Understanding the supply chain integration - supply chain sustainability relationship: a study of the pharmaceutical industry in the UK and Ghana

By

Frank Donkor

A thesis submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy

Submission date: September 2020

Word count: 79122

Ph.D. Management Science
Kent Business School

University of Kent-UK

DECLARATION

I confirm the work submitted is entirely my own and have fully referenced my sources as appropriate.

I confirm that information from this thesis was used to draft two conference papers that were presented during the European Operations Management Association (EurOMA) 2020 conference. Information was taken from each of the chapters in this thesis.

ACKNOWLEDGEMENT

To God be the Glory!!

To my supervisors Professor Thanos Papadopoulos to whom I much owe, for being an excellent supervisor through his brilliant discussions, insightful and constructive criticism, and encouragement. His vast wealth of academic experience I will always appreciate; and Dr. Virginia Spiegler for her excellent, detailed, truthful, and intelligent comments which have supported me enormously throughout this journey. I am grateful to have you both as mentors.

To my friend Jason Anquandah, you are indeed a great blessing and I am truly grateful for all the support. I appreciate the entire Donkor family for being my inspiration and drive. But most especially to my brother Isaac Donkor, and sister Gladys Donkor, for making this a reality for me. I dedicate this thesis to you both.

ABSTRACT

Purpose- The purpose of this thesis is to identify, propose, and test a framework that provides insights into the internal and external factors which enhance or hinder supply chain sustainability through supply chain integration (SCI).

Design/methodology/approach- The conceptual framework was noted/developed after the review on the main constructs SCI, supply chain sustainability, and external uncertainty (EU). From the conceptual framework, it was noted that this thesis can explore the direct impact of SCI on supply chain sustainability, and also how the aforementioned impact is moderated by EU. Based on this assertion first, empirical data were obtained through interviews with managers in 18 leading pharmaceutical companies and national pharmaceutical institutions and regulators in Ghana and the UK. Observations and secondary data were also used. The conceptual framework was then reformed to include the additional moderators' product innovation, resource, and leadership style, and the mediator patient satisfaction. Second, survey data were collected from 231 pharmaceutical companies in both the UK and Ghana which were used to test the reformed proposed framework.

Findings- All three dimensions of supply chain sustainability can be positively impacted through SCI. The SCI-supply chain sustainability relationship is moderated by different levels of EU, the amount of resources available to firms, the type of leadership style adopted by firms, and the rate at which a firm engages in product innovation. The extent to which a firm satisfies its customers, through its products and services mediates the SCI-supply chain sustainability relationship. Hence, the proposed framework shows that the internal and external contextual factors (IECF's): EU, patient satisfaction, leadership style, product innovation, and resource constraint, must be collectively considered as they enhance or hinder supply chain sustainability through SCI.

Practical implications- To achieve supply chain sustainability through SCI, practitioners should first operationalise and strengthen the collaboration of activities and flow of adequate and timely information among internal functions before investing in external integration. This thesis provides practitioners with guidance on how to achieve supply chain sustainability whilst increasing patient satisfaction and managing the effect different levels of EU, autocratic and non-autocratic leadership style, high and low product innovation, and resource constraint and availability have on supply chain activities.

Originality/value- This thesis, to the best of the author's knowledge, is the first to propose a framework that adds to the literature on how SCI can be used to simultaneously impact the three dimensions of supply chain sustainability given different EU's. The proposed framework considers the IECF's: patient satisfaction, leadership style, product innovation, and resource constraint as factors that need to be collectively considered to achieve supply chain sustainability.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

AI	Active Ingredient
ABPI	Association of the British Pharmaceutical Industry
AN_TRN	Annual turnover
CI	Customer integration
CLF	Common latent factor
COMP_TYP	Company type
CR	Critical realism
EFPIA	European Federation of Pharmaceutical Industries and Association
ENV	Environmental performance
EU	External uncertainty
FIN	Financial performance
GDP	Good Distribution Practices
GMP	Good Manufacturing Practices
GrSCM	Green supply chain management
IECF's	Internal and external contextual factors
II	Internal integration
IM	Inventory Management
LEAD	Leadership style
MHRA	Medicines and Healthcare products Regulatory Agency
NPA	National Pharmacy Association
NPC	National Pharmacy Council
ns	Not significant/insignificant
OPER	Operational performance
PA_SAT / SATS	Patient satisfaction
PERF	Performance
PMAG	Pharmaceutical Manufacturers Association of Ghana
PROD	Product innovation
RES	Resource constraint
RQ	Research question
SCI	Supply chain integration
SCS	Supply chain sustainability
SI	Supplier integration
SOC	Social performance
UKGOV	United Kingdom Government

CHAPTER 1

INTRODUCTION

1.0 Research background

Over the years, there has been growing recognition regarding the important role supply chain integration (SCI) plays in improving performance. Many have supported the assertion that the adoption and/or an increase in SCI leads to better performance (Danese et al. 2020; Flynn et al. 2010; Munir et al. 2020; Zhao et al. 2020). For example, the 2013 Global Supply Chain Survey report conducted by PwC (2013) revealed that the important value drivers; delivery (98%), cost (93%), flexibility and responsiveness (74%), in the industrial product sector are maximised by the companies through integration with key suppliers and customers, and other supply chain stakeholders. Such collaboration was also known to enable the companies tailor their output to meet the exact needs of customers whilst focusing on operating fast and efficient supply chains. Besides, as firms are now operating in a more global, competitive and highly unpredictable external environment (EU) (Danese et al. 2020; Fynes et al. 2004; Wiengarten et al. 2014), integrating activities of internal functions (II) and with suppliers (SI) and customers (CI) have been mentioned as an effective/efficient way to manage these complexities (Danese et al. 2020; Flynn et al. 2010; Wiengarten et al. 2014; Zhao et al. 2020). Aside from the pressure to manage these external uncertainties, companies are faced with a high stakeholder (especially customers) demand for not only economically competitive products but products that are environmentally friendly and produced under ethical conditions (Wolf 2011). For example, a study by "Cone communications and Ebiquity" showed that globally, 9 in 10 consumers' demand from firms to not only make revenue but contribute to solving environmental and social issues (Cone 2015). This makes the study of SCI to improve performance, whilst managing the impact of EU and meeting stakeholder needs extremely important.

