalisation and automation in various industries (Kolberg, Knobloch & Zühlke, 2017). This improvement has given an upward

push to numerous new moral worries concerning integrating ethical generation rules to obtain ethical and economic dreams. It seems most organisations are struggling to move from visionary goals to a missionary level of integrating sustainability and ethics into SCs amid a revolution, (Luthra & Mangla, 2018; Ero, Jäger, Hold, Ott & Sihn, 2016). Due to disruptions such as (delays in deliveries, changes in demands, lack of monitoring and tracing of goods) and the shift toward the digitalisation of traditional business models based primarily on physical activities in recent years, both researchers and practitioners have expressed interest in Industry 4.0 as one of the most incipient topics (Maciel, de Toffoli, Neto, Nazario & Lancas, 2019).

Modern technology breakthroughs are at the forefront due to the complicated and repetitively changing business milieu, client demand, and the need for organisations to be responsive and agile (Cheng, Lang, Starr, Pusic & Cook, 2014; Chung & Swink 2009; Genovese, Lenny Koh, Kumar, & Tripathi, 2014; Oberg & Graham 2016). Enterprises are aware of the importance of technical improvements and look at the era as a robust device for accomplishing long-time period achievement (Shrivastava, Ivanaj & Ivanaj, 2016; Wortmann, Barais, Combemale, & Wimmer, 2020). Many organisations are currently enforcing e-business technologies to rally their operational efficiency by use of process integration and optimise their enterprise operations (Cao & McHugh, 2013; Chen & Holsapple 2012; Sanders, 2007; Srinivasan & Swink 2015; Weingarten, Humphreys). They are currently making giant investments in automation and robotics to adopt additional cutting-edge technical advances linked to Industry 4.0. (Chung, Gulcehre, Cho & Bengio, 2015).

The harmonisation of the SC has completely fledged strategic importance as new organisational bureaucracies, like cybernetic commerce, global manufacturing, and logistics, are evolved. Enterprise-level SCM has garnered more attention in recent years, replacing factory-level SCM (Gunasekaran, Williams & McGaughey, 2005). Businesses becoming greater without boundaries (Puigjaner & Lainez 2008), more globalisation problems, more outsourcing, Advanced Planning Systems (APS), and extra integration needs have led to a broader characterisation of the Supply Chain (Meixell & Gargeya, 2005). Gunasekaran et al. (2005) offer an awesome discussion of the variations among "conventional" and "networked" companies, underlining the importance of expanded enterprise integration (integration that goes beyond enterprise resource planning and includes both internal and external integration), partnership building, and collaboration.

Transparency could rise as Supply Chain managers learn more about the possibilities presented by this new technology. The introduction of this technology such as Lightwave Health Management Information System (LHMIS), Ghana Integrated Logistics Management Information System (GhiLMIS), Oasis etc, coincides with customer demands for openness in the SC (Astill et al., 2019). Customers often require assurances, for example, that fish they purchase and consume are not farmed using illicit netting techniques or from confined waters (Astill et al., 2019). Jewelry customers also want proof that the diamonds they buy are real and don't come from areas of the world that have seen conflict. SCs that are multi-tiered and expanding globally amplify these worries. Transparency, according to Awaysheh and Klassen (2010), is the notch to which information is eagerly accessible to trade counterparties as well

as to outside observers. Transparency in the context of a SC refers to the data that businesses participating in a supply network can access.

SCTB leverages transparency to operationalise organisational desires associated with raw material origins (Sodhi & Tang, 2019). The connexion between SCTR and SCTB is not clear-cut and linear: while having more data available (i.e., transparent) may result in accelerated traceability, elevated traceability will not lead to accelerated transparency if the SC is made up of few members with loose affiliations. Scholars have identified that optimising traceability and transparency are correlated. Skilton and Robinson (2009) became aware of traceability because of the potential to discover and substantiate the additives and sequence of events in all steps of a procedure chain.

The United Nations Global Compact on Traceability (2017) states that corporate due diligence is still the best way to identify potential negative effects, and traceability is not a substitute for it. Certain businesses that possess a thorough comprehension of their supply networks and their SC partners have traceability protocols in place, frequently for strategic or high-value commodities. Several traceability frameworks exist to build a credible and rigorous chain of custody standards and certification for products alongside the SC for other industries, such as agriculture, health, and most manufacturing, that have a broad and disjointed multi-stakeholder framework.

These days, SCs are intricate with multiple enterprises spread out around the world. This has drawn attention to SCTR and SCTB, as well as how organisations should benefit from these capabilities that allow businesses to gather and share SC data (Sodhi & Tang, 2019). However, there is

disagreement in the literature on SCTR and SCTB over how these two linked concepts should be conceptualised. For instance, statistics disclosures to give up customers and other companies inside the SC (Marshall et al., 2016), the two-way exchange of information amid a dealer and a customer (Stranieri, Orsi & Banterle, 2017), and information disclosures to the general public, which includes customers and traders (Sodhi & Tang, 2019), are some examples of how the SC is being described concerning transparency.

Comparably, SCTB has occasionally been denoted as the data that a company knows on the location and strategies of product drift in a supply chain (Cousins, Lawson, Petersen & Fugate, 2019). As a result, there are divergent views on how SCTR and SCTB interact, linking them has been poorly understood. There is a perspective that states that SCTR cannot occur without SCTB (Caritte, Acha & Shah, 2015). As an illustration of SC transparency, Garcia-Torres, Albareda, Rey-Garcia and Seuring (2019) recommend outlining supply chain operations to determine product origin. A different perspective might also hold that SCTR improves SCTB by reducing data asymmetry between SC participants (Beske, Land & Seuring, 2014). The potential of the literature to explain the combined overall performance consequences of SCTR and SCTB has been limited by those conceptual differences and hazy boundaries between SCTR and SCTB.

Moreover, it is thought that integration increased visibility and openness all through the SC, Swift, Guide and Muthulingam (2019). It has been tough to deal with the aforementioned concerns and enhance supply chain transparency and traceability since supply chain practices cross functional boundaries. Many companies have begun to use technical solutions to cope

with this trouble, which includes information technology (Najmi & Makui 2012). It can enhance traceability and transparency by way of tying collectively corporate systems, which might bring about Supply Chain Iintegration (SCI) (Nakandala, Samaranayake & Lau, 2013; Rashid & Tjahjono 2016).

Bestowing to Luo, Shi and Venkatesh (2018), many companies are already using ITs through E-commercial enterprise solutions to enhance their operational excellence and system integration. Given that Industry 4.0, allowing technology is predicted to transform SC management with the aid of enabling superior ranges of connectivity and thorough integration, in addition to bringing about traceability and obvious improvements in the supply chain, their incorporation is visible as a promising method for overcoming the integration challenges (Shrivastava, Ivanaj & Ivanaj 2016).

The healthcare sector produces a variety of health statistics from numerous sources (Jha et al., 2009). The decisions made by healthcare professionals and the affected person's effects can both be improved via the meaningful use of health records (Blumenthal & Tavenner, 2010). To acquire and keep unremitting stability between quality improvement and price rationalisation, healthcare systems are presently seeking to reconfigure and revolutionise their tactics, (Berthet et al., 2015; Lee & Porter, 2013; Sharma, Thomas & Paul, 2021). Technology (Aste, Shang, Wang, Li, Chen & Li, 2018; Helo & Hao, 2019; Kambleet al., 2020; Kshetri, 2018; Tasca & Matteo, 2017; Wang et al., 2019) can transform almost all SCM business models, commercial enterprise tactics, and consequently enhance SCTR and SCTB.

Statement of the Problem

The healthcare industry is becoming more competitive, which calls for better healthcare options at lower rates. Information systems such as CPOE (Computerised Physician Order Entry) and LHIMS (Legal Health Information Management System), are being used by hospitals to expedite administrative and medical processes. According to WHO (2019), Ghanaian healthcare sector faces several challenges (including inadequate supply chain visibility, lack of traceability, counterfeit medicines) related to supply chain transparency and traceability, which hinder the efficient delivery of essential medicines and healthcare services.

Researchers such as Mubarik et al. (2021) have found that digital technology can improve SCTB and SCTR while solving the challenges of managing various entities in complicated supply chains. Implementing traceability and transparency in hospitals can improve performance, but its implementation often falls short of expectations (Ghislieri et al., 2019; Sarubbo et al., 2020). Due to the COVID-19 pandemic, healthcare services are now far more important than ever and are under tremendous pressure to keep up with the surge in demand (Dhaliwal et al., 2022). To minimise risks in the healthcare industry and maximise their supply base, large hospitals are implementing sophisticated management strategies.

Hospital information systems (HIS) are becoming essential digital integration infrastructures that improve SC transparency and traceability. To create SCs that are open, fair, and accountable, academics are pushing for traceability in the debate surrounding sustainability (Marconi, Marilungo, Papetti & Germani, 2017; Pagell & Wu, 2009). The goal of this research is to

achieve both operational and sustainable goals by focusing on expanded traceability. Advantages include decreasing scandals and recall, enhancing the quality of products and processes, preventing capitulation, and controlling stock performance (Giesers et al., 2019; Marconi, Marilungo, Papetti & Germani, 2017).

Healthcare scandals demonstrate how ineffective practices can arise in the incorrect type of corporate environment, (Mannion et al, 2015; Taylor, Clay-Williams, Hogden, Braithwaite & Groene, 2015). In the sector, there is still a culture of personal accountability, professional fabrications of unfavourable events, and information reporting anxiety, (Johnstone & Kanitsaki 2006; Woodier 2015). Administrators and regulators of healthcare are accused by the media of lacking transparency (e.g. Hannawa, Wu, Kolyada, Potemkina, & Donaldson, 2022, b; Woodier 2015).

Supply chain processes are greatly impacted by digitalisation, which creates long-term value and gives a competitive edge. Supply Chain Management (SCM) could be greatly enhanced by digital technology through decentralisation, traceability, transparency, and visibility (Cole, Stevenson & Aitken, 2019; Ivanov & Dolgui, 2021; Wong, Tan, Lee, Ooi & Sohal, 2020). Worldwide research on digitalisation has been done by researchers like; (Almeida, Farias & Carvalho, 2017; Dana et al., 2019; Fitri, Nugraha, Hakimah & Manihuruk, 2019; Laurenza, Quintano, Schiavone & Vrontis 2018), with an emphasis on how it affects business models, what motivates people to accept technology in the healthcare industry, and how it integrates into other industries.

Although there are limited studies conducted in Africa or Sub-Saharan Africa, Martin et al., (2021), the 11th Malaysian Development Plan recommends using digital technology in companies to improve SCM, traceability and transparency in the SC (Pflaum, Bodendorf, Prockl & Chen, 2017). Ouheda, Hafeez-Baig, Chakraborty and Gururajan (2019), Factors Influencing the Adoption of Electronic Health Records in the Australian Environment. Outside these areas, there is, however, a famine of research on digital technology. Again, studies have been conducted globally, few of these studies on digital technology have been undertaken in the Ghanaian health sector by Kesse-Tachi, Asmah, and Agbozo (2019), who scrutinised the factors swaying the eHealth technologies adoption in Ghana; Owusu Kwateng, Appiah and Atiemo (2021), adoption of health information systems: the viewpoint of health professionals; Healthcare Benefactors' Intention to use Technology to Attend to Clients at Cape Coast Teaching Hospital, Ghana: A Quantitative Study (Boadu, Lamptey, Boadu, Adzakpah & Mensah, 2021), Change Management and Adoption of Health Information Technology (HIT)/eHealth in Public Hospitals in Ghana.

However, until the Ministry of Health launched a nationwide e-Healthcare Management System 2017 in the central region, at the Trauma hospital, Winneba, the health sector in Ghana had received less attention from this digitalisation of technology (MOH, 2017). With the use of a central data center, Lightwave eHealthcare Services (LWEHS) is transforming the healthcare industry by introducing a healthcare infrastructure solution into 26 hospitals in Ghana and improving supply chain transparency and traceability. To obtain a competitive edge in the SC, 90% of organisations expect

digitalisation to occur within the next five years; yet, 73% are unsure of what this entails, O'Connor, Zimmerman, Anastas, and Plata (2016).

Organisations benefit from research on supply chain integration and digitalisation, yet both areas lack research models and empirical data, (Björkdahl, 2020; Frohlich & Westbrook, 2001; Giménez, Özcan, MartnezRus & Prades, 2015; Lusch, Vargo & Tanniru, 2010). Büyüközkan and Göçer (2018) make the case for more investigation into how digitalisation affects SC and how it functions in SCM. Additionally, Büyüközkan and Göçer (2018) contend in their systematic review that there is a need for additional research on the effects of digitalisation on the SC because there has been little work done on the role of digitalisation in SCM.

Previous studies suggest that SCI can enhance SCTR and SCTB (Cole, Stevenson & Aitken, 2019; Ivanov & Dolgui, 2021; Wong, Tan, Lee, Ooi & Sohal, 2020), while digital technologies can facilitate amalgamation between business operations, it is still unclear, nevertheless, how digitalisation relates to SCI for better business visibility. Mihailescu, Mihailescu, and Schultze (2015) claim that there has been relatively little progress in understanding the generative mechanisms and causal explanations underlying the transformation of social structures to capitalise on digitalisation in the existing literature. Additionally, the majority of studies used a qualitative approach to gather data. To better understand how DTA helps enhance SCTRand SCTB through SCI in Ghana's health sector, a study has to be conducted.

Purpose of the Study

This research examines the relationship among digital technology adoption, supply chain integration, and supply chain transparency and traceability in Ghana's health sector.