The study of the SCI-performance relationship is important as today international trade and globalisation have widened the general market reachable by companies. Although this has created opportunities for companies to capture new trading markets and improve upon their economic performance, there are complex uncertainties (e.g. market, price, technology, competitors, and demand and supply uncertainties) exposed to these companies (Danese et

al. 2020; Fynes et al. 2004; Ragatz et al. 2002; Wong et al. 2011). Managing these complexities is very important especially for industries that produce and supply critical/essential products like that of the pharmaceutical industry. For example, presently the pharmaceutical industry is highly expected to consistently produce and supply essential drugs to all economies to enable fight the uncertain outbreak of the COVID-19 pandemic. Such unpredictability and complexities place extreme pressure on the pharmaceutical supply chains in both developed and developing countries to effectively and efficiently integrate their supply chain activities to enable rapid production (under ethical conditions) of quality, cost-effective, and environmentally friendly products to meet the high uncertain demands. The pharmaceutical companies are to ensure that manufactured products reach the patients at the right place and time and in the right quantity to avoid the adverse effect of drug unavailability (Rossetti et al. 2011; Schneider et al. 2010; Shah 2004). Some scholars have mentioned that for companies to reduce/mitigate the negative impact of EU (Wong et al. 2011) on essential supply chains, strong integration of internal activities and with customers and suppliers is imperative (Wiengarten et al. 2019). Based on these arguments, it is important to investigate the relationship between SCI and supply chain sustainability in the pharmaceutical industry.

1.1 Research context

The purpose of keeping the collaboration between processes, as the flow of material and information moves towards the customer is to optimise all activities across the supply chain. SCI is known in the literature as the extent to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages intra-organisation and inter-organisation activities (Flynn et al. 2010; Frohlich and Westbrook 2001). The majority of researchers have mentioned and supported the importance of using SCI to achieve improvement in several performance measures (Wiengarten et al. 2019). Examples are on: quality and cost (Schoenherr and Swink 2012), flexibility (Wong et al. 2011), and delivery (Wiengarten et al. 2019). However, less research has been done to explore and understand how companies can effectively and efficiently use SCI to simultaneously impact the economic, social, and environmental dimensions of sustainability (Ahi and Searcy 2013; Asif et al. 2013; Gimenez et al. 2012) to achieve truly sustainable supply chains. This indicates that despite increasing interest in SCI, in-depth understanding of how companies can effectively and efficiently generate or transform generated resources through SCI, to

positively impact the economic performance with no negative impact on social and environmental performance within/across the supply chain (truly sustainable supply chains) (Pagell and Shevchenko 2014) is less explored.

Researchers have viewed SCI from different perspectives. Thus from the external (suppliers and customers) and the focal firm- internal integration perspective (Flynn et al. 2010; Narasimhan and Kim 2002; Zhao et al. 2020), and also from a unidimensional point of view (Rosenzweig et al. 2003; Huang et al. 2014). Several researchers argue that considering both external and internal integration is important (Flynn et al. 2010; Weingarten et al. 2014) as the literature has shown extensively that both play different roles and affect performance differently. Despite this importance, many studies (Frohlich and Westbrook 2001; Schoenherr and Swink 2012; Weingarten et al. 2019) that have contributed to the SCI literature ignored arguably the most critical SCI dimension, thus II (Flynn et al. 2010; Han and Huo 2020; Zhao et al. 2020). This has also contributed to the inconsistent positive and negative/insignificant SCI-performance literature results. Additionally, most of these aforementioned SCI studies also focus on the economic performance only (Ahi and Searcy 2013; Asif et al. 2013). Aside from this study taking into consideration all the SCI dimensions (II, SI, and CI), the study importantly extends the performance measures by inculcating the equally important social and environmental performance.

Supply chain sustainability aims to incorporate and positively impact the social, economic, and environmental dimensions whilst truly sustainable supply chains further seek to achieve supply chain sustainability but with no negative impact on social and environmental systems (Pagell and Shevchenko 2014) within/across the supply chain. These definitions from the literature place critical importance in understanding how companies effectively/efficiently create, extend or modify resources (Beske et al. 2014; Helfat et al. 2007) generated through SCI to impact supply chain sustainability, of which this study explores.

A number of researchers argue that to achieve supply chain sustainability all the key stakeholders within/across the supply chain must be considered (Gimenez et al. 2012; Wolf 2011). Despite this significance, most SCI-performance studies did not consider all the key stakeholders within/across the supply chain, but rather focused on the focal firms (Danese and Romano 2011; Flynn et al. 2010; Yu et al. 2017) and economic dimension (Schoenherr and Swink 2012; Vanpoucke et al. 2014) only while ignoring the other important social and

environmental performance. Thus, little research has been done to explore and understand how companies can effectively and efficiently operationalise SCI to simultaneously impact the economic, social and environmental dimensions of sustainability (Ahi and Searcy 2013; Asif et al. 2013) whilst considering all the key stakeholders within/across the supply chain (Gimenez et al. 2012; Wolf 2011).

Sousa and Vous (2008) emphatically indicated that as the value of SCI on firm performance is known, it is more appropriate to have a shift in understanding what internal and external contextual conditions makes SCI most effective (Danese et al. 2020). Exploring and understanding such context is very important as although the majority of studies found a positive SCI-performance relationship (Narasimhan et al. 2010; Wiengarten et al. 2019) other researchers also found a negative/insignificant relationship (Flynn et al. 2010; Koufteros et al. 2005). Despite these result inconsistencies in the SCI literature which indicates the presence of contextual factors, little effort has been made to identify and critically understand the key contextual factors that moderate the SCI-performance relationship (Sousa and Vous 2008; Wong et al. 2011). Based on this necessity, it is important to take into consideration the influence of EU exposed to firms on the SCI-supply chain sustainability relationship.

1.2 Research justification and gaps

Based on the raised arguments/problems in the previous sections, this thesis justifies that it is important to consider the social and environmental performance in addition to the economic dimension due to high; (1) stakeholder pressure for companies to consider employee health and safety, and the life of the external environment (Gimenez et al. 2012) (2) demand for companies to account for their effective/efficient use of resources (Gimenez et al. 2012) (3) demand for companies to achieve truly sustainable supply chains by improving the economic performance, with no negative impact on social and environmental systems (Pagell and Shevchenko 2014) within/across the supply chain. This thesis further justifies that understanding the context in which the SCI-performance relationship is most effective is important as companies are being exposed to different levels of EU, and supply chain complexities through globalisation and international trade (Wiengarten et al. 2014). Based on these justifications the two main gaps identified are; (1) less research has been undertaken to explore and understand how companies can effectively and efficiently use SCI to simultaneously impact the economic, social, and environmental dimensions of sustainability

(Ahi and Searcy 2013; Asif et al. 2013; Gimenez et al. 2012) to achieve truly sustainable supply chains (2) little research has been undertaken to explore and understand the contextual factors (both internal and external) and conditions in which SCI-performance relationship is most effective (Sousa and Vous 2008; Wong et al. 2011).

1.3 Research aims and objectives

Based on the aforementioned gaps, this thesis aims to identify, propose, and test a framework that provides insights into the internal and external factors which enhance or hinder supply chain sustainability through SCI. Hence, the objectives are to;

(1) Analyse the impact of SCI on supply chain sustainability.
(2) Identify and analyse the internal and external factors that enhance or hinder supply chain sustainability through SCI.

With reference to the two main objectives, the study will first use an exploratory qualitative approach (Yin 2003) to identify and propose a framework that provides insight into the internal and external factors which enhance or hinder supply chain sustainability through SCI. Drawing from the qualitative study results the quantitative study will be used to statistically build and test a model that provides insight into the impact of SCI on supply chain sustainability whilst considering the influence of EU on the aforementioned relationship.

1.4 Research questions

Drawing from the stated aims and objectives, the main research questions (RQ) for the study are;

(1) What is the impact of SCI on supply chain sustainability?
(2) What internal and external factors enhance or hinder supply chain sustainability through SCI?

1.5 Theoretical foundations

To answer RQ 1 and 2, this thesis uses dynamic capability, stakeholder, and contingency theory. Firstly, the dynamic capability theory is defined as the capacity of a firm to create,

modify or extend its resources to attain a high economic value (Beske et al. 2014; Helfat et al. 2007). This thesis will apply the dynamic capability theory by exploring how pharmaceutical companies create/modify/extend resources through effective/efficient SCI to impact supply chain sustainability. Secondly, the stakeholder theory is defined as the combination of a firm fulfilling its business goals toward its stakeholders whilst maintaining the morals and values in managing the organisation (Friedman and Miles 2002). This thesis will apply the stakeholder theory by considering manufacturers, wholesalers, distributors, retailers, regulators, and national trading associations in the pharmaceutical supply chain in studying the relationship between SCI-supply chain sustainability. Lastly, the Contingency theory which suggests that there should be a fit between a firm's internal business structures and its external environment (Donaldson 2001), this study will apply this theory by (1) exploring how EU affects the SCI-supply chain sustainability relationship (2) considering and comparing how the SCI-supply chain sustainability relationship, and the EU effect on the SCI-supply chain sustainability relationship differ among the Ghana and the UK pharmaceutical companies.

1.6 Methodology

With reference to the raised gaps (1.2), this study adopts a mixed-method approach. For the qualitative study, this study uses semi-structured interviews to collect empirical data from 18 leading pharmaceutical companies, national pharmaceutical institutions, and regulators in Ghana and the UK. Whilst for the quantitative study, survey data will be collected from pharmaceutical companies in both Ghana and the UK.

The pharmaceutical industry in both the UK and Ghana house many giant leading pharmaceutical companies known for their large market sizes, financial contribution to the global economy, and vital supply chain activities (Christel 2018; Ellis 2019; Sulaiman and Boachie-Danquah 2017) of producing and supplying essential drugs to medical stores, health centres and households globally. Examples of such giant pharmaceutical companies are GlaxoSmithKline (GSK) in the UK and Ernest chemist in Ghana. The pharmaceutical industry is characterised by globalised companies, different levels of uncertainty, high cost, complex regulations, complex supply chains, and long research duration (Breen 2008; Yadav and Smith 2012) which affects the effectiveness and efficiency of supply chains. The aforementioned characteristics are strong but vary in terms of level and competitiveness in

the UK and Ghana setting. Hence, aside from Ghana and the UK capturing the supply chain activities of leading pharmaceutical companies in the developed and developing country perspective, it also enables the study to capture and examine the moderating effect of different levels of EU on the relationship between SCI and supply chain sustainability similarly and differently.

1.7 Expected contribution

1.7.1 Theoretical contribution

With the qualitative study, this research will serve as a precursor to identifying and understanding in-depth the different factors affecting supply chains' sustainability performance through SCI within the pharmaceutical industry context. Whilst from the quantitative study point, the study will further demonstrate statistically the simultaneous impact of SCI on the three dimensions of supply chain sustainability. Taking into consideration the different levels of EU exposed to pharmaceutical companies in a developed (UK) and developing (Ghana) country perspective, the study will demonstrate how these different levels of EU affect the operationalisation of SCI to achieve supply chain sustainability similarly and differently. Drawing from the dynamic capability, contingency, and stakeholder theory, the study will propose a framework that provides insight into the internal and external factors which enhance or impede supply chain sustainability through SCI. The framework will inform theory and can be used to formulate and test hypotheses in future research.

1.7.2 Practical implications

For practitioners, the model to be proposed and tested will guide managers to know-how, and to what extent they should integrate their internal functions, and with suppliers and customers to positively impact their social, economic, and environmental performance to achieve truly sustainable supply chains (Pagell and Shevchenko 2014). Exploring the moderating role of EU on the relationship between SCI and supply chain sustainability will also serve as a guide for practitioners to identify the exact uncertainties they are exposed to, and how to mitigate the negative effects of EU on their SCI operationalisation to impact the economic, social and environmental performance.

1.8 Thesis structure

The structure of the thesis has been developed based on nine chapters (Figure 1.1);

(1) Introduction; This chapter details the background of the research which entails SCI, supply chain sustainability, and EU. The chapter further justifies the research and gaps, details the research aim and objectives, research questions, theory, methodology, expected contribution, and the structure of the thesis.

(2) Review on SCI, EU, and supply chain sustainability; This chapter provides an in-depth review of the key constructs SCI, supply chain sustainability, and EU and their related issues/gaps.

(3) Overview of the pharmaceutical industry; This chapter reviews the pharmaceutical supply chain and structure with a particular focus on the UK (developed country) and Ghana (developing country).

(4) Theoretical framework; This chapter presents the theoretical background for the research and provides the posited hypotheses. Based on these the study provides the theoretical framework.

(5) Methodology; This chapter details the philosophical assumptions for the study. The chapter further discusses the research method, research design, sample size, data collection, and analysis for the study.

(6) Interview findings and analysis; This chapter presents the interview results and analysis.

(7) Model reformulation and preliminary data analysis; This chapter details the justification for the updated conceptual framework developed after the qualitative study (chapter 6), and all the preliminary analysis for the collected survey data.

(8) Model testing; This chapter details the statistical testing of the proposed framework after the qualitative study using the preliminary analysed survey data.

(9) Discussion of findings; This chapter provides a detailed discussion of the qualitative and quantitative results.

(10) Conclusion; This chapter provides an overview of the thesis and details the theoretical and practical implications of the study.