Research Objective

The research sought to;

1. analyse the effect of digital technology adoption on supply chain integration in Ghana's health sector.
2. examine the effect of digital technology adoption on supply chain transparency in Ghana's health sector.
3. examine the effect of digital technology adoption on supply chain traceability in Ghana's health sector.
4. examine the mediating role of supply chain integration in the relationship between digital technology adoption and supply chain transparency in Ghana's health sector.
5. examine the mediating role of supply chain integration in the relationship between digital technology adoption and supply chain traceability in Ghana's health sector.

Research Questions

The following research questions were derived from the objectives;

1. What is the effect of digital technology adoption on supply chain integration in Ghana's health sector?
2. What is the effect of digital technology adoption on supply chain transparency in Ghana's health sector?

3. What is the effect of digital technology adoption on supply chain traceability in Ghana's health sector?
4. What is the mediating role of supply chain integration in the relationship amid digital technology adoption and supply chain transparency in Ghana's health sector?
5. What is the mediating role of supply chain integration in the relationship amid digital technology adoption, supply chain traceability in Ghana's health sector?

Significance of the Study

The study would comprehend the currently explored subjects, difficulties, and future headings concerning digital technology innovation from the specialised perspective in the health care system. Readers' understanding of supply chain integration contributes to digital technology adoption which enhances SCTR and SCTB in Ghana's health sector. Additionally, it will define the digital technology adoption factors to consider by corporations to better ensure a successful implementation of innovative technology. The study intends to offer insight into the potential for DTA by identifying benefits to Ghana's Health Sector. The knowledge gained will serve as a roadmap for domestic and foreign countries that want to succeed in the local market. It will serve as a guide for upcoming research on the topic or the use of DTA, SCI, and SCTR in enhancing SCTB in Ghana's health sector.

Delimitation

Only the Healthcare facilities in the Central Region employees will be taken into consideration. Additionally, the researcher will not be able to use all of the healthcare facilities in the Central Region due to the short time frame in which the study will be finished. This condition will probably make it difficult to generalise the study's findings. As a result, extra care will have to be taken when applying the study's findings to other regions.

Limitation

The study used the health facilities who have access to digital technologies among the 618 health facilities in the Central Region. The study was restricted to only employees in charge of procurement activities in the health facilities. This makes generalising the findings for this study a problem. There is the inability to identify trends in DTA and SCI, and how they will influence SCTR and SCTB.

Additionally, the study used primary means of collecting data with the help of a questionnaire. However, this means of collecting data limits responses to only questions asked in the questionnaire document, hence cumulating the views of respondents only on the asked questions. This therefore limits the opinions of respondents and leaves no room for new ideas.

Finally, the study utilised partial least squares approach to structural equation modelling which is a symmetrical approach to analysing results. In this approach predictor variables, which significantly explain the outcome variable are deemed acceptable and accepted while those may predict the outcome in some situations.

Definition of Terms

Digital technology adoption: Digital technology adoption is the process by which users learn to use new digital tools and systems to improve work processes and achieve objectives.

Supply chain integration: SCI is the process of connecting all parts of an SC to ensure efficient and effective communication, collaboration, and coordination.

Supply chain transparency: SCTR is the ability to see and track every element in the SC from start to finish.

Supply chain traceability: SCTB is the ability to track and trace the movement of goods and materials throughout the SC, from raw materials to their final destination. It involves collecting and analysing data at every stage of the SC to ensure that products are made safely, ethically, and sustainably.

Organisation of the Study

The study is structured into five main chapters. The first chapter provides an introduction, which covers the background to the study, the research problem, the purpose of the study, the researcher's objectives, research questions, hypotheses, and the significance of the study. Additionally, it includes limitations, delimitations, and an overview of how the study is organised. The second chapter dowries a comprehensive review of relevant literature related to the research project. The third chapter outlines the research methodology used in the study. The fourth chapter presents the results and discusses them in detail. Finally, the fifth chapter concludes the report with a summary, conclusions, and recommendations.

CHAPTER TWO

LITERATURE REVIEW

Introduction

This study examines digital technology adoption, SCI, and SC transparency and traceability in the Ghana Health Service. Theoretical and empirical reviews related to digital technology adoption, SCI, SCTR, and SCTB were reviewed. It also reviews correlated theoretical bedrock, such as the resource based-theory, network theory, and empirical research, which are analysed to explain the research problem. The required definitions and variables, both dependent and independent variables, are then covered in the chapter. It also explains the variations in knowledge that arise from the analysis of the theoretical and empirical literature. Furthermore, the study's conceptual framework is developed and explored.

Digitalisation in the health sector

Digitalisation is not an unruly technology because it is a basic technology that has the potential to create new foundations for our economic and social systems (Bock, Iansiti & Lakhani, 2017). Applications of digital technology nowadays range from simple, low-novelty initiatives to complex, high-novelty projects (like bitcoin payments), like self-executing contracts. Tasks for tracking the supply chain that is intricately digitalised are also accessible. For instance, digitalised off-the-shelf solutions can be purchased to track diamonds along the SC from origin to buyer in the diamond industry. Digital technology is being used in the music industry, and open ledgers are used to hold databases that list who own what musical rights.

Healthcare stakeholders can track the whereabouts of drugs and medical equipment of the pharmaceutical SC and logistics (Karamchandani, Srivastava & Srivastava, 2020; Mackey & Nayyar, 2017). To trace the delivery of the product, it also links the pharmaceutical SC from the manufacturer through apothecaries to the final consumer. Due to the immutability of medical insurance, researchers have proposed a digital technology-based personal healthcare data management system for transferring health information across insurance providers (Shetty, Liang, Bowden, Zhao & Zhang, 2019). These claiming processes and the associated papers are made public for the parties involved through cryptographic authentication. Even if digitalisation seems to be the technology that will revolutionise the current healthcare systems, supply chain integration would allow Ghana Health to increase SCTB.

Healthcare Digitalisation in Ghana

According to Otoo-Arthur, Asare and Frimpong (2017), the healthcare industry has managed patient information using paper-based record methods for the past 200 years. These changes have affected Ghana's health sector as well. Even though paper-based record systems have historically aided in the delivery of healthcare, Coiera and Clarke (2004) pointed out that these systems come with some inherent physical and informational difficulties that raise concerns about their long-term viability as suitable file-keeping structures for the healthcare sector. The development of District Health Information Systems (DHIS) at government hospitals in Ghana has been successful over time (Agawal, Gao, DesRoches & Jha 2010; Brown, Austin & Boxerman 2012).

These advancements have been guided by the Ghanaian government's implementation of many programs to improve healthcare in the country. Adjorlolo and Ellingson (2013) note that the absence of precise and judicious data has prevented the desired effect of these policies from materialising. A lack of policy standards for data exchange among hospitals and medical staff has impeded Ghana's healthcare digitalisation, according to Dzator, Acheampong, Appiah-Otoo and Dzator (2023). Alternative perspectives, such as those offered by Alvarez, Pacala, Winebrake, Chameides and Hamburg (2012), contend that because staff and system users were excluded from the development of such systems, the challenges faced in Ghana's digitalisation of health records were more likely due to their commitments. However, the majority of the issues raised here are generally present in other poor countries and are not chiefly inimitable to the Ghanaian setting.

The fundamental problem preventing digitalisation, according to Asare, Otoo-Arthur, and Frimpong (2017), is staff members' lack of computer literacy because most health managers lack the confidence to implement electronic health systems because they seem weirder to the Ghanaian context and some other developing countries. Therefore, the development and implementation of digital innovations may be one of the major causes of the inconsistent results of digitalisation in contemporary studies. Despite the aforementioned, Preko, Boateng and Effah (2019) found a few unique factors that are affecting the healthcare sector and encouraging digitalisation. Among these are the development of electronic payment platforms for mobile devices, Visa-powered electronic payment systems, and electronic payment methods in utmost healthcare facilities.

The authors also point out that the growing use of smartphones and other digital devices, which permit data and information sharing on various platforms, is driving digitalisation in the health industry. The extensive alliances and partnerships flanked by different state institutions, like the banking, healthcare, and telecommunications industries, which have made it possible for money to be transferred seamlessly within and between the various institutions, have laid the groundwork for digitalisation in the GHS. Even though some of the characteristics that enable digitalisation are not unique to the Ghanaian environment, the use of itinerant money wallets and the connections amidst various state entities seem peculiar to the Ghanaian context and some other developing countries. Digitalisation is progressively affecting and encompassing business (Manaadiar, 2020).

Theoretical Review

Transparency and traceability in the SC are essential in all organisations, but obtaining them has grown increasingly difficult as business processes have grown more intricate in the digital era. To get fresh perspectives, the existing literature on SC, digitalisation, transparency, and traceability will be reviewed. It was wise to map the gaps after the SC was integrated to make it easier to understand how digital technology affects supply chain transparency and traceability. The network theory (NT) and resource-based theory (RBT) are the two basic theories that underpin the study. Understanding the dynamics of inter-organisational relationships is predicted by this theory. This idea is then explained in further detail.

Network theory (NT)

According to Halldorsson, Kotzab, Mikkola and SkjttLarsen (2007), NT aims to understand the dynamics of inter-organisational relationships with a focus on human interactions and the development of collaborative relationships. To access resources that are not their own, organisations must establish links. As a result, networks with a range of interactions will be developed, increasing the connections between Ghana's Health sector and providing a means for supply chain partners to interact and adapt (Johanson & Mattsson, 1987). Despite the widespread use of network theory in the literature on operation management, the SC is regularly and implicitly taken into account when discussing issues like long-term relationship building, intra-firm coordination, and information exchange, and administrative adaptation.

In an earlier study, NT was utilised to analyse and build manufacturing strategies based on horizontal and vertical technologies and production system processes (Karlsson & Skold, 2007). The supply chain has been proposed as having a strong theoretical foundation based on network theory. This is so that it may explain agent behaviour in the context of operations management in terms of their position in a network and, consequently, trust and authority in relationships between Ghana's health sector and suppliers (Dekkers et al., 2020). NT focuses on dyadic connections with profoundly embedded networks (Halldórsson, Hsuan & Kotzab, 2015).

The potential for a "trustless trust network" to be created by digital technology can be investigated using network theory (Werbach, 2018). Additionally, by integrating technologies, data transparency will assist people in building relationships with one another and provide a relational viewpoint

foundation for assessing the function and importance of inter-organisational networks within businesses. However, when supply chain confidence is no longer a problem, the significance and characteristics of inter-organisational links may usually drop (Werbach, 2018). From the perspective of network theory, the visibility of the SC has several immediate and related implications regarding organisation relationships, trust, commitment, and information sharing.

Resource-based theory (RBT)

Digitalisation is one of the age's disruptive technologies. Despite its rising relevance, the majority of businesses are unsure of what digital technology (digitalisation) is. Moreover, how would deployment help their company? RBT examines efficiency-based variations in an organisation's performance based on its resources, which represent the strengths that help an organisation become competitive and aid in the implementation of stratagems to accomplish its vision, mission, and organisational goals (Porter, 1981). Additionally, various resource utilisation efficiency will result in various organisational success levels. A business's efficiency can also be determined by looking at the net benefits after deducting its costs (Miles, 2012). An efficient business will also produce more value for less money than an inefficient one.

The concept outlines how businesses can set themselves apart from their competitors and stay in business (Hoopes, Madsen & Walker, 2003). In response, Josefy, Kuban, Ireland and Hitt (2015) suggested that RBT offers a distinctive method for supply chain analysis that considers both the individual and group actions of the chain. Integrating medical technologies will increase

the effectiveness and efficiency of the SC, assisting Ghana's health sector in lowering operational costs (Helo & Hao, 2019). Therefore, Ghana Health will gain and keep a competitive advantage over the resources they now have by applying RBT in this study.

Conceptual Review

This section elucidates the concepts that have been adopted in the study.

Digital Technology Adoption (DTA)

Using the concept of DTA, Shen, Zhang, and Liu (2021) examine how product service innovation performance in process industries relates to digital technology. They conclude that DTA is a crucial strategy for helping manufacturing industries realise the potential for competitive advantage based on DT and adapt to competitive pressures. Depending on the study approach, the meaning of DTA is resolved in a varied manner. Three types may be identified in mainstream research on DTA. The first defines DTA as the use of DT as a means of product and service innovation in manufacturing, drawing on the legal perspective on process innovation (Mackert et al., 2016).

This establishes that DTA is an external activity because of the nature of process innovation: its "adoption" establishes that it is an "autonomous" "choice" of external DT by the company, as opposed to an independent innovation of its own. These businesses tend not to develop or maintain digital technologies on their own; instead, they focus mostly on the initial processing and transformation of these technologies. The second one, which highlights DTA as a resource extraction process that integrates DT resources into its system, is indicative of a resource-based perspective.

This means that DTA must also involve intrafirm activity. Adoption of DT will evaluate how likely it is that digital technology will be used within the company (Blichfeldt & Faullant, 2021). If these technologies are fully explored and put to use, deep knowledge will be produced, which will serve as an alternative source of innovation for the company. Although the innovation process, which decides how DTA is presented in terms of the breadth of DT, is not yet involved in this corporate strategy, it does make DTA a necessity for digital innovation.

Original, incremental, and radical innovation are the three categories into which innovation theory divides it (Yang, Kuo, Eslami & Moody, 2021). DTA functions as a precursor to incremental innovation, whereas radical innovation is concerned with producing new information and incorporating it into the body of current knowledge. The only factor that can determine how much digital adoption contributes to radical innovation is the firm's strategic perspective and whether it adds new capabilities to spur creativity that should be used with the digital technology it has acquired. According to Wu, Shen and Hengel (2019), incremental innovation is the preservation and renewal of current knowledge. This aligns well with the concept of a RBT and the DTA.

In conclusion, this study suggests that DTA is the method by which businesses expand their use of DT and convert the prospective applications of DT into a breadth and depth of technology. Through this method, businesses can create incremental innovation and gain a competitive edge. In the end, it will probably drive digital performance by supporting more radical innovation based on the expansion of corporate strategy and other skills.