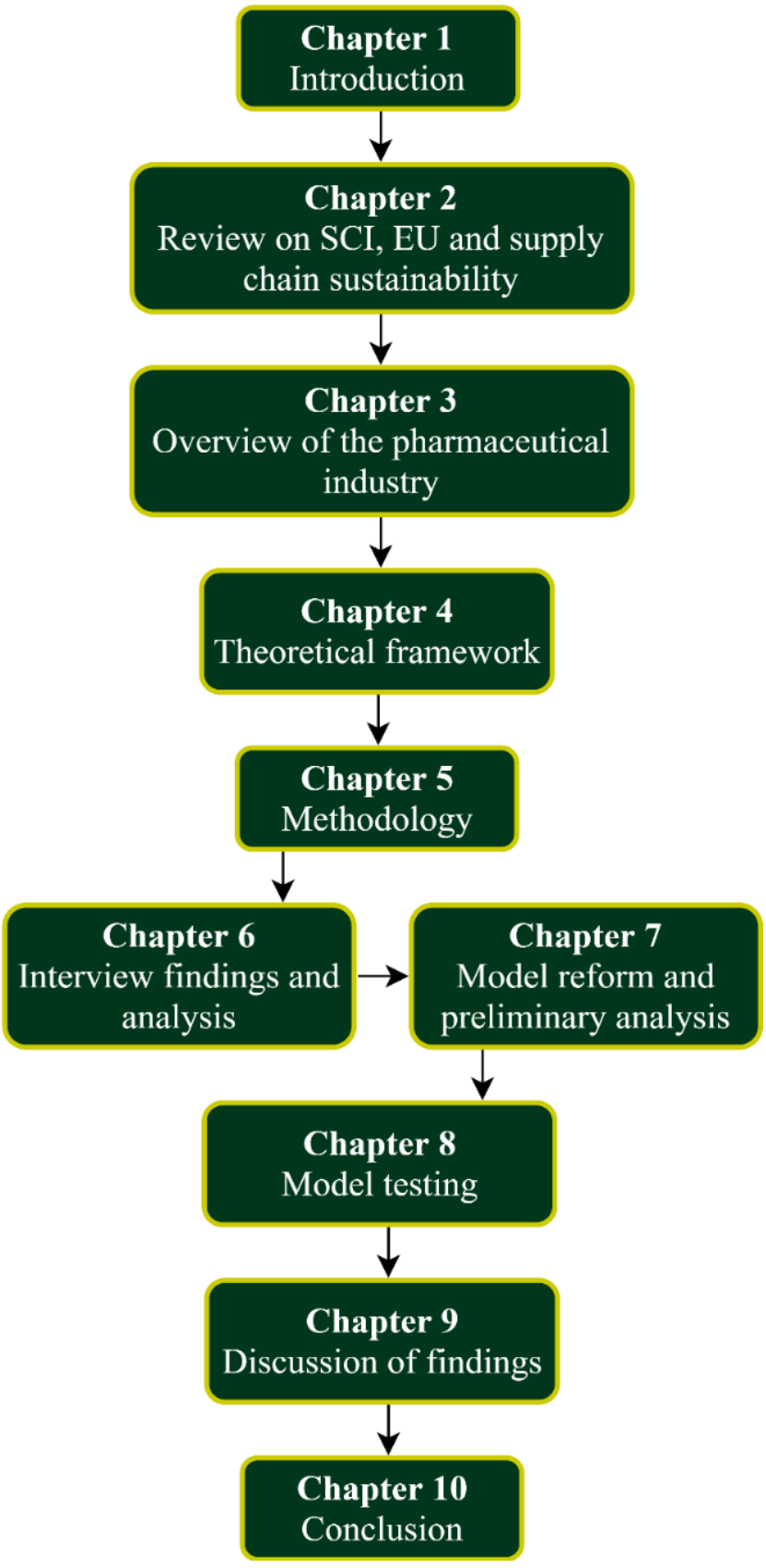


Figure 1.1: **Thesis structure**

CHAPTER 2

REVIEW ON SUPPLY CHAIN INTEGRATION, EXTERNAL UNCERTAINTY, AND SUPPLY CHAIN SUSTAINABILITY

2.0 Chapter overview

This chapter gives an in-depth review of supply chain integration (SCI) and its related issues, external uncertainty (EU), sustainability, and supply chain sustainability. Based on these in-depth reviews, the main gaps and research questions are presented as well as the development of the conceptual framework.

2.1 Supply chain integration

Integration is defined "as to combine one thing with another to form a whole and or bring people or groups with particular characteristics or needs into equal participation in or membership of a social group or institution" (Oxford dictionary 2017). In applying this fundamental definition of integration to the context of supply chain management (SCM), the literature defines SCI as the extent to which a firm is strategically interconnected and aligned with it partners in the supply chain (Flynn et al. 2010; Jayaram et al. 2010; Wong et al. 2011; Yu et al. 2019). Flynn et al. (2010) further defined SCI as the extent to which a firm strategically collaborates with its supply chain partners and collaboratively manages intra-organisation and inter-organisational activities (Rosenzweig et al. 2003). Flynn et al. (2010) definition of SCI gave detailed insight on achieving collaboration both within and outside (supply chain players) the organisation. More importantly, the goal of integration is to create and coordinate processes, flow of products and services seamlessly and competitively within and across the chain to provide maximum value to end consumers at low cost and high speed (Bowersox et al. 1999; Flynn et al. 2010; Frohlich and Westbrook 2001). Thus, the logic of keeping the collaboration between processes, as the flow of material and information moves towards the customer is to optimise all activities within every stage of the supply chain. From the raised definitions of SCI, It can be said that the two key elements underpinning the operationalisation of SCI are collaboration and coordination, however, these two key terms are sometimes used interchangeably. The aforementioned two key underpinning elements indicate that to achieve integration, firms need to collaborate and or coordinate on agreed processes and activities to effectively and efficiently optimise their entire supply chain. To

justify the key role of collaboration and coordination in defining and achieving integration, the following definitions of SCI from selected key researchers in the field of SCI are giving in Table 2.1.

Table 2.1: **Examples of supply chain integration definition from key researchers**

Author	Supply chain integration definition
Yu et al. (2017)	They investigated the direct and interacting effect of IT capability and marketing on SCI and defined SCI as the extent to which a firm coordinates its strategic supply chain activities e.g. planning with its channel members, such as customers and suppliers (Wu et al. 2006).
Wong et al. (2011)	In their study to investigate the contingency effect of external uncertainty on integration and operational performance, they indicated that after following Pagell (2004) and Flynn et al. (2010) SCI is defined as the strategic collaboration of both intra-organisational and inter-organisational processes. These authors definition gives a clear indication of how collaboration is used in the context of defining SCI.
Frohlich and Westbrook (2001)	Supply chain integration describes the degree to which a manufacturer strategically collaborates the forward flow of physical products and the backward flow of information with its supply chain partners.

In Wong et al. (2011) definition of SCI the adjective "strategic" was used to qualify collaboration, this indicates that although collaboration serves as the key element for integration, integration must be carried out strategically in alignment with the overall strategy of the participating firms. In support of the strategic use of collaboration and coordination, Richey et al. (2009) indicated that operational coordination could only lead to operational benefits whilst strategic coordination provides both operational and strategic benefits (Flynn et al. 2010: Sanders 2008). Operational benefits in this context refer to meeting set targets of quality, cost, delivery, and flexibility through operational coordination. However, a firm's strategy aligned with its operational strategy can also be achieved through strategic coordination. The use of both operational and strategic coordination is key for this research, as it will help measure the impact of SCI on both the operational and financial performance of the firms.

In addition to the use of the terms coordination and collaboration, other key researchers in the field of supply chain management (SCM) also defined SCI as the alignment and interlinking of business processes that embody various communication channels and

linkages within a supply network (Mangan et al. 2011). However, the Oxford dictionary (2017) defines alignment as "putting things into correct or appropriate relative positions" whilst interlinking means the "joining or connecting of two or more things together". In extending the definition of SCI, Mangan et al. (2011) indicated that collaboration is the relationship and trust achieved among partners through integration over a long period. That is, integration can be achieved without collaboration but collaboration cannot be achieved without integration. This clearly shows that in the context of defining SCI, there is a lack of consensus in the use of the key terms coordination or collaboration and interlinking or alignment in precisely defining SCI. However this thesis adopts the definition of SCI as a *strategic collaborat*ion of activities within organisations and among supply chain players through coordination and information sharing (Flynn et al. 2010), with the aim of keeping collaboration between processes, as the flow of material and information moves towards the customer is to optimise all supply chain activities to provide maximum value to the customer at low cost and high speed (Bowersox et al. 1999; Frohlich and Westbrook 2001; Wolf 2011).

2.1.1 Dimensions of supply chain integration

According to existing SCI literature, several researchers have viewed SCI from the suppliers, firm and customers perspective (Narasimhan and Kim 2002; Rosenzweig et al. 2003; Swink et al. 2007; Vanpoucke et al. 2014; Wiengarten et al. 2014; Wong 2013; Wong et al. 2011) whilst quite a few have also viewed SCI from a unidimensional point of view (Armistead and Mapes 1993; Morash et al. 1997). Unidimensional in this context is defined as measuring/viewing SCI as a single construct of collaboration with suppliers and customers (ignoring internal integration). A number of authors were known to also view SCI from the internal and external perspectives (Stank et al. 2001; Swink et al. 2007) only.

Even though SCI is considered to improve performance, each SCI dimension (internal, supplier, and customer integration) has a unique impact on performance (Flynn et al. 2010; Yu et al. 2013). For example, several studies have shown a positive impact of integration with suppliers (Cao and Zhang 2011; Schoenherr and Swink 2012) and customers (Narasimhan and Kim 2002; Wiengarten et al. 2019) on firm performance. Whilst internal integration, has shown both positive (Narasimhan et al. 2010; Wong et al. 2011) and negative/or insignificant (Flynn et al. 2010; Gimenez and Ventura 2005) results. Although the results are inconsistent, the importance of the findings shows that to holistically

understand the impact of SCI on performance, it is vital to consider all the SCI dimensions. Despite the importance raised on considering all the SCI dimensions, many studies (Cao and Zhang 2011; Frohlich and Westbrook 2001; Danese and Romano 2011; Devaraj et al. 2007; Gligor et al. 2015; He et al. 2014; Jitpaiboon et al. 2013; Schoenherr and Swink 2012; Weingarten et al. 2014; Zhang and Huo 2013) that have contributed to the SCI literature ignored arguably the most critical SCI dimension, thus internal integration (Flynn et al. 2010). Hence, also contributing to the inconsistent positive (Cao and Zhang 2011; Huo et al. 2016; Narasimhan et al. 2010; Narasimhan and Kim 2002; Schoenherr and Swink 2012) and negative/insignificant (Flynn et al. 2010; Gimenez and Ventura 2005; Koufteros et al. 2005; Stank et al. 2001) SCI-performance literature results. Notwithstanding the various aforementioned SCI dimensions taken by the various authors in studying SCI-performance, the majority of the studies focus on the economic performance only (Ahi and Searcy 2013; Asif et al. 2013). Aside from this study taking into consideration all the SCI dimensions (internal, supplier, and customer integration) the study most importantly extends the performance measures by inculcating the equally important social and environmental (discussed in sub-section 2.2.2) performance. Additionally, to support and have a standardized form of analysing SCI as currently, the majority of key research analyses SCI from both the focal firm, and supplier and customer's point of view, this thesis will adopt the same form of analysing the dimensions of SCI. To elaborate and justify the dimensions of SCI, Mangan et al. (2011) further gave two primary modes of integration within a supply chain;

2.1.1.1 External integration

External integration is defined as the degree to which a firm can partner with its key supply chain members (customers and suppliers) to structure their inter-organizational strategies, practices, procedures, and behaviours into collaborative, synchronized and manageable processes in order to fulfil customer requirements (Chen and Paulraj 2004; Zhao et al. 2011). External integration consists of the interlinkage between the retailer, manufacturer (OEM), the supplier, and the customer. External integration can further be subdivided into three distinct features (Childerhouse and Towill 2011; Mangan et al. 2011) that is;

(1) Backward integration; Describes the integration with selected first-tier and second-tier suppliers.
(2) Forward integration; Integration with selected first-tier customers.

(3) Forward and backward integration; Embodies the integration with suppliers and customers.

Based on the three types of external integration given, it is noticed that to understand the holistic concept of integration (from the external point of view) and its related social, economic, and environmental importance and impact, interlinkages with both suppliers and customers must be rigorously examined. Especially as both suppliers and customers play key roles in obtaining superior value chains. Based on this argument the forward and backward integration will be adopted. To support this argument and selection, it is known in the literature that most organisations now do not compete on a company level basis but rather on the value of their entire supply chain value (Flynn et al. 2010). Hence creating the need to study integration from both upstream and downstream levels. To support the importance of external integration (both suppliers and customers), a number of empirical research has shown a positive impact of integration with suppliers (Cao and Zhang 2011; Frohlich and Westbrook 2001; Scannell et al. 2000; Schoenherr and Swink 2012) and customers (Griffin and Hauser 1996; Narasimhan and Kim 2002) on firm performance. Indicating that there is a need to consider the external dimension of integration when measuring the impact of integration on firm performance. However, the majority of these studies focused on first-tier suppliers and final consumers only whilst ignoring other important supply chain players such as regulators, distributors, and or key logistics service providers.

2.1.1.2 Internal integration

Internal integration embodies the interlinkage and alignment between the various departments within an organisation (Mangan et al. 2011). An example is the interlinkage between operations, marketing, finance, human resource management departments, etc. Internal integration is mostly operationalised through the use of enterprise resource planning (ERP) within an organisation to achieve a common set goal. Internal integration breaks down functional barriers and facilitates the sharing of real-time information and materials across key functions (Flynn et al. 2010; Wong et al. 2011). Morash (2001) also defined internal integration as collaboration across product design, procurement, production, sales, and distribution functions to meet customer requirements at a low total system cost. To support the importance of internal integration, a number of empirical research has also shown a significant impact of integration among internal functions on firm performance. Thus, literature shows both positive (Cao and Zhang 2011; Narasimhan et al. 2010; Schoenherr

and Swink 2012; Wong et al. 2011) and negative (Gimenez and Ventura 2005; Koufteros et al. 2005; Vereecke and Muylle 2006) significance. These significant results indicate that to fully analyse the impact of SCI on firm performance, internal integration is also a key dimension that must be considered.