Supply Chain Integration (SCI)

Over the decade, the idea of an "integrated supply chain" has gained appeal. This is the result of heightened levels of international rivalry as well as adjustments to manufacturing and supply methods (Handfield, Ragatz, Petersen & Monczka, 1999; Ragatz, Handfield & Petersen, 2002). Businesses now understand that providing better products at lower costs than their rivals is necessary to stay competitive. This meant that businesses needed to concentrate on integrating supply activities with customer demand in addition to improving production practices (Frohlich & Westbrook, 2001).

Considering cooperative relationships between a manufacturer and its suppliers or customers, despite the large amount of research on unidimensional supply chain relationships (Fawcett & Magnan, 2002; Mabert & Venkataramanan, 1998; Paulraj, Lado & Chen, 2008; Spekman, Kamauff, & Myhr, 1998). Some concentrate on the dyadic interactions that exist between supply chain participants (Hong, Youn & Nahm, 2008), while others manage an SC as a single system instead of trying to optimise each fragmented component separately. While some SCI definitions flow patterns of parts and materials, others place greater emphasis on information, resource, and money movements.

Supply Chain Transparency (SCTR)

According to the literature currently under publication, the essence of the transparency phenomena is the perceived public exposure of organisational or SC information (Schnackenberg & Tomlinson, 2016). Whereas SCTR makes information about internal processes and upstream operations related to the various layers of SC publicly available, organisational transparency only

makes information available to the public. The research also notes that different stakeholders share information at different rates, and it credits these differences to a variety of institutional forces (Villena & Dhanorkar, 2020).

We define SCTR as "the perceived extent to which information about supply chain sources, processes, and relationships is made readily accessible to a wide range of internal and external stakeholders" by combining the themes of "varying levels of SC disclosures" and "perceived public disclosures." The counterparties in a SC exchange are referred to as internal stakeholders (Chen et al., 2019), and consumers and consumer advocacy groups are considered external stakeholders (Longoni & Cagliano, 2018). The concept of the "perceived extent of public disclosures" enables us to define the following three aspects of SCTR.

First, the idea of the perceived breadth of public disclosures implies that to foster the perception of SCTR, a minimum amount of information needs to be made publicly available. The literature is almost unanimous that the public disclosure of SC membership information is the minimum set of information needed for SC openness (Marshall et al., 2016). Information about suppliers, such as names, addresses, and information on materials purchased or made goods, must be disclosed to access SC membership data (Garcia-Torres, Rey-Garcia, Sáenz & Seuring, 2022; Stevenson & Cole, 2018).

Different companies have applied the practice of reporting SC membership in different ways. While some exemplar companies share information just with tier 1 suppliers, others provide information with multiple tiers of suppliers (Sodhi & Tang, 2019). However, Marshall et al. (2016) contended that the first-tier suppliers' names must be disclosed as a basic need

for SC openness. Many nations do not have laws requiring the disclosure of supplier information (Shafiq, Lasrado & Hafeez, 2019); yet, in response to consumer demand and to preserve their brand's reputation, many businesses have made their SC membership publicly known (Garcia-Torres, Rey-Garcia, Sáenz & Seuring, 2022).

Second, the "perceived extent of public disclosures" also highlights the reasons for SC openness as a means of explaining the different degrees of SC information sharing. The different institutional pressures that corporation experiences are the main forces behind SC transparency. Businesses may react to these pressures in numerous ways. For example, some may decide to comply with the minimum SC transparency criteria, which include disclosing their membership, and acting symbolically (Villena & Dhanorkar, 2020). Nonetheless, exemplary businesses that have greater faith in their SC procedures use voluntary disclosures as a chance to win over customers' trust by swaying the opinions of outside stakeholders (Huang & Kung, 2010).

To set themselves apart from the competition, these businesses take a more proactive approach and provide more details on important operational and sustainability factors (Schnackenberg & Tomlinson, 2016). This is a more proactive method of overseeing the upstream operations of SCs. Thorough information helps stakeholders in a company feel more confident and trusted, which helps companies stand out as more responsible organizations (Garcia-Torres, Rey-Garcia, Sáenz & Seuring, 2022). Thorough information disclosures would increase an SC's transparency and draw more environmentally sensitive clients, which would boost sales (Stevenson & Cole, 2018).

Transparency in SCs is essentially the result of information flowing back and forth amid the sender and the recipient, which shapes the notion of transparency. This gives companies the chance to reveal information without being completely transparent, to enhance their reputation (Villena & Dhanorkar, 2020). According to the research, these organisational goals to disseminate information selectively or exaggerate performance are conscious attempts at impression management (Fabrizio & Kim, 2019).

Verifying facts through auditing enables external stakeholders to determine the reliability of information supplied to them, which deters impression management (Boiral, Heras-Saizarbitoria & Brotherton, 2019). The highest level of assurance on the accuracy and dependability of the information disclosed is provided by the public disclosure of such auditing results because external stakeholders can critically examine the veracity of SC disclosures.

According to the literature, a company may benefit monetarily from SC openness if the information revealed helps it build a better reputation (Schnackenberg & Tomlinson, 2016). According to Villana and Dhanorkar (2020), companies often strive to strike a compromise between safeguarding their company image and meeting the information needs of stakeholders. Instead of fully complying with the transparency standards set forth by the stakeholders, the main goal in these situations is to be seen as a responsible firm (Fabrizio & Kim, 2019).

Supply Chain Traceability (SCTB)

The literature appears to be mostly in accord with how to conceptualise the SCTB phenomenon at a high level. Nonetheless, there hasn't been agreement on how to advance SCTB as a systematic idea or particular

formulation (Hastig & Sodhi, 2019). Researchers' capacity to produce a generalisable formulation for this new construct has been hindered by the proliferation of industry-specific traceability canons and the academic literature's focus on the creation and implementation of traceability systems (Stranieri, Orsi & Banterle, 2017).

We use different definitions from the literature to determine the dimension structure of SCTB and its connection to organisational performance as a prelude to the research. The majority of conceptualisations define the primary characteristics of SCTB as the capacity to capture and repossess product-related data and the capacity to trace products across the SC (Corallo, Lazoi & Lezzi, 2020).

First, it has been determined that gathering data on raw material sources is a crucial step in the product validation process (Cousin, Lawson, Petersen & Fugate, 2019). An organisation's capacity to identify process and product quality conformity is directly impacted by this aspect of SC traceability (Skilton & Robinson, 2009). From a sustainability standpoint, tracing the origins of raw materials is also crucial because it enables the identification of several tiers of suppliers who must adhere to reasonable social and environmental standards (Garcia-Torres et al., 2019).

Second, according to the literature, the data on the chemical management of products has significant effects on the milieu as well as consumer health and safety (Brun, Karaosman & Barresi, 2020). Following their receipt by the suppliers, raw materials go through a variety of procedures like comingling and blending, which alter the product's chemical and physical properties (Wowak, Craighead & Ketchen, 2016). Consequently, the SC may be subject

to several safety and quality compliance issues if information on these processes and their chemical components is not gathered and managed (Wowak, Craighead & Ketchen, 2016).

Specifically, chemical-intensive industries have devised a protocol wherein suppliers are informed of prohibited ingredient lists containing compounds that have detrimental effects on human health and the milieu to ensure compliance (Malik, Ghaderi & Andargoli, 2021). The first step towards the chemical management of SCs is thought to be the capacity to evaluate an organisation's degree of compliance with the restricted use of chemicals and hazardous materials (Karaosman et al., 2018). The management of SC chemicals can impact not only the environmental recital (Mejías, Bellas, Pardo & Paz, 2019) but also the financial performance by preventing expensive product recalls and liabilities in advance (Skilton & Robinson, 2009).

Third, a drive to gather data on sustainability as part of SC traceability is being suggested by the literature. Caritte, Acha and Shah (2015), for instance, proposed that gathering data on the environment presents chances to enhance SC sustainability. Utilising the products' environmental information as a strategic lever for market differentiation is made possible by consumers' increased awareness of the product's environmental impact (Corallo, Lazoi & Lezzi, 2020). In response to this chance, Garcia-Torres, Albareda, Rey-Garcia and Seuring (2019) developed the concept of "traceability for sustainability," which expands on the operational orientation of traceability by incorporating the gathering of data linked to sustainability within the SCs. Environmental traceability has been referred to as a SC risk management strategy to anticipate

suppliers' hazardous environmental behaviour and violations (Cousin, Lawson, Petersen & Fugate, 2019).

Consistent with this claim, we designate the tracking of SC environmental performance as the third SC traceability dimension. Monitoring environmental performance, including energy and water use, may also help SCs cut expenses and their environmental impact (Brun, Karaosman & Barresi, 2020). Fourth, one of the most important steps in ensuring that the manufacturing at each of the SCs' phases is done responsibly is to keep an eye on the suppliers' production procedures. Corallo, Lazoi, and Lezzi (2020), traceability systems facilitate interorganisational control by exchanging information that the systems make available and by monitoring actions throughout SCs. Mejías et al. (2019) noted the benefits of deploying traceability systems in terms of sustainability and operations while tracking offshore manufacturing processes and facilities.

Thus, by monitoring the various stages of suppliers' production processes, companies can safeguard their brand by controlling suppliers' hazardous behavior, such as unfavorable working circumstances (Guan et al., 2020). Skilton and Robinson (2009), insufficient monitoring of the production processes may result in financial losses and reputational risks if the precise SC location of the faulty items cannot be determined. This indicates that one important aspect of SC traceability that impacts an organisation's triple bottom line is the tracking of supply chain manufacturing processes.

Empirical Review

This section dowries empirical studies that have been conducted on DTA, SCI, SCTR, and SCTB. This study employed the NT and the RBT, to assess how DTA and SCI can enhance in achieving SCTR and SCTB.

Digital Technology Adoption (DTA) and Supply Chain Integration (SCI)

An empirical review of DTA and SCI is presented in the section. No prior research had examined DTA as an antecedent or preceding SCI, therefore literature on the two constructs is presented based on a prior conceptualisation of the constructs. According to Jiang and Ke (2019), the existing SCM system has several issues. Information silos are produced when SC data is isolated within a business. Research by Jeong and Hong (2019) confirmed Jiang and Ke's (2019) assertion that information is disseminated by upstream and downstream businesses in a bullwhip effect. In addition, information opacity in the SC reduces participant confidence and prevents the accurate transfer of information (Gao et al., 2020). Third, when subpar and counterfeit goods start to appear, it can be challenging to identify the root of the issue (Porey et al., 2020).

Bharadwaj et al. (2013), "fundamentally transforming business strategies, business processes, firm capabilities, products and services, and key inter-firm relationships in extended business networks" is what DTs viewed as amalgamations of information, computing, communication, and connectivity are doing. DTAs have gained attention as an enabler of new business model development (Visnjic et al., 2016). The Ghanaian health sector can change from a traditional business to a digital business by utilising digital technologies. Bharadwaj et al. (2013), digital business is concerned not only

with how to convert a traditional business into one that is backed digitally by technology but also with the digitalisation of goods and services as well as the information required to supply them.

Teece (2018), posit that, digital technology has made it easier for businesses to break down organisational boundaries and reduce functional and process silos, which is one of the dimensions of organisational agility. The various ways that digital technology has provided enterprises to interact with their customers have led to the development of business models (Khanagha et al., 2014). As a result, the health sector may easily integrate its SC activities so that it can clearly understand the effects of the different SC participants.

Internal integration acknowledges that various departments and handy areas within a health facility should operate as part of an integrated process, much like internal fit indicates uniformity amongst structural traits inside an agency (Milgrom & Roberts, 1995; Venkatraman & Prescott, 1990). Internal integration is considered to be related to recital because it inspires collaboration and breaks down functional boundaries to gratify customer needs, as opposed to functioning in the functional silos associated with traditional departmentalisation and specialisation, Bharadwaj et al., (2013). Even while producers may keep a functional organisational structure, customer orders flow across functions and activities. Bharadwaj et al., (2013), customers only care that their order has been filled; they are not concerned with the function that resulted in an order delay. This necessitates an integrated order fulfillment procedure for customers in which all relevant tasks and operations collaborate.

DTA can assist the healthcare industry in unifying its supply chain on a single platform with the aid of systems like Enterprise Resource Planning (ERP). ERP is a crucial instrument for coordinating, combining, and reorganising company data and processes into a single unique system to get a competitive edge in the nebulous commercial world (Mubarik et al., 2021). ERP systems give businesses the ability to easily and securely collaborate with their clients, other organisations, and distant parts of their firm. It is hypothesised that –

H1a: DTA has a positive effect on SCI.

Digital Technology Adoption (DTA) and Supply Chain Transparency (SCTR)

According to Kamble, Gunasekaran and Gawankar (2020), transparency is crucial to guarantee product authenticity and enhance product tracking. According to Hyla and Pejas (2020), two factors influence how transparent digital technology is. The timestamp in the block, which offers chronological verification of a series of occurrences, is the first component. In their study, Helo and Shamsuzzoha (2020) confirmed the integration of contemporary sensors such as GPS and radio frequency identity (RFID) is the second attribute of digital technology transparency. According to Azzi, Chamoun and Sokhn (2019), digital technology helps create a block for each connection of items that records operations from manufacturing to sales. Since information cannot be changed once the blocks are formed, traceability and subsequently product safety are assured (Moya, Galvez, Muller & Camargo, 2019).