Although the dimensions of SCI given above is explained from both internal and external point of view, other authors (Armistead and Mapes 1993; Morash et al. 1997) explain and examine SCI from a unidimensional point of view. Thus, these authors viewed integration from only the collaboration with suppliers and customers (ignoring internal integration), whilst other authors (Droge et al. 2004; Vickery et al. 2003) viewed integration from a multiple (including internal integration) dimensional points of view. Hence, showing the overlap of how integration is viewed. In the context of this thesis, it is argued that considering both external and internal dimensions is more appropriate as both investigates all aspects of the focal firm, it customers and suppliers as they all contribute differently in creating a successful value chain (Wong et al. 2011; Yu et al. 2013; Zhao et al. 2011). Table 2.2, gives examples of authors that used the unidimensional and multiple dimensional approaches.

2.1.2 Supply chain integration issues

Various literature was searched precisely from Scopus with the key phrase "supply chain integration". Key issues or topics tackled with regards to searched SCI literature were selected and reviewed. 3,689 papers were identified based on the search and content analysis was performed using the factors title, keywords, abstract, and journal ranking of the identified papers. Out of this analysis, 28 key papers were selected and critically reviewed to support the main constructs and gaps for the study (Appendix A). The key themes regarding the issues analysed on SCI were largely grouped as information technology, sustainability, and uncertainty. Based on these groups, it was noticed that the majority of the studies have taken a direction of analysing SCI with regards to uncertainty and sustainability as compared to information technology. Also as firms, both multinationals and SMEs, are pushing vigorously to increase their market shares and remain competitive, globalisation and international trade have formed a large part of these firm's opportunities. Therefore, there is an increased rate of uncertainty exposed to firms mostly operating beyond their country scope. Additionally, there is a high stakeholder (government, firm shareholders, consumers, etc.) demand for not only economically competitive products but products that are

environmentally friendly and produced under ethical conditions (Wolf 2011). This makes the study of SCI to improve sustainability performance, whilst managing the impact of EU extremely important.

Table 2.2: Dimensions of supply chain integration (Schools of thought)

Author (s)	Dimension	Key findings
Armistead and Mapes (1993)	Focused on external dimension only	Integration is correlated with an increase in manufacturing performance.
Frohlich and Westbrook (2001)	Focused on external dimension only	Supplier and customer integration increase operational and financial performance.
Stank et al. (2001)	Viewed both internal/external dimensions	Logistical performance is improved through internal integration but not external integration.
Narasimhan and Kim (2002)	Viewed both internal/external dimensions	Both internal and external dimensions improve product and market diversification.
Swink et al. (2007)	Viewed both internal/external dimensions	Both internal and external dimensions increase market performance.
Schoenherr and Swink (2012)	Focused on external dimension only	Extended arcs of external integration increase operational performance.
Wong (2013)	Viewed both internal/external dimensions	Internal integration impacts environmental adaptability. Customer integration engenders environmental adaptability and innovativeness.
Vanpoucke et al. (2014)	Focused on external dimension only	Supplier integrative capability improves cost and flexibility performance.
Wiengarten et al. (2014)	Viewed both internal/external dimensions	Both internal and external dimensions increase operational performance.
Huo et al. (2016)	Viewed both internal/external dimensions	Internal and customer integration improve competitive performance.
Song et al. (2017)	Viewed both internal/external dimensions	Green SCI is related to both operational and financial performance.
Wong et al. (2017)	Viewed both internal/external dimensions	Internal integration and customer integration impact operational performance. Customer integration impacts delivery performance.

Source: Author's construct

Moreover, aside from the inconsistencies in results of SCI-firm performance which was identified, there are also fewer studies and proposed models to clearly understand the key internal and external factors which contribute to enhancing supply chain sustainability through SCI. These arguments raise the need for more empirical research to clearly understand the impact of SCI on firm performance (supply chain sustainability) under the conditions of uncertainty (Boon-itt and Wong 2011; Srinivasan et al. 2011; Wong et al. 2011; Zhu et al. 2007). Based on these raised supporting arguments, the research will focus on the three main constructs SCI, sustainability, and uncertainty. However, with the construct sustainability, the focus will be placed on the economic, social, and environmental performance through the entire supply chain, whilst with uncertainty, the focus will be placed on the external environment in which companies operate in.

2.2 External uncertainty

Uncertainty is a state of doubt about the future or about what is the right thing to do (Collins dictionary 2018). Thus, a situation where the current state of knowledge is such that the order or nature of things is unknown, the consequences, extent, or magnitude of circumstances, conditions, or events are unpredictable (Business dictionary 2018). Milliken (1987) also described uncertainty as an unpredictable state of the environment, and not able to forecast the impact of changes in the environment whilst clearly not knowing the outcome of a choice/decision (Chin et al. 2014). In other terms, uncertainty can be defined as the inability to assign probabilities to future events (Duncan 1972; Wong et al. 2011).

Inculcating the environmental context in which companies operate in the given definitions of uncertainty, EU can be defined as the degree to which a firm's external environment in terms of competitors, technology, and customer preferences is, unpredictable and characterised by unexpected change (Fynes et al. 2004). EU is described as a complex construct, thus EU comprises different factors based on numerous perspectives (Sutcliffi and Zaheer 1998). However, literature identifies EU to include factors mostly external to the supply chain and strategic in nature e.g. changes in product and process technology, competitor behaviour, changes in customer preferences, etc. (Fynes et al. 2004).

The value of SCI practices on firm performance has been supported by literature over the years. Sousa and Vous (2008) indicated that as the importance of SCI on firm performance is known, its more appropriate to have a shift in understanding what contextual conditions makes SCI most effective as other researchers also found a negative and or/insignificant impact of SCI on performance (Flynn et al. 2010; Wong et al. 2011; Yu et al. 2013). Although there are several contingent factors (e.g. national culture, state of economy, etc.), EU is identified as one of the key factors, which affects the effectiveness of SCI practices (Wong et al. 2011). A number of contingency-based research have indicated that the external environment is a significant factor to consider (Sousa and Vous 2008; Wong et al. 2011) when making decisions regarding the type of strategy and practices to adopt. To support the raised argument, a study by Zhu et al. (2005) on selected Chinese companies showed that some of the key environmental factors affecting the companies in adopting sustainable strategies is price competition and responsiveness. This can be linked to the argument by Sousa and Vous (2008) were they indicated that as the importance of SCI on firm performance is known, it is more appropriate to have a shift in understanding what contextual

conditions makes SCI most effective. Especially as other researchers also found a negative and/or insignificant impact of SCI on mainly firm performance (Flynn et al. 2010; Yu et al. 2013). Hence justifying the need to investigate how EU influences companies to operationalise SCI to impact performance. Despite this need, there are fewer studies specifically analysing the effect of EU (collectively considering supply and demand, technology, competition) on the SCI and supply chain sustainability relationship in both developed and developing countries. The next sub-section details the various dimensions of EU.