Due to their comprehensive understanding of the value chain, SC academics, according to Markman and Krause (2014), are among the most

qualified to solve these issues. According to Lamming (2001), there are different levels of information exchange (also known as "visibility") inside the SC. Lamming refers to this as transparency, and SCs are required to openly share information with all parties involved, standardising the informational bargaining position and providing more information about the locations and methods of manufacture of parts. In their study of the connection amid DT and the performance of product and service novelty in process industries, Shen, Zhang and Liu (2021) make use of the DTA concept and contend that it is a crucial strategy for helping manufacturing sectors respond to modest pressures and realise the potential for digital technology-based competitive advantage.

In response to this need for growth, many manufacturing sectors have started their digital transition (Colli et al., 2021). Over 84.9% of Chinese manufacturing firms have begun their digital transformation as of 2018, and 26.6% have accelerated it to increase productivity and profitability. However, 24.4% of industries are inhibited by a lack of digital resources and skills, and 14% are constrained by the limitations of the transformation mindset, according to Alvarado-Vargas, Inamanamelluri and Zou's (2020) study.

To conduct socially and environmentally responsible business, the contemporary market necessitates that companies divulge information about their supplier chains and employ sustainable business practices. Large brands considered this strategy and adopted innovative technology to gain access to an SC that is transparent and open in a competitive market. SCTR is a crucial necessity for organisations nowadays, as manufacturers are under increasing regulatory pressure to safeguard the quality of their end products and have a better understanding of their SC (Cynthia, 2018).

To assure compliance, safety, accuracy, sustainability, and social responsibility standards, SCTR is a mapping of the SC network that enables stakeholders at every level to identify, map, or offer transparent and correct information (Ignatio & Charles, 2016). Bestowing to Abeyratne and Monfared (2016), manufacturing businesses' need for SCTR and SCTB is growing as a result of the complexity of those industries on a worldwide scale. Successful businesses have realised, according to Wang et al. (2019), that competitive advantage comes from high levels of product openness that increase customer confidence. When the actions of the health sector are transparent and there is a fair and open exchange of information among all SC participants, supply chain transparency is simple to achieve. Thus, it is hypothesised that –

H1b: DTA has a positive effect on SCTR.

Digital Technology Adoption (DTA) and Supply Chain Traceability (SCTB)

Digital technologies, including social media and online marketplaces, have made it possible for small businesses to expand quickly both domestically and abroad (Huang et al., 2017). At the same time, new technologies have made it possible for incumbent enterprises that are in danger of losing their market share to reposition themselves (Kaulio, Thorén & Rohrbeck, 2017). The competition becomes more dynamic with the help of DT as the competence gap amid large incumbent corporations and tiny companies just entering the market (Teece & Linden, 2017).

A study by (Helo & Hao, 2019; Tijan, Aksentijevi, Ivani & Jardas, 2019), digital technology is well suited to address these supply chain challenges because it can certify the veracity and traceability of information while

According to Kamble et al., (2019), these features have a significant impact on SCM and have an impact on the structure, organisation, and operations of the SC. Di Vaio and Varriale (2020) posit that digital technology prevents information from being modified, which lowers SC risk and boosts confidence among SC actors. Conferring to Lambourdiere and Corbin (2020), digital technology maintains data integrity. Depending on the precise requirements, more sorts of materials may need to be obtained. Digital technology improves product safety, as shown and supported by Ding, Cruz, Green and Bauman (2020).

When material information is lacking or inadequate, supply chain traceability is hampered; nevertheless, the benefits of traceability are constrained by the supply network's complexity (Ghislieri et al., 2019). For instance, a manufacturer of coffee beans from a single source is less intricate than a multinational conglomerate that combines the beans from several suppliers in various nations. There are hidden components in the intricacy of SC networks made up of various entities (Such as raw material suppliers, distributors, manufacturers, retailers, and end customers), which creates concerns regarding efficient and secure monitoring.

The capacity to detect and identify the causes of population-based occurrences is crucial for public health. It would be very beneficial to have a thorough track and trace system from the manufacturer to the patient, especially when faulty products are found (Giesers et al., 2019). These demands are demonstrated in a variety of ways, including the tracking of all patients who have received a certain medication, prosthesis, or other materials, medications, vaccinations, or human products utilised with patients (Ivanov &

Dolgui, 2021). Unfortunately, there is a wide range of traceability that is available.

While there is very good traceability accessible for some products, such as pacemakers, it is virtually non-existent for others, such as pharmaceuticals, Ouheda, Hafeez-Baig, Chakraborty, and Gururajan (2019). Additionally, state or national policies have a significant influence on the legal framework that enforces traceability. The implementation of digital technology by the healthcare industry not only improves supply chain traceability but also helps maintain transparency. Consequently, it is hypothesised that –

H1c: DTA has a positive effect on SCTB.

The mediating role of Supply Chain Integration (SCI) in the relationship between Digital Technology Adoption (DTA) and Supply Chain Transparency (SCTR).

Digital technology, according to Saberi, Kouhizadeh, Sarkis and Shen (2019), helps customers engage in environmentally friendly consumption by enabling them to follow a product's raw materials and carbon emissions throughout every stage of manufacturing. The innovative use of smart contracts exemplifies the sophistication of digital technologies. Singh, Tang, Zhang and Zheng (2020) proposed smart contracts, which are incorporated into a network and allow the automatic execution of contract terms when the circumstances for execution are met, to achieve internal participant interaction. Smart contracts, according to Macrinici, Cartofeanu and Gao (2018), are swiftly executed, increasing operational efficiency.

Digital technology is especially well suited to these networks because multi-tier supplier networks with intricate relationships make it difficult to

track the condition of the business and settle payments. Smart contracts can be used to integrate transactions across multiple currencies, organise the financial status of the entire SC network, and ensure that each participant is compensated (Pournader, Shi, Seuring & Koh, 2020). Smart contracts can also help reduce the risk of default by ensuring that the parties to a transaction fulfill their obligations (Min, 2019).

However, it appears that when applied by organisations, particularly Ghana's Health Sector, digital technology, though still in its infancy due to daily advancements, may help handle the most difficult problems and maintain transparency in their business dealings with their suppliers and customers (Hyla & Pejas, 2020; Kamble et al., 2020; Wang et al., 2019). In addition, this research demonstrated that SCI is essential for the use of DT in the SCTR of organisations, which is counter to the conclusions of the majority of studies conducted globally. Finally, it may be argued that through improving SCTR, the digitalisation of supply chains and technology can benefit the Ghanaian health sector.

It is not easy for businesses to incorporate digital technology into their daily operations since they first need to address organisational problems (Leih et al., 2015). Nevertheless, there are several benefits that businesses may experience if they are successful in incorporating digital technology into their day-to-day operations. These benefits include enhanced transparency, resource efficiency, the ability to expand business models (Warner & Wäger, 2019), enhanced performance (Bouwman et al., 2018), enhanced innovation capability, and the possibility of easily implementing multiple business models.

The convergence of technical development has made it more difficult for managers to forecast the state of the business and choose the most effective way to distribute the resources needed to create successful business models, El Sawy et al., (2016). Big data analysis is one approach that could work, allowing managers to not only adapt to current technology development trends but also predict how they will change in the future (Brocal, Sebastián & González, 2017). Owing to the unpredictable nature of technological progress, established businesses need to establish mechanisms that enable them to antedate the convergence of technological breakthroughs to maintain their status as digital leaders (El Sawy et al., 2016).

The configuration strategy emphasis creating silhouettes. According to configuration theory (Miller, 1986), patterns seen in practice are a reflection of how strategy and systems or practices are aligned. This implies the necessity to define emerging SCI patterns. The inductive configuration approach uses data-driven analysis to construct an empirical taxonomy. By sharing information and working together on planning, which is directly tied to how well a firm performs (Teece, 2018a). The manufacturer will be able to produce higher-quality products at cheaper costs and with more flexibility with the support of customer integration, which will enable the manufacturer to better understand customer requirements and forecast customer demand. Through the integration of the system and the implementation of digital technologies, these will in turn result in SCTR in the SC of the health sector. Additionally, how the three SCI dimensions are configured will affect how effective SCI is. Accordingly, it is hypothesised that –

H2a: SCI Mediates the relationship between DTA and SCTR.

The mediating role of Supply Chain Integration (SCI) in the relationship between Digital Technology Adoption (DTA) and Supply Chain Traceability (SCTB).

Scholars in the contemporary sustainability deliberation are linking traceability with broader objectives and stakeholder expectations for more responsible, transparent, and equitable supply chains (Garcia-Torres et al., 2022). According to the Global Compact (2014), traceability is the ability to identify and track the origin, movement, location, and application of products, parts, and materials in order to verify the accuracy of sustainability claims in areas such as human rights, labour (including health and safety), the environment, and anti-corruption (Rasche, 2020, p. 228).

Thus, SCTB is the ability to retrieve and make specific information available when needed (for operational or sustainability purposes) (Olsen & Borit, 2013). This gave rise to the concept of "Traceability for Sustainability," defined by Garcia-Torres et al. (2019, p. 87) as "the ability to combine SC information sharing and visibility in such a way that the actors within the chain have access to information that is 'accurate, trusted, timely, and useful' for their operations and the reliability of sustainability claims." This "broader traceability" strategy, which targets both operational and sustainability goals, is used as the starting point for this research.

SCI's proposed contributions to DTA and SCTB array from ensuring acquiescence and security (Garcia-Torres et al., 2022) to reducing scandals and recalls (Garcia-Torres et al., 2022), as well as improving flexibility, agility, and inventory performance (Garcia-Torres et al., 2022; Shou, Zhao, Dai & Xu, 2021). By integrating their supply chain, organisations can gain a competitive

edge and produce incremental innovation, which helps them attain SCTB. Therefore, it is hypothesised that –

H2b: SCI Mediates the relationship between DTA and SCTB.

Conceptual Framework

The study hypothesises that the DTA and SCI will enhance supply chain transparency and traceability in Ghana's Health Sector (GHS). The study suggested that independent factors are SCI and DTA. SCTR and SCTB is the dependent variable. Figure 1 shows the structural relationship amid DTA, SCI SCTR, and SCTB in Ghana's Health Sector. It can be seen that SCI and DTA influence SCTR and SCTB. Moreover, SCI mediates the relationship between DTA, SCTR, and SCTB. The extent of influence is not shown in the conceptual framework since the framework is only a blueprint of how the variables are connected.

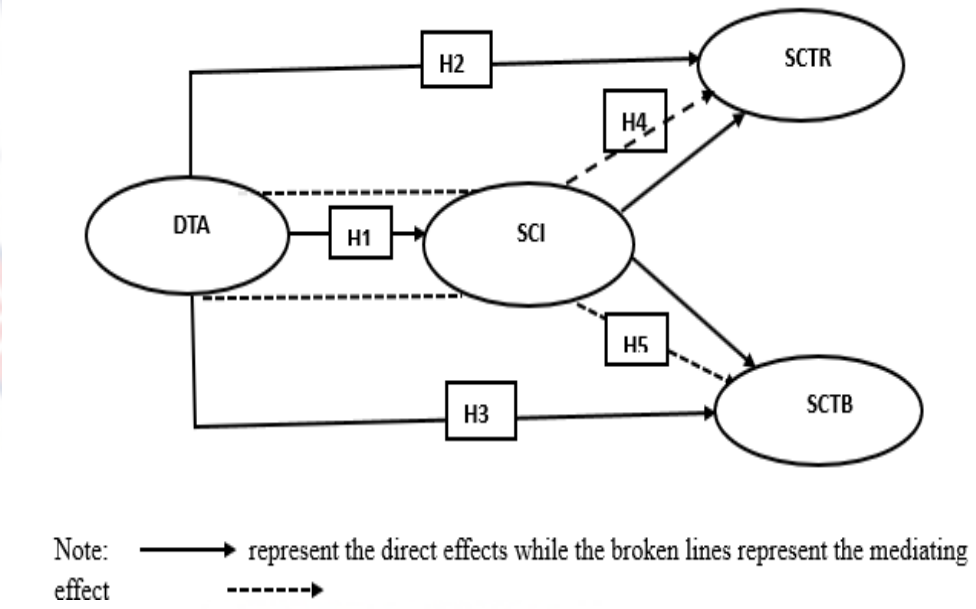

Figure 1: *Conceptual Framework for the study*

Source: *Author's Construct (2024)*
Note*: DTA= Digitalised Technology Adoption; SCI= Supplier Chain Integration; SCTB= Supply Chain Transparency; SCTR= Supply Chain Traceability*

CHAPTER THREE

RESEARCH METHODS

Introduction

The research design used to explore the research issue is covered in this chapter. It centers on the population and sample characteristics. Additionally, the method and measurement tool for collecting the data were covered. The research design provided more details on the quantitative method studies that were employed in the study. Ultimately, the statistical methods for gathering, processing, and presenting data were also covered.

Research Philosophy

This is used to describe ‘‘a system of beliefs and assumptions about the development of knowledge’’ (Saunders, Lewis & Thornhill, 2016). It refers to the set of beliefs held by the researcher when conducting their study. They comprise the assumptions of the researcher and affect how they develop knowledge from their study (Saunders, Lewis & Thornhill, 2016). Our assumptions influence how we create or contribute to knowledge. Every researcher makes assumptions about knowledge (epistemological stance), views reality in their peculiar way (ontological stance) and one way or another has their values influencing their research (axiological stance). All the above influence and determine the drafting of research questions, the type of methods to adopt, and the form of analysis and interpretation to use.

From the pluralists’ point of view, several philosophies exist and they each have their significant way of contributing to research (Pellegrinelli & Murray-Webster, 2011). Saunders et al., (2016) described five research

philosophies namely; positivism, critical realism, interpretivism, postmodernism, and pragmatism. Creswell (2009) also described four philosophies or paradigms that is post-positivism, constructionism, advocacy, and pragmatism. The philosophical stance for this study is the post-positivism paradigm. This is because given the research context, the study's results may vary in terms of those studied in another context (Saunders et al., 2016). This confirms the post-positivist stance by Jennings (2005), who stipulates that with regards to the post-positivist paradigm, truth is mutable and therefore socially dependent, hence cannot be ''universal and apprehendable''.

Post-positivism implies thinking after positivism since it challenges the idea that there is no absolute truth when studying a phenomenon that involves human beings (Philips & Burbules, 2000). The post-positivist orientation is different from the positivism approach which determines that truth is universally determined and hence, infallible (Jennings, 2005).

Research Approach

The study employed a quantitative research design, which is often thought to yield data that is accurate, representative, and generalisable (Rutberg & Bouikidis, 2018). The benefit of using quantitative research in methodology is that it helps to describe in detail the process or methodology for processing and analysing data, as well as the specific tools used to study the research objective and the type of software used in the manipulation of existing data. The quantitative research method is often focused on predictions and aims to maximise objectivity, dependability, and generalisations of research findings (Guba & Lincoln, 1994).

Research Design

An explanatory design was employed to conduct the study since it is unclear how DTA, SCI, SCTR, and SCTB relate to each other in the Ghanaian health sector. The study employed an explanatory research methodology to assess participants' knowledge, beliefs, preferences, and views about how the adoption of digital technology, SCI, SCTR, and SCTB have affected Ghana's health sector. This is how the study's goals and hypothesis were created. Explanatory research studies aid in greater comprehension of a subject and provide more reliable conclusions that make it simpler to generalise findings (Creswell, 2014). Explanatory studies are the most important sort of research for social work researchers and practitioners because they provide a lot of information on the people, situations, and surroundings studied (Siedlecki, 2020).

Study Area

The 9,826 square kilometers, or around 6.6% of Ghana's total land area, make up the Central Region. It belongs to Ghana's sixteen administrative regions. Its boundaries are the Gulf of Guinea to the south the Western Region and the Western North Region to the west. The territory borders the Greater Accra territory to the east, the Ashanti Region to the north, and the Eastern region to the northeast. The capital and oldest city of the area is Cape Coast, which is divided into 22 administrative districts. Approximately 63% of the area is rural (DHS, 2008). The majority of the Akan people in the area are Fantes.

With a regional growth rate of 3.1% and a populace density of around 215 people per square kilometer, the predicted population in 2020 is 2,605,490. The population under five years old is 521,098; the women in fertility age (WIFA) is 625,318. The vegetation in the area is split between a tropical rainforest that covers parts of the hinterland and a dry coastal savannah that stretches about 15 km inland. The region has two significant wet seasons each year. There is only one forest reserve, the Kakum National Park, which is roughly 25 kilometers from Cape Coast and is a popular tourist destination both domestically and abroad. Due to the homogenous nature of operations by the Ghana Health sector, responses from other region will not differ from that of central region, hence cutting down on cost for data collection by the researcher, central region was sued for the study.

Population

Mouton (2002), a population is made up of people who share traits that the researcher is interested in. Therefore, it also becomes crucial to apply the findings of the current study to a particular group, the population was defined. The term "study population" denotes the total group of individuals from which data can be gathered, and examined, and from which the researcher can draw references. In this regard, the 618 people who made up the target demographic were employees in charge of procurement activities at the 618 healthcare facilities in the Central Region (Ghana Health Service).

Sampling Techniques

Neuman et al., (2011) define sampling as the procedure of choosing a subset of the populace of interested people to epitomise that populace for a

study. A slice of the populace chosen to reflect the complete populace makes up the sample size (Garson, 2012). Consequently, a practical sampling approach was used for this study. However, the sample size only represents a portion of the whole population (Saunders, Lewis & Thornhill, 2012).

There exist two sampling methods which include probability and non-probability sampling techniques. The probability sampling technique provides equal chances to each sample for selection based on the sample frame, while the non-probability sampling enables the selection of samples based on judgment (Saunders, Lewis & Thornhill, 2016). Convenience sampling was used for this study. Convenience sampling is a non-probabilistic sampling technique where participants are selected based on their easy accessibility and readiness to participate in the study. Non-probability sampling methods are suitable when the sample frame is not easily available and accessible.

To gather data, health facilities who had access to digital technologies such as GhiLHMIS, LHMIS, Oasis, etc, in central region were used. Non-probability sampling was adopted for the study. Specifically, central region was suitable given that healthcare systems in Ghana are deemed to have homogenous characteristics in terms of their operating processes. Convenience sampling provides the advantages of allowing researchers to gather data from respondents available at the period of the study.

Sample Size

Respondents were chosen from a population of 618 healthcare in the Region using the Ramsetty and Adam (2020) and Yamane (1967) sample size determination formula, which extrapolates from Krejcie and Morgan (1970). This sample size determination formula is grounded on a confidence level of

95% and a level of precision of 0.05. The calculation provided a sample size of 243 employees in charge of procurement activities from the healthcare facilities in the region.

The formula is shown as: n = N/ 1+ N (e)2

Where N = population size, e = level of precision, and n = sample size.

n = 618/ 1+ N618 (0.05)2

n = 618/ 1 + 1.545

n = 618/ 2.545 = 242.829 = 243

Data Collection Instruments

The study adopted a primary type of data for gathering and collecting data. Primary data are data collected by the researcher to suit the purpose of the study objectives. Primary data was needed for this study, and questionnaires were the appropriate instruments used to gather data for the study. This was deemed suitable because questionnaires help respondents respond at their own free will and pace, and the responses tend to be concise and precise (Sekaran & Bougie, 2016). Questionnaires were sent to respondents both physically and electronically via email. The validity and reliability of the question used in the questionnaire were examined using composite reliability and Cronbach alpha (a) for reliability, as well as convergent and discriminant validity tests for validity (Hair, Ringle & Sarstedt, 2013).

Ledney and Ormrod (2005), the Likert scale is better suited for evaluating behaviour, attitude, or other phenomena of interest on a continuum. There were four sections to the questionnaire. The demographics of the respondents are covered in Section A. Section B evaluated the impact of SCI and DTA on the Ghanaian health sector. Section C looks at the impact of SC

and traceability on the Ghanaian health sector. Sector D looks at SCI in the relationship between these three factors. To avoid uncertainty, the questionnaire was written in clear, short language. A questionnaire, which does not need any kind of identification, is thought to produce responses that are more honest and objective. This study adopted its measurement scale for Digital Technology Adoption from BLichfeldt and Faullant (2021) and Huang and Zhou (2013), supply chain integration from Flynn, Huo & Zhao, (2010) and Kim (2006), supply chain transparency and supply chain traceability from (Ethical Fashion Report 2019). The questionnaire is in Appendix 1.

Data Collection Procedure

Authorisation for the data hodgepodge isometric was sought from the authority of the institution when a letter, issued by the University of Cape Coast was then sent to that outfit. The purpose of the study was elucidated to all participants. The participants' consent was requested. On a few mutually agreed-upon dates, the participants' questionnaires were distributed. The responders filled out the questionnaire on their own. All of the respondents received the necessary information in full and with accuracy.

Reliability and Validity

It is important to consider the validity and reliability of a study's measures when assessing its quality. Validity, according to De Vos and Fouche (1998), is the degree to which a data collection instrument accurately and sufficiently assesses the selected concept. Since the researcher only documents what participants say and do during the data collection process, validity must be achieved. Reproducibility is the idea

that a study may be accurately repeated in a different environment by a different researcher. The consistency and stability of the data obtained with such a research tool can be determined by the reliability. The researcher researched additional pertinent literature to ensure the validity of the questionnaires. Scientific validation was used for several of the scale items. Before being given to the respondents, the prepared questionnaire was also given to the thesis supervisor for review, approval, and modification.

Data Processing and Analysis

The statistical aids that were used for this research are the IBM SPSS Statistics (version 27) and Smart PLS (version 4) software. After the questionnaire collection period, the researcher went through each of them to ensure completeness and then assigned numbers to them for entry purposes. The data was entered into the SPSS software which allowed for additional checks for outliers and missing data. The enciphering of the survey items before data entry was done by assigning some inimitable ciphers to the innumerable items of the constructs in the SPSS file.

For digital technology adoption (DTA), the 6 items were adapted as DTA1, DTA2, DTA3, DTA4, DTA5, and DTA6; the 6 items of the Supply Chain Integration (SCI) were named uniquely as SCI1, SCI2 SCI3, SCI4, SCI5, SCI6; supply chain transparency (SCTR) had indications such as SCTR1, SCTR2, SCTR3, SCTR4, SCTR5, SCTR6 and SCTR7 whiles those of supply chain traceability (SCTB) were named (SCTB1, SCTB2, SCTB3, SCTB4, SCTB5, SCTB6 and SCTB7). Once all these were ensured the SPSS file was saved as “Comma delimited” to make it suitable for the SmartPLS software.

The comma-delimited file was also subjected to two stages of running the data, i.e., the PLS Algorithms and Bootstrapping. Results for analysis and discussion were generated through these two stages and modelled to suit the specific objectives of the study. Inferential statistics through PLS-SEM was used to address the objectives of the study.

Data management

Before collecting data, respondents were assured of anonymity of response to aid in giving the most accurate response. Data collected will be kept and used securely, and efficiently for the data collection. Data collected will be stored on a secured cloud. The soft copies will also be stored in the researcher's Dropbox accounts and Google Drive as well as on an external hard drive on the researcher's computer. The hard copies and soft copies of the data will be kept for about five (5) years after graduation before they will be disposed of. The hard copies will be disposed of by burning the copies and soft copies deleted from drives on the researcher's computer.

Ethical Consideration

The study took into account and addressed a few significant ethical problems in social science research. In conclusion, the researcher requested official approval from University of Cape Coast officials for this exercise. All parties involved in the study, especially the volunteers, were given a thorough explanation of the study's goals and benefits. Again, participants' verbal informed agreement was requested, and none of the respondents were forced to take part in the study. When respondents had difficulties responding to a particular item, proactive measures were taken to clear up the situation.

Concerns like privacy, confidentiality, and unanimity were thoughtfully addressed through the creation of a substantial structured questionnaire. During the study's data processing and analysis phase, there was no data tampering. The results were to be reported as created in due time.

Chapter Summary

Information about the collection, organisation, analysis, and presentation of the study's primary data for ease of understanding has been included in this chapter. This chapter also included details on the study's design and scientific methodology, including how data requirements were addressed, statistical methods were employed, and the investigation was approached methodically.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

The study examines Digital Technology Adoption, Supply Chain Integration, and Supply Chain transparency and traceability in Ghana's Health Sector. A questionnaire was used to collect data from various health facilities in the Central Region. SPSS version 27 and Smart Pls 4 were used to process and analyse the data, and this chapter presents the findings of the study with discussions.

Demographic Information of Respondents

This section presents the demographic information of the respondents which was relevant to the study. Information details include the gender, position, year of experience, educational qualification, and category of entity. The demographic information provides a synopsis of the respondents' characteristics and is discussed subsequently. The results show that the majority of the respondents were males representing 69.2% and 30.8% were females as presented in Table 1. This shows how males dominate in the health facilities sector, especially in a developing country context.

Moreover, 65.0% of the respondents occupied procurement officer positions, 22.4% were procurement managers/administrators and 12.6% were storekeepers. 52.4% of the respondents had occupied their positions for 10-20 years, while 43.7% had occupied their positions for 0 – 10 years, and 3.9% had occupied their positions for 30 years and above respectively. 81.5% had a Bachelor's degree, 8.7% of them had a Master's degree, 7.3% had a Diploma,

1.7% of the respondents also had a Doctorate and 0.85% of the remaining respondents had other certificates. Lastly, in the category of health facilities, 40.9% of the respondents were AT the clinics, 25.8% of the respondents were at the CHPS, 19.0% of the respondents were at the health centres, also, 10.9% of the respondents were at the hospitals whilst 3.4% of the remaining respondents were at the polyclinics. The respondents were contacted based on their acquaintance with the operations at the health facility, hence the results presented in terms of office designation are not a disparity.

Table 1: Demographic Information of Respondents

Category	Frequency	Percent
Gender		
Male	247	69.2
Female	110	30.8
Total	357	100
Position in the facility		
Procurement manager/Administrators	80	22.4
Procurement officer	232	65.0
Stores keeper	45	12.6
Total	357	100
Number of years worked		
0 - 10 years	156	43.7
10 – 20 years	187	52.4
Above 30 years	14	3.9
Qualifications		
Diploma	26	7.3
Bachelor's degree	291	81.5
Master's degree	31	8.7
Doctorate	3	0.8
Others		
Total	357	100
Category of health facilities		
Clinics	146	40.9
CHPS	92	25.8
Hospital	39	10.9
Polyclinic	12	3.4
Health Centre	68	19.0
Total	357	100

Evaluation of the PLS-SEM Results

PLS-SEM is a suitable approach when the study is exploratory, the model is complex, the constructs/variables are measured formatively and the study aims to predict the constructs (Hair, Ringle & Sarstedt, 2011). Hair, Hult, Ringle, and Sarstedt (2021) posit that reporting the results of PLS SEM involves two steps. The first step is to specify the model (measurement and structural models), and the second step is to assess the models that are the measurement model and structural model (Hair, Risher, Sarstedt & Ringle, 2019).

The measurement model which is also known as the outer model is used to assess the relationship amid the constructs and their corresponding indicators, while the structural model is used to depict the relationship which exists among the constructs and it is also known as the inner model (Hair, Sarstedt, Hopkins & Kuppelwieser, 2014).

Model Specification

The measurement and structural models will be specified in this section. The measurement model, also known as the outer model describes the relationship amid the constructs and their respective indicators. Moreover, the structural model describes the relationship that exists among the constructs in the study (Hair et al., 2020).