Most research on EU emerged especially after the work of Kraljic (1983) who studied the contingent effect of EU on SCI-performance using the buyer-supplier relationship (Wiengarten et al. 2013). EU emerged due to the significant role it plays especially as firms extend their market share through globalisation and international trade whilst demands are dynamic with a rapidly changing business environment. In a study by Qi et al. (2011) were they studied the role of EU on the relationship between competitive strategy and supply chain strategies on business performance, they indicated that much research has also linked strategic decisions and practices to the environment in which a company operates (Ward and Duray 2000). Example of such research carried out and published in top journals in the field of Logistics and Supply Chain Management are *Journal of Operations Management*- Gligor et al. 2015; Wong et al. 2011; *International Journal of Physical Distribution & Logistics Management*- Boon-itt and Wong 2011; Van der Vorst and Beulens 2002; *Industrial Marketing Management*- Agarwal et al. 2007; *European Journal of Operational Research*- Santoso et al. 2005; *International Journal of Operations & Production Management*- Prater et al. 2001) just to mention a few.

2.2.1 Dimensions of external uncertainty

Ying (2006) emphatically stated that many researchers have viewed EU differently whilst these differences are influenced by the identification of variability, complexity, and vulnerability (Chin et al. 2014). For example, Lawrence and Lorsch (1967) indicated that EU should be grouped into the aspects of "technology and market" whilst Govindarajan (1984) extended Lawrence and Lorsch (1967) category and mentioned that EU can be related to demand, market competitors, suppliers, labour and capital, and regulations (Chin et al. 2014). The categories labour and capital, and regulations by Govindarajan (1984) can also be named as logistical capabilities as used by Wiengarten et al. (2013) in their study on how

a country's logistical capabilities moderate the external integration performance relationship. Porter (1980) also suggested five categories of EU; customers, competitors, suppliers, latent competitors, and alternative products (Chin et al. 2014). All the raised arguments show the variations and similarities of EU categorisation by various researchers. However, from the SCI literature, it is noticed that the main categories of EU used are technology, competition, supply and demand, and logistical capabilities (Wiengarten et al. 2013; Wong et al. 2011; Ying 2006). Despite these being the main categories of EU, there are less studies that collectively consider all the aforementioned categories of EU and analyse their impact on the SCI- supply chain sustainability performance relationship. The main categories/dimensions of EU as identified from the literature are briefly explained below.

2.2.1.1 Technology uncertainty

Meyer (2008) described technology uncertainty as a lack of precise knowledge about what manufacturing technology will be useful or significant in the future due to the rapid change of technology in producing products or services. Such unpredictability is known to cause firms to have less precise knowledge of how newly introduced technology will be accepted and dispersed by the market and customers (Fynes et al. 2004). Change et al. (2002) further described technological uncertainty as having unpredictable processes and product technology whilst Ragatz et al. (2002) emphatically stated that technological uncertainty measures the degree at which a product or process technologies used are new, complex, or dynamic. Although technology is known to present opportunities for firms when applied to processes and development of new products, there are threats as firms have less precise knowledge about how new technologies will be accepted by the market and customers.

2.2.1.2 Competition uncertainty

Competition uncertainty mainly describes the unpredictability of the actions of competitors (Stevenson and Spring 2007). Unpredictable actions of competitors may be in the form of product life cycles, marketing promotions, product design sophistication, quality of product, cost of product, etc. which makes decision making and accurate competitive predictions for supply chain activities difficult (Fynes et al. 2004; Huang et al. 2014; Wong and Boon-itt 2008).

2.2.1.3 Supply and demand uncertainty

Fynes et al. (2004) defined demand uncertainty as the unknown/unpredictable variations in the quantity and timing of demand within/across the supply chain. Geary et al. (2002) also defined demand uncertainty as the difference in actual end-market demand and orders placed by customers with an organisation. Kim et al. (2011a, 2011b) indicated that firms exposed to high demand uncertainty are likely to hold higher inventories in the form of buffer stock which adds up to cost. However, some researchers suggested that firms exposed to demand uncertainty can integrate their processes and collaborate with supply chain partners to enhance quick response for delivery and flexibility of firm activities (Wong et al. 2011). Similarly, supply uncertainty relates to the unpredictable nature of the quantity and timing of supply (Fynes et al. 2004). The occurrence of supply uncertainty can be as a result of downtime during production, unforeseen problems in relation to quality, order-entry errors, or forecast errors (Davis 1993; Fynes et al. 2004). A critical analysis of the aforementioned factors shows that for firms to mitigate the negative effect of supply uncertainty, firms need to integrate and collaborate more with their suppliers (Wong et al. 2011).

2.2.1.4 Logistical capabilities uncertainty

Logistical capabilities encompass the quality and breathe of logistics services, activities, infrastructure, and the rules and regulations available to firms in a particular geographical area (Wiengarten et al. 2013). From the management literature, it is known that the majority of research on SCI- performance relationships and the moderating role of EU mostly considers technology, supply and demand, and competition uncertainty in isolation. Whilst most of the studies focus on the economic performance only (Wiengarten et al. 2013; Wong et al. 2011) and ignore the logistical capabilities factors (e.g. rules and regulations) (Wong et al. 2011). However, due to the high level of international trade and globalisation, the significant role of logistical capabilities and its impact on performance has been supported by literature (Schoenherr 2009; Stock et al. 2000; Wiengarten et al. 2013). Besides, most firms in one way or the other carry out activities of outsourcing, distribution or transportation, warehousing, information sharing, etc. all of which are largely affected by the state of logistical capabilities available to firms (Wiengarten et al. 2013). Hence raising the importance of considering logistical capabilities as a dimension of EU in this study. Table 2.3 shows an example of 6 related key papers that studied the SCI-performance relationship under EU. These papers show samples of the dimensions used for measuring EU. Table 2.3 also shows the gap that most studies do not holistically consider technology, supply and