Specifying the measurement model means describing the relationships that exist among the constructs and their corresponding indicators, while the structural model specification is concerned with describing or depicting the relationship amid the constructs (Acquah, 2020). The measurement and structural model are represented in Figure 2.

Measurement Model Specification

The measurement model refers to the indicator items that were used to measure the constructs. This model used twenty-six (26) indicators to measure four constructs as shown in Figure 2. The items used to describe each construct are described subsequently. The exogenous variable was Digital Technology Adoption while the endogenous variables were SCTR and SCTB. Lastly, SCI is the mediating variable.

Digital Technology Adoption was measured with 6 indicator items. They were represented by DTA1, DTA2, DTA3, DTA4, DTA5 and DTA6. Supply Chain Integration was measured with 6 indicators namely SCI1, SCI2, SCI3, SCI4, SCI5, and SCI6.

Supply Chain Traceability was measured with 7 items namely SCTB1, SCTB2, SCTB3, SCTB4, SCTB5, SCTB6 and SCTB7. Supply Chain Transparency was measured with 7 items and they include SCTR1, SCTR2, SCTR3, SCTR4, SCTR5, SCTR6 and SCTR7.

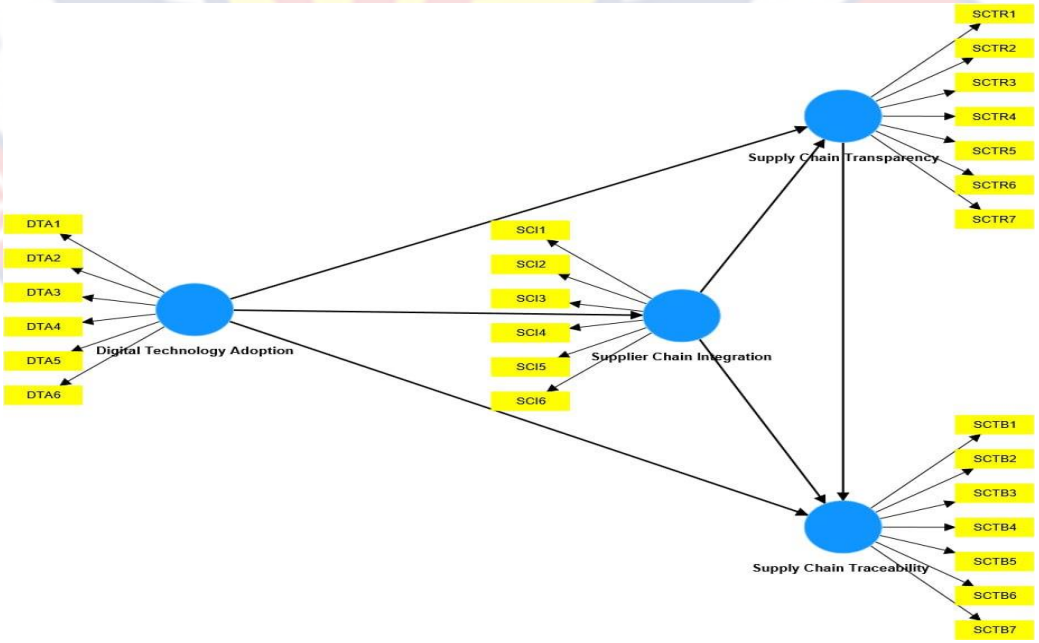

Figure 2: *Measurement and structural model results*

Source: Author's construct (2024)

Structural Model Specification

The study's inner model, also known as the structural model, comprises one exogenous construct, one mediating variable, and two endogenous constructs. The constructs for this study are represented with blue circles as can be seen in Figure 2. The two endogenous constructs in this study, that is SCTR and SCTB.

The exogenous construct is digital technology adoption and it is connected to the endogenous variable through the mediating variable supply chain integration theoretically using the network theory and the RBT.

Model Assessment

The second step in analysing results with PLS-SEM is to assess the measurement and structural models respectively (Hair, Howard & Nitzl, 2020). It involves analysing results to gauge the reliability and validity of the measures of the construct in the outer model. Doing so helps to ascertain the trustworthiness of the outer model as well as form the basis for assessing the inner model. Assessing the inner model is concerned with examining the hypothesised relationships that exist in the inner model which also form the bases for the study (Hair et al., 2019).

Measurement Model Assessment

The measurement model assesses the quality of the outer model using reliability and validity (Hair et al., 2020). Reliability is considered in terms of construct reliability and internal consistency while validity is considered in terms of convergent and discriminant validity.

Construct reliability and internal consistency reliability are gauged using the indicator loadings and Cronbach's alpha (α) as well as the composite reliability of the construct, respectively.

Convergent validity is measured using factor loadings and the average variance extracted (AVE) values of the items (Hair et al., 2019). Discriminant validity is measured using cross-loadings, heterotrait-monotrait (HTMT) ratio criteria, and Fornell-Larcker.

Assessing Construct Reliability

Reliability describes the robust nature of the questionnaire and whether the items in the questionnaire would yield the same or similar results when used in different situations on different sets of samples and administration means (Saunders et al., 2009). Construct reliability is examined using indicator loadings, which ought to be above 0.708 for the item to be said to be reliable (Hair et al., 2019). Hair et al. (2019) posits that loadings above the stated threshold imply that the construct elucidates more than 50% of the variation in the indicator. The analysis requires that items that do not load 0.708 and above be deleted from the model. This led to the deletion of some of the indicators since their presence affected the composite reliability and AVE values. The results in Figure 3 show that the remaining indicators are reliable in explaining the constructs since they are all above 0.708.

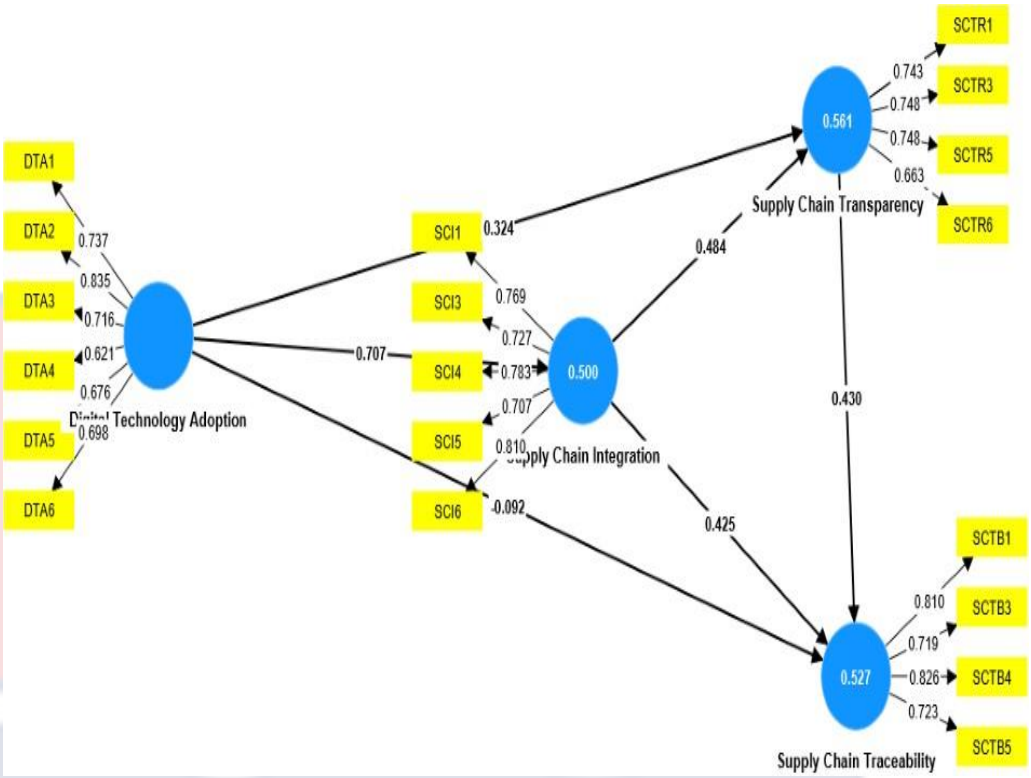

Figure *3: Structural and measurement model results*
Source: Author's construct (2024)

Assessing Internal Consistency Reliability

Internal consistency reliability weighs how congruous and consonant responses are across some subsets of the questions (Saunders et al., 2009). Internal consistency reliability is assessed using Cronbach's alpha and composite reliability values (Haire et al., 2019). Threshold values for both measures ought to be 0.7 and above for a model to be said to possess internal consistency reliability (Afthanorhan, 2013).

Cronbach's α is depicts the lower bound of internal consistency reliability while composite reliability presents the upper bound of internal consistency reliability (Acquah, 2020). This means that Cronbach's α is a less precise measure of reliability while composite reliability is also a more robust a higher predictor of reliability (Hair et al., 2019).

However, a more exact measure within the two extremes is presented as Rho A, and this produces a good compromise for a model if one is faced with outlying results in terms of Cronbach's α and composite reliability. The internal consistency assessment is presented in Table 2. The values in the table meet the stated threshold (above 0.7), hence the model is said to have internal consistency reliability.

Table 2: Internal Consistency Assessment Results

Items	Cronbach's alpha	Rho_A	Composite reliability
DTA	0.809	0.818	0.863
SCI	0.817	0.821	0.872
SCTB	0.775	0.784	0.854
SCTR	0.793	0.800	0.858

Source: Field survey (2024)

Assessing Convergent Validity

The validity of a construct is explained as the rate at which the questions or indicators measure the questions for which they are intended and enables researchers to make generalisations of a given set of questions in terms of a construct (Saunders et al., 2009). Convergent validity describes the ability of a given set of questions to come together or correlate to measure the construct (Hair et al., 2014).

The criterion used to assess convergent validity is the AVE with a threshold of 0.5 and above as well as factor loadings of 0.7 and above (Hair et al., 2019). An AVE above 0.5 means that the construct explains more than 50% of the variance in its indicators (Afthanorhan, 2013). The AVE values and factor loadings presented are presented in subsequent sections for the various variables. Some of the items were deleted from the model because their

loadings on the respective constructs were below 0.7, and their presence affected the AVE.

Digital Technology Adoption (DTA): Digital Technology Adoption was measured with 6 indicators. Though three of the indicators were below the assessment of quality criteria, there was no deletion of three indicators since their presence did not affect the AVE. The AVEs and factor loadings of the indicators are presented in Table 3.

Table 3: Convergent Validity for Digital Technology Adoption

Construct	Indicators	Factor loadings	AVE
DTA	DTA1	0.737	0.514
	DTA2	0.835	
	DTA3	0.716	
	DTA4	0.621	
	DTA5	0.676	
	DTA6	0.698	

Source: Field survey (2024)

The indicators for the final model have factor loadings above 0.7, ranging from 0.621 to 0.835. Even though DTA*4, DTA5, and DTA6* had factor loadings of 0.621, 0.676, and 0.698, their presence did not affect the AVE, moreover, the AVE value is above 0.5. Therefore, there is convergent validity for the indicators on the construct.

Supply Chain Integration (SCI): SCI was measured with 6 items and one item was deleted because its presence affected the AVE. Convergent validity outcomes are shown in Table 4.

Table 4: Convergent Validity for Supply Chain Integration

Construct	Indicators	Factor loadings	AVE
SCI	SCI1	0.769	0.578
	SCI3	0.727	
	SCI4	0.783	
	SCI5	0.707	
	SCI6	0.810	

Source: Field survey (2024)

The items for Supply Chain Integration, as shown in Table 4, reveal that there is the satisfaction of convergent validity. Factor loadings range between 0.707 to 0.810 which is higher than 0.7, and AVE of 0.578 which is above 0.5 though one item; SCI2, was deleted because its presence affected the AVE.

Table 5: Convergent Validity for Supply Chain Traceability

Construct	Indicators	Factor loadings	AVE
SCTB	SCTB1	0.810	0.595
	SCTB3	0.719	
	SCTB4	0.826	
	SCTB5	0.723	

Source: Field survey (2024)

The AVE of Supply Chain Traceability was 0.595 (above the threshold of 0.5) with factor loadings ranging from 0.719 to 0.826 but the assessment of quality criteria led to the deletion of three indicators (SCTB2, SCTB6, and SCTB7), respectively. The AVEs and factor loadings of the remaining indicators are presented in Table 5. hence it can be concluded that there is convergent validity.

Table 6: Convergent Validity for Supply Chain Transparency

Construct	Indicators	Factor loadings	AVE
SCTR	SCTR1	0.790	0.547
	SCTR2	0.743	
	SCTR3	0.748	
	SCTR5	0.748	

Source: Field survey (2024)

The AVE of Supply Chain Transparency was 0.547 (above the threshold of 0.5) with factor loadings ranging from 0.743 to 0.790 but the assessment of quality criteria led to the deletion of three indicators (SCTR4, SCTR6, and SCTR7) because their presence affected the AVE. The AVEs and factor loadings of the remaining indicators are presented in Table 6.

Assessing Multi-Collinearity

Multicollinearity is used to describe a data problem that arises due to the linear relationship that exists among variables (Alin, 2010). It may lead to reliability issues and model estimation problems. The variance inflation factor (VIF) and tolerance values are used to assess collinearity issues, and VIF values ought to be less than 3 even though values that are higher but less than 5 are also acceptable (Hair et al., 2019).

Moreover, Hair et al. (2019) tolerance (1÷VIF) values are also expected to be above 0.2 to be conclusive proof of the absence of multi-collinearity. Results in Table 13 show that there is no multi-collinearity issue since the values meet the stated criteria. The VIF values in Table 7 also show that there is no issue of common method bias since the values are below 5 (Kock, 2015).

Table 7: Multi-Collinearity Assessment

Variable		Collinearity statistics :s	
		Tolerance	VIF
DTA	-> SCI	1.000	1.000
DTA	-> SCTB	0.447	2.237
DTA	-> SCTR	0.501	1.998

Source: Field survey (2024)

Assessing Discriminant Validity

Discriminant validity describes the extent of empirical distinctiveness of constructs; that is situations where constructs measure what they are envisioned to measure (Hair et al., 2020). The Fornell-Larcker criterion, HTMT

(heterorait-monotrait), and cross-loadings are used to assess discriminant validity (Bagozzi & Yi, 1988).

The Fornell-Larcker criterion posits that a construct and its indicators ought to share more variance as compared to the construct and other indicators (Fornell & Larcker, 1981). The rule of thumb here is that the square root of the AVE of each of the constructs must be higher than the squared inter-construct correlation (Hair et al., 2019). The Fornell-Larcker criterion are presented in Table 8.

Table 8: Fornell-Larcker Criterion for Discriminant Validity

	DTA	SCI	SCTB	SCTR
Digital Technology Adoption	**0.717**			
Supply Chain Integration	0.707	**0.760**		
Supply Chain Traceability	0.495	0.667	**0.771**	
Supply Chain Transparency	0.666	0.713	0.672	**0.740**

Source: Field survey (2024)

Results in Table 8 indicate that the square root of AVE for each construct on itself is higher than the construct's relationship with other constructs. The square root of AVEs is depicted in bold and is seen to be higher, hence this study meets the discriminant validity criterion based on Fornell and Larcker (1981).

The cross-loading criteria require that indicators should load higher on their actual construct than on their cross-loadings. Indicators are expected to load significantly on the constructs they measure as compared to their loadings on constructs that they do not measure. Results in Table 8 show that the

indicators measure higher on their corresponding constructs than other non-measuring constructs.

Discriminant validity was further assessed using the heterotrait-monotrait (HTMT) criterion. For constructs that are similar conceptually, an HTMT value of 0.9 or less is deemed acceptable, hence depicting the absence of discriminant validity problems (Henseler, Ringle, & Sarstedt, 2015). The HTMT criterion is the most robust and generally accepted measure of discriminant validity since it has higher performance in terms of the Fornell-Larcker and cross-loading methods of assessing discriminant validity. Results from discriminant validity using the HTMT criterion are presented in Table 9. All the HTMT values are below the threshold of 0.90 which means there are no discriminant validity problems. It also implies that the constructs are empirically discrete from each other.

Table 9: Heterotrait-Monotrait (HTMT) Criterion for Discriminant Validity

	DTA	SCI	SCTB	SCTR
Digital Technology Adoption				
Supply Chain Integration	0.846			
Supply Chain Traceability	0.597	0.811		
Supply Chain Transparency	0.815	0.877	0.837	

Source: Field survey (2024)

Structural Model Assessment

After examining the outer model, a structural model assessment which refers to examining the hypothesised relationships in the inner model by following certain systematic steps (Hair, Hult, Ringle & Sarstedt, 2021). To begin with, it is necessary to assess the coefficient of determination (R^2), effect

size (f^2), and predictive power (Q^2Predict). The procedure for the structural model assessment is discussed in subsequent sections.

Coefficient of Determination (R^2)

Before examining the R^2, it is necessary to examine the inner model for collinearity issues if it does not compromise the results of the regression analysis. VIF values in Table 7 show that collinearity issues are absent since the VIFs are below 5 and 3 (Becker, Ringle, Sarstedt & Völckner, 2015). Due to the absence of collinearity issues, the R^2 of the endogenous variables were examined. The R^2 represents the combined effect of the exogenous variable on the endogenous variable (Hair et al., 2014). It is also seen as a measure of the model's explanatory power since it assesses the variance that is elucidated in each of the endogenous constructs (Hair et al., 2014; Shmueli & Koppius, 2011). R^2 values range between 0 and 1 and numbers close to 1 indicate that the exogenous construct significantly predicts the endogenous construct and satisfactory R^2 values ought to be above 0.1 (Hair et al., 2019).

In assessing the explanatory power of the model values of 0.25, 0.5, and 0.75 are considered weak, moderate, and substantial respectively (Hair, Ringle & Sarstedt, 2011). In the structural model, the endogenous variables include SCI, SCTR, and SCTB. The mediating variable (Supply Chain Integration) and the study's endogenous constructs R^2 values are presented in Table 10 are 0.500, 0.527, and 0.561 for SCI, SCTB, and SCTR, respectively.

Table 10: Coefficient of Determination (R^2)

	R-square	R-square adjusted
Supply Chain Integration	0.500	0.498
Supply Chain Traceability	0.527	0.523
Supply Chain Transparency	0.561	0.558

Source: Field survey (2024)

This means that 56.1% of the variation in SCI is accounted for by DTA. Moreover, 52.7% and 56.1% of the variation in SCTB and SCTR are accounted for by DTA and SCI, respectively. All the R^2 values presented in Table 10 are above 0.1, hence the model is said to have in-sample predictive power.

Predictive Power (Q^2 Predict)

Shmueli, Ray, Estrada and Chatla (2016) propose the PLS Predict method for examining the out-of-sample prediction power of a model using results from Q^2predict. This is because in-sample prediction techniques use a single (the same) sample in estimating the model as well as predicting results, hence increasing the likelihood of overprediction of the model's predictive ability (over-fitting problem) (Hair et al., 2020). PLS prediction produces MAE and RMSE values against which the key endogenous construct's Q^2predict is compared to its predictive relevance in the model (Hair et al., 2019).

MAE (mean absolute error) helps to examine the mean magnitude of errors in a combination of predictions, and it does not consider their direction. The MAE finds the mean of the complete variances that exist between the real observations and the estimates and their difference have the same magnitude (Shmueli et al., 2019). As compared to MAE, RMSE calculates the square root of the squares of the means of variances flanked by predicted and actual observations, hence it attaches greater magnitude to significant errors which may likely influence the results (Hair et al., 2019; Shmueli, Sarstedt, Hair, Cheah, Ting, Vaithilingam & Ringle (2019). Moreover, Hair et al. (2019) assert that the key endogenous construct should be considered when using the PLS Predict results to assess the predictive significance of the model.

The key endogenous construct for this study was Supply Chain Traceability (*SCTB)*. The model is said to have predictive power if the Q^2Predict values for the key endogenous variables are positive and significant (Hair et al., 2020; Shmueli et al., 2019). Since results in Table 11 reveal positive values for the Q^2Predict of the key endogenous constructs' indicators, this model can be concluded to have medium predictive power. As a guide, Shmueli et al. (2019) assert that when the majority of the indicators for the key endogenous construct have high prediction errors (that is if the MAE and RMSE of major indicators of the PLS process are higher than the LM), the model is said to have medium prediction power even though this prediction ability is low.

Table 11: Q^2 Predict Results

	Q^2 predict	PLS-SEM RMSE	LM RMSE	PLS-SEM MAE	LM MAE
SCTB1	0.137	0.712	0.716	0.447	0.466
SCTB3	0.040	0.832	0.831	0.617	0.626
SCTB4	0.117	0.785	0.804	0.532	0.547
SCTB5	0.194	0.683	0.684	0.563	0.542

Source: Field survey (2023)

Effect Size (f^2) Assessment

The effect size is used to assess changes in the R^2 when a particular construct is eliminated from the model and is represented by Cohen's (1988) f^2. In interpreting the f^2, values higher than 0.02, 0.15, and 0.35 are an indication of small, medium, and large effect sizes, respectively (Hair et al., 2019). The effect sizes of the constructs used in the study are presented in Table 12. The effect sizes presented show that DTA has a large (0.998) effect size on

SCI, while DTA has a small (0.008) effect on SCTB. Moreover, DTA has a small (0.120) effect size on SCTR.

Table 12: Effect Size (f^2)

Structural path	f^2 Effect size
Digital Technology Adoption -> Supply Chain Integration	0.998
Digital Technology Adoption -> Supply Chain Traceability	0.008
Digital Technology Adoption -> Supply Chain Transparency	0.120

Source: Field survey (2023)

Size and Significance of Structural Model Path Coefficients

The hypothesis of the study was examined by assessing the size and significance of the structural model using results from bootstrapping in Smart PLS 4. The path coefficient, significance levels (p values), and t-statistics were used as the criteria for determining the significance of the inner model. The t-statistics and the p-values should be greater or equal to, and less or equal to the chosen significance level respectively, that is the t-statistic should be greater or equal to 1.65, 1.96, and 2.57 with the p-values lying below or less than or equal to 10%, 5% and 1% confidence levels respectively (Acquah, 2020).

For this study, the standard where the t-statistic should be greater or equal to 1.96 or the p-value less or equal to 5% is used to determine the significant path coefficients amid the independent constructs and the dependent constructs. The structural coefficients' size and significance are arranged in Table 13. In the next sections, the size and significance of the structural path coefficients are shown by the objectives and the hypothesis.

Table 13: Path Coefficients Results

Paths	Path coefficient (β)	T statistics	P values	Decision rule
DTA -> SCI	0.707	15.229	0.000	H1(supported)
DTA -> SCTB	-0.092	1.052	0.146	H2 (not supported)
DTA -> SCTR	0.324	2.679	0.000	H3 (supported)
DTA -> SCI -> SCTR	0.342	3.650	0.000	H4 (supported)
DTA -> SCI -> SCTB	0.300	5.054	0.000	H5 (supported)

Source: Field survey (2023)

Discussion

Digital Technology Adoption (DTA) and Supply Chain Integration (SCI)

The goal of the first objective was to examine the impact of DTA and SCI. It was further hypothesised after an extensive literature review that Digital Technology Adoption positively influences Supply Chain Integration.

Results in Table 13 indicate that DTA has a significant positive relationship with SCI with β = 0.707, t-statistics = 15.229, and p-value = 0.000. The results are positive and significant because the path coefficient is positive, t – t-statistics exceed the threshold value of 1.96 and the p-value is less than 0.05. This leads to the refusal to reject the hypothesised relationship, hence supporting the assertion that DTA led to Ghana's Health Sector's adoption of SCI.

The results also imply that there is a high likelihood (70.7%) that when Ghana's Health Sector adopts digital technology, they will be able to incorporate lifecycle thinking into their activities and orient their management

and suppliers' activities towards SCI. This finding is supported by the NT and the RBT.

The NT posits the dynamics of inter-organisational relationships with a focus on human interactions and the development of trust through collaborative relationships and process exchanges. To access resources that are not their own, organisations must establish links. The resource-based theory also postulates that organisations possess distinctive resources which they can capitalise on to gain a competitive advantage. RBT examines efficiency-based variations in an organisation's performance based on its resources, which represent the strengths that help an organisation become competitive and aid in the implementation of stratagems to accomplish its vision, mission, and organisational goals (Porter, 1981).

Based on these theories, digital technology adoptions enhance the ability to engross SCI which is in line with studies by (Teece, 2018a; Khanagha et al., 2014; Bharadwaj et al., 2013). Also, technology adoption is a way of ensuring SC integration because it will enhance communication and information sharing among actors in the chain, and overall coordinations. Given that there are few empirical bases for the relationship between DTA and SCI, the theoretical stance for this study concludes that DTA significantly influences SCI in Ghana's Health Sector.

Digital Technology Adoption (DTA) and Supply Chain Transparency (SCTR)

The second objective examined the impact of DTA on SCTR. The hypothesised relationship from this objective emphasised that there is a significant and positive relationship amid DTA and SCTR. DTA had a

significant and positive impact on SCTR with β = 0.324, t-statistic = 2.679, and p value = 0.000. This outcome exceeds the expected threshold of t-statistic should be more than 1.96 and the p-value should be less than 0.05. The results lead to the affirmation of the hypothesised relationship that DTA has a significant and positive relationship with SCTR of Ghana's health sector.

DTA provides Ghana's Health Sector with a 32.4% likelihood of contributing to positive SCTR in their SC. DTA enables firms to develop SCTR competencies which is crucial to guarantee product authenticity and enhance product tracking (Kamble, Gunasekaran & Gawankar, 2020). The results of the study are also corroborated by (Cynthia, 2018; Hyla & Pejas, 2020; Kamble et al., 2020) whose findings indicated that though DT is still in its infancy due to daily advancements when adopted by Ghana's Health Sector may help handle the most difficult problems and maintain transparency in their business dealings with their suppliers and customers.

Digital Technology Adoption (DTA) and Supply Chain Traceability (SCTB)

The third objective examined the impact of DTA on SCTB. The hypothesis from this objective positioned that there is a significant and positive relationship amid DTA and SCTB. The verdicts of the study in Table 13 affirm the hypothesis that DTA does not have a significant and positive nexus with SCTB (β = -0.092, t-stats = 1.052, and p-value = 0.146). The findings do not support the hypothesis because it does not meet the acceptable threshold of positivity of β, t-statistics > 1.96, and p-value <0.05. The findings provide a clear indication that the adoption of Digital Technology affords Ghana's Health Sector a -9.2% decrease in SCTB concerning their activities.

This means that when Ghana's Health Sector considers the adoption of digital technology though will improve their supply chain transparency but does not have any direct positive effect on their SCTB. This is differing to studies by (Ding, Cruz, Green & Bauman, 2020; Lambourdiere & Corbin, 2020) who asserted that digital technology adoption affects an organisation's supply chain which enhances traceability.

Digital Technology Adoption (DTA), Supply Chain Integration (SCI), and Supply Chain Transparency (SCTR)

The hypothesis (H4) was to assess the extent of the influence of SCI in the relationship amid DTA and SCTR. The hypothesis from this objective followed that SCI positively and significantly mediates the relationship amid DTA and SCTR. Results from the indirect relationship in Table 13 support the hypothesis since there is a positive and significant mediated effect ($\beta = 0.342$, t-statistics = 3.650 and p-value = 0.000) by SCI in the relationship between DTA and SCTR. The direct effect amid DTA and SCTR was significant ($\beta = 0.324$, t statistic = 2.679, and p-value = 0.000), meaning that even though SCI mediates the relationship between DTA and SCTR, the mediation that exists is a partial mediation.