***Table 2.3*: Six selected key papers regards to SCI-performance and external uncertainty**

Author(s)	Scope	Industry	Methodology	EU (Dimensions)	Journal	Performance
Fynes et al. (2005)	Supply chain relationship, performance, competitive environment	Manufacturing (Electronics)	Quantitative (survey)	Technological, competitive, and demand uncertainty	International Journal of Production Research	Cost, Delivery, Quality, Flexibility
Boon-itt and Wong (2010)	Internal integration, supplier integration, customer integration, delivery performance	Automotive	Quantitative (survey)	Technological and demand uncertainty	International Journal of Physical Distribution and Logistics Management	Customer Delivery
Srinivasan et al. (2011)	Partnership quality, performance, external uncertainty, risk	Manufacturing	Quantitative (survey)	Technological, supply and demand and competition uncertainty	European Management Journal	Cost, Delivery, Flexibility
Wong et al. (2011)	Sustainability, internal integration, supplier integration, customer integration	Manufacturing (Automotive)	Quantitative (survey)	Technological, supply and demand and competition uncertainty	Journal of Operations Management	Cost, Delivery, Quality, Flexibility
Yeung et al. (2013)	Supplier partnership, external uncertainty, performance	Manufacturing (Electronics)	Quantitative (survey)	Competitive and demand uncertainty	International Journal of Production Economics	Cost
Wiengarten et al. (2014)	Supplier integration, customer integration, performance, information visibility, global competition	Manufacturing	Quantitative (survey)	Logistical Capabilities uncertainty	Journal of Operations Management	Cost, Delivery, Quality

Source: Author's construct

demand, competition, and logistical capabilities when considering EU as a factor or construct. The papers were selected based on how related (considering SCI, EU, and the dimensions of supply chain sustainability) they are to this thesis.

2.3 Sustainability

According to Rajeev et al. (2017) although the latter part of the 20th century also saw a higher rise in diverse demands from customers, the fulfilling of these needs by companies through their operational activities mostly compromised the impact on the society and environment. This also contributed to the increased need and recognition of the term sustainability till this present day. Although the introduction of the term sustainability dates decades back, a higher increase of reports and papers that focus on the concept of sustainability was also seen in the latter part of the nineties (Rajeev et al. 2017). Sustainability encompasses social, environmental, and economic responsibilities (UN 1987). Sustainability is defined as the "development that meets the needs of the present without compromising that of the future generation in meeting their needs" (World Commission on Environment and Development (WCED) 1987). The definition of sustainability is known to be macroeconomic which poses a difficulty for organisations to apply. Thus, the application of sustainability in real practice is known to be complicated based on the ambiguity and vagueness surrounding the definition. Although over the past years various stakeholders in the form of consumers and governments have been pressuring companies to reduce the environmental impact of their products, processes, and activities (Thierry et al. 1995**)** most of these pressures focus on mainly multinational companies and less on small and medium enterprises (SMEs). The issue of company size and the adoption of sustainable practices were evident in Collins et al. (2007) study on New Zealand firms and Zhu et al. (2007) study on Chinese firms. Both studies identified that SMEs are less proactive with regards to the adoption of sustainable practices as compared to larger size firms. Hence, raising the need to devise new effective strategies that will collectively apply to both large firms and SME's in adopting/achieving sustainability.

Although early approaches to sustainability focused mainly on environmental issues, currently the approach of sustainability has become more diverse by considering economic and social dimensions (Ahi and Searcy 2013). Thus the majority of researchers operationalise sustainability through the triple bottom line, which simultaneously considers

and balances between economic, environmental, and social issues. The application of sustainability throughout the supply chain to benefit all partners in the chain is detailed in the next sub-section.

2.3.1 Supply chain sustainability

"Supply chain sustainability is defined as the management of social, environmental and economic impacts and the encouragement of good governance practices, throughout the lifecycle of goods and services" (Sisco et al. 2011; UN 2010). Supply chain sustainability aims to incorporate and positively impact the social, economic, and environmental dimensions of the triple bottom line in order to achieve sustainable supply chains. The stated aim places critical importance in understanding how companies effectively/efficiently create, extend or modify resources (Beske et al. 2014; Helfat et al. 2007; Teece et al. 1997) generated through SCI to impact the social, economic, and environmental dimensions of supply chain sustainability. Based on this argument, emphasis will be placed on how supply chain sustainability adoption can result in achieving sustainable supply chains**.**

Focusing on how companies can achieve sustainable supply chains is very important (Wolf 2011), as in practice companies rely on supply chain sustainability to gain competitive advantage and meet the diverse needs of customers. To support this claim, Martins and Pato (2019) also indicated that the introduction of the concept sustainability into business activities is one of the main and dynamic research areas in management studies that mostly focus on supply chains. This important recognition in practice has also placed enormous pressure on not only the focal firms but also how supply chain partners and all other supply chain stakeholders can be integrated to operationalise strategies (.e.g. SCI) that can impact their supply chain performance in a sustainable way. Thus the concept of sustainability is not limited to the boundaries of the focal firm but that of supply chain players and inter-organisational partners (Zhu et al. 2005).

Many studies have also outlined a number of factors as raising the need or serving as drivers for operationalising and achieving supply chain sustainability. Holistically, the factors/drivers are known to emancipate from both internal (e.g. employees, and managers) and external stakeholders (e.g. regulators/government, and investors) (Rice 2003; Zhu et al. 2005). Zhu et al. (2005) gave an example that showed that Chinese companies faced high pressures from customers especially in foreign countries in the form of demanding

sustainability certifications. Meeting such certification is known to be a great challenge for the companies which has resulted in the rejection of huge amounts of exported goods worth billions of dollars.

Wolf (2011) argued that to achieve supply chain sustainability all the key stakeholders within/across the supply chain must be considered. Thus, the joint effort of all the key supply chain stakeholders is required to simultaneously impact the social, economic, and environmental performance of the focal firm and the entire players across the supply chain. Despite this significance, most SCI-performance studies did not consider all the key stakeholders within/across the supply chain, but rather focused on the focal firms (Danese and Romano 2011; Flynn et al. 2010; Narasimhan and Kim 2002) and economic dimension (Flynn et al. 2010; Narasimhan and Kim 2002; Schoenherr and Swink 2012; Vanpoucke et al. 2017; Weingarten et al. 2014; Wong et al. 2011; Yu et al. 2013) only. Some have also mentioned that although the sustainability concept is well known, many companies have not yet integrated the sustainability concept into their value chains (Zhu et al. 2005). This raises the need for studies to consider all the supply chain stakeholders to encourage the effective and efficient operationalization of SCI to achieve supply chain sustainability. The explanation of the various dimensions of supply chain sustainability is detailed in the next subsection.

2.3.1.1 Triple bottom line (TBL) of supply chain sustainability

The triple bottom line is an accounting framework that incorporates three dimensions of performance, thus social, environmental, and financial. Literature refers to the dimensions of TBL as the three Ps: people (social), planet (environmental), and profits (economic). TBL was introduced into sustainability by John Elkington, which has been applied to the field of operational research (OR) and management science (MS) over the past years (Elkington 1998). Before the introduction of the TBL framework by Elkington (1998) the majority of supply chain sustainability studies in management focused on environmental performance, but largely ignored that of social performance. Even after the introduction of the TBL which advocates for the consideration of all the aforementioned three dimensions, the majority of supply chain literature study the three dimensions in isolation/parts whilst the majority of the studies also focus on the economic dimension only. The majority of studies also explored the concept of sustainability through green supply chain management (GrSCM), however, the