Implying that on its own, DTA can contribute to SCTR even if the health facilities do not implement SCI. In conclusion, DTA could suffice for the achievement of SCTR needless SCI. The findings also indicate that DTA helps Ghana's Health Sector to integrate their SC which in turn enables them to achieve positive SCTR. The findings corroborate with (Hyla & Pejas, 2020; Kamble et al., 2020) who asserted that SCI is essential in ensuring SCTR in an organisation.

Digital Technology Adoption (DTA), Supply Chain Integration (SCI) and Supply Chain Traceability (SCTB)

The hypothesis (H5) aimed to assess the extent of influence of SCI Integration in the relationship between DTA and SCTB. The hypothesis from this objective followed that SCI positively and significantly mediates the relationship amid DTA and SCTB. Results from the indirect relationship in Table 13 support the hypothesis since there is a positive and significant mediated effect (β = 0.300, t-statistics = 5.054, and p-value = 0.000) by SCI in the relationship between DTA and SCTB. The direct effect amid DTA and SCTB was not significant (β = -0.092, t statistic = 1.052, and p-value = 0.146), meaning that even though SCI mediates the relationship between DTA and SCTB, the mediation that exists is a partial mediation.

This means that on its own, DTA does not contribute to supply chain traceability if the health facilities do not implement SCI. In conclusion, DTA could suffice for the achievement of SCTR through SCI. The study indicated that DTA helps Ghana's Health Sector to integrate its SC which in turn will lead to achieving positive SCTB outcomes. The results of the study are also corroborated by (Garcia-Torres et al. (2019, p. 87; Shou, Zhao, Dai, & Xu, 2021) who proposed contributions of SCI to DTA and SCTB from ensuring acquiescence and security to reducing scandals and recalls, as well as improving flexibility and agility.

Chapter Summary

Presented in this chapter were the results from data analysis accompanied by a discussion of the findings. Data was processed and analysed using SPSS and Smart PLS software. The main variables of the study were

DTA, SCI, SCTR, and SCTB in Ghana's health sector. The results showed that DTA independently does not contribute to positive and significant results in the SCTB of Ghana's health sector. Moreover, the results indicate that SCI arbitrates the relationship amid DTA and SCTR, DTA, and SCTB even though the mediation is partial.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This study aimed to examine the influence of supply chain integration (SCI) on digital technology adoption (DTA), supply chain transparency (SCTR), and supply chain traceability (SCTB) in Ghana's Health Sector. This study examined the direct and indirect effects of SCI on DTA, SCTR, and SCTB. The previous section provided results as well as discussions from data that was collected from the Ghana Health Service. The study's summary, results, and suggestions are given in this last chapter. These subheadings were examined in light of the findings and conversations, as well as the conclusions made to formulate policy and provide guidance to upcoming researchers in related fields.

Summary

Given the objectives, 5 hypotheses were developed and subsequently tested to achieve the objectives of the study. The study adopted a quantitative approach based on the post-positivism paradigm, structured questionnaires were developed for data to be gathered from 618 health facilities in the Central Region, Ghana. Using the convenient sampling technique for data collection, 357 usable responses were utilised for the study, thereby exceeding the minimum sample size of 243. The data were processed and analysed with IBM SPSS version 27 and SmartPLS version 4 software.

Concerning the first objective the findings proved that DTA was positively and significantly related to SCI. The results were in contrast with earlier studies which found DTA as an important tool to enhance the SCI in Ghana's Health Sector. This means that Ghana's Health Sector ought to Adopt digital technology to enhance and integrate its supply chain activities. Digital Technology enables the integration of firms or organisations supply chain systems.

The second hypothesis was developed from the second objective. The hypothesis asserted that there is a positive and significant relationship amid DTA and SCTR. The findings of the study corroborated this hypothesis. This means that when Ghana's Health Sector adopts digital technology into their health facilities, it will enhance SCTR and they will be able to reduce any unethical dealings by the procurement practitioners.

The third hypothesis from the third objective asserted that there is no significant positive relationship amid DTA and SCTB. The findings from the study were contrary to the hypothesis. This means that DTA does not have a positive and significant influence on SCTB asserting that, SCTB in Ghana's health sector is not a result of DTA.

The fourth objective examined the mediating role of SCI in the relationship amid DTA and SCTR, DTA and SCTB in Ghana's Health Sector. Two hypotheses were developed from the objective. The first hypothesis from this objective asserted that SCI significantly and positively impacts the relationship amid DTA and SCTR. The findings showed that the mediated relationship was positive and significant even though the mediation was

partial. This indicates that for DTA to be able to contribute positively and significantly to SCTR, there is a need for SCI in Ghana's health sector.

Moreover, the last hypothesis from this objective posits that SCI positively and significantly mediates the relationship amid DTA and SCTB. The findings from the study postulated that SCI had a positive and significant influence as a mediator between DTA and SCTB. This implies that for DTA in Ghana's Health Sector to contribute positively and significantly to SCTB, there should be SCI as a mediator since there was no direct effect of DTA and SCTB from the results of the study.

Conclusions

The study examined DTA, SCI, SCTR, and SCTB in the Ghana's Health Sector. The study has conclusively established that DTA and SCI enable the achievement of SCTR and SCTB in Ghana's health sector. In line with the objective of the study, the following conclusions are made based on the study's findings.

Concerning the first objective, the results show that DTA enables SCI in health facilities. The result of the DTA model implies that the health facilities being able to adopt digital technology will ease the manual processes of carrying out their activities by integrating the supply chain system into a common platform to enhance the smooth running of their day-to-day activities. Therefore, to ensure SCI, Ghana's Health Sector is supposed to adopt digital technology into its operations.

Results from the findings for the second objective mean that DTA was crucial to achieving SCTR in health facilities. These findings imply that DTA by Ghana's Health Sector would contribute to SCTR at the health facilities

activities. Findings for the third objective mean that DTA was crucial to achieving SCTB in health facilities though the mediation was partial. These findings imply that DTA by Ghana's health sector would contribute to SCTB at the health facilities activities.

The final objective findings espoused that SCI significantly mediates the relationship amid DTA and SCTR in Ghana's Health Sector. Also, findings for the last hypotheses under the last objective showed that SCI significantly mediates the relationship between DTA and SCTB. This indicates that SCI leads to SCTB in Ghana's health sector when they adopt digital technology in the operations and in doing so, it will enable easy integration of their SC. In summary, DTA and SCI are critical elements for SCTR and SCTB in Ghana's Health Sector and help improve efficiency, reduced stockouts and better cost control as well.

Recommendation

The study's conclusions and findings led to the formulation of the following recommendations;

The study offers some recommendations based on the findings presented. First of all, Ghana's health sector should adopt digital technology which would enable them to integrate the supply chain at their various health facilities which would enable SCTR and SCTB as well.

Management of Ghana's Health Sector must be committed to ensuring that they provide resources that would help facilitate digital technology adoption as this would help fast track and ensure tracking of goods that come in and out of the facilities. These resources provided by the management would enable the facilities in remote areas to facilitate the smooth adoption of digital

technology to reduce the rate at which they would have to wait for officers from districts before they can place orders for medical supplies.

Finally, the Ministry of Health through the minister can lobby for an increment in the annual budget to be able to afford the adoption of digital technology which would enable more of the health facilities enrolled in the system which would enable bring all health facilities unto a common platform by integrating their supply chain in ensuring transparency and traceability.

Suggestions for Further Studies

The study examined DTA, SCI, SCTR, and SCTB in the Ghana's Health Sector. The study focused on only procurement practitioners, anyone in charge of procurement activities for the health facilities in the Central Region. Given that the ability to adopt digital technology could be influenced by the size of the organisation, especially some private health facilities. Further research should identify a suitable metric against which they would investigate the difference in the ability to adopt digital technology by health facilities.

Moreover, the study was conducted in health facilities in the Central Region, hence the generalisability of the findings across the country may not be possible, hence further research should consider the health facilities in the country so that the results can be generalised for a developing country.

Finally, the use of a structured questionnaire for this study limited the responses of respondents only to the questions that were asked in the questionnaire. Respondents were not able to provide details on the extent of adoption and integration of digital technology and supply chain. Therefore, further research should utilise a mixed-method means of collecting data to make exhaustive conclusions on the situation in Ghana.

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APPENDICES

APPENDIX A

Dear Sir/Madam

The questionnaire is to solicit information on the **"Digital Technology Adoption, Supply Chain Integration, and Supply Chain Transparency in Ghana's Health Sector."** The researcher is a student at the School of Business, Department of Marketing and Supply Chain Management, University of Cape Coast Ghana. You are hereby invited to share your views on the issue under investigation. The responses would be used for purely academic purposes and hence, your confidentiality is greatly assured. Thanks for your time and accepting to participate in the study.

SECTION A:

DEMOGRAPHICS

Gender of respondents

Male [ ] Female [ ]

What is your position in the entity?

Procurement manager [ ] Procurement officer [ ] Stores keeper [ ]

Years of experience working in public procurement

0-10 Years [ ] 10-20 Years [ ] 20-30 Years [ ] Above 30 Years [ ]

Please specify your educational qualification

Diploma [ ] Bachelor's degree [ ] Master's degree [ ] Doctorate [ ] Others [ ]

Which category does your Entity belong to?

Clinics [ ] CHPS [ ] Hospitals [ ] Polyclinics [ ] Health Center [ ]

SECTION B: DIGITAL TECHNOLOGY ADOPTION IN THE GHANA'S HEALTH SECTOR.

Please indicate the degree of your agreement with the following statements by ticking or clicking (√) the appropriate number.

Instructions: For the following statements indicate your opinion for the following statement by ticking the right number in the right column under the 5- 5-point Likert scale where: 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, and 5= Strongly Agree

"Digital Technology Adoption"						
Statements						
DTA1	"Our healthcare facility is digitally connected with smart devices and has a database"					
DTA2	"Our healthcare facilities benefit from various digital technologies (LHIMS)"					
DTA3	"Our healthcare facility can work digitally and have a creative design basis"					
DTA4	"Our healthcare facility can interact digitally in activities for our employees, such as training, co-processing, etc"					
DTA5	"We have a stable procurement through the network with our major supplier"					
DTA6	"There is a high level of strategic partnership with suppliers using digital technology (LHIMS)"					

SECTION C: SUPPLY CHAIN INTEGRATION.

Kindly indicate the level of degree of your agreement with the following statement by ticking or clicking (√) the appropriate number

Instructions: For the following statements, indicate your opinion by ticking the right number in the right column under the 5- 5-point Likert scale where: 1= S D, 2= D, 3= N, 4= A, and 5= S A

"Supply Chain Integration"						
Statements						
SCI 1	"Our healthcare facility can exchange information with suppliers through IT (LHIMS)"					
SCI 2	"The high level of a strategic partnership with suppliers is due to our integration processes"					
SCI 3	"There is a high participation level of suppliers in the process of procurement and design stage due to effective systems in place"					
SCI 4	"There is an establishment of a quick ordering system at our healthcare facility with our suppliers on a common platform (ERP)"					
SCI 5	"Our major supplier shares their production capacity with us through our digital platform."					
SCI 6	"Data integration among internal functions at our healthcare facility through a network is effective and high"					

SECTION D: SUPPLY CHAIN TRANSPARENCY.

Kindly click or select the relevant number to indicate how much you agree with the following statement (√).

Instructions: For the following statements, indicate your opinion by ticking the right number in the right column under the 5- 5-point Likert scale where: 1= S D, 2= D, 3= N, 4= A, and 5= S A

"Supply Chain Transparency"						
Statements						
SCTR1	"Through digital technology, our healthcare facility can disclose information needed to its supply chain members"					
SCTR 2	"Digital technology adoption and supply chain integration helps ensure comprehensive information to our suppliers through and after tendering processes"					
SCTR 3	"Digital technology adoption and supply chain integration assures the disclosed information"					
SCTR 4	"Digital technology adoption and supply chain integration have enhanced quality service delivery through transparent evaluation and awarding of the contract to our suppliers''					
SCTR 5	"We have accurate and transparent inventory management which enables us to meet our daily targets set through the adoption of digital technology''					
SCTR 6	"The Lightwave Health Information Management System (LHIMS) promotes openness of the organisation processes, like hiring & promotion''					
SCTR 7	"The Lightwave Health Information Management System (LHIMS) allows us to disseminate information on the organisation's performance''					

SECTION E: SUPPLY CHAIN TRACEABILITY

Kindly click or select the relevant number to indicate how much you agree with the following statement (√).

Instructions: For the following statements, indicate your opinion by ticking the right number in the right column under the 5- 5-point Likert scale where: 1= S D, 2= D, 3= N, 4= A, and 5= S A

"Supply Chain Traceability"						
Statements						
SCTB1	"Digital technology adoption and supply chain integration enables our healthcare facility in tracing the origins of raw materials"					
SCTB2	"Digital technology adoption and supply chain integration in our healthcare facility help in tracing the chemicals management of a product from our suppliers"					
SCTB3	"Digital technology adoption enhances tracking Supply Chain environmental performance of our suppliers"					
SCTB4	"Our healthcare facility can track the Supply Chain production processes of our key suppliers"					
SCTB5	"The adoption of digital technology enables us to track missing information or materials easily"					
SCTB6	"The Lightwave Health Information Management System (LHIMS) allows us to track our daily activities"					
SCTB7	"Supply chain integration through digital technology adoption enhances real-time searching of logistics-related operating data which enhances transparency and traceability"					

THANK YOU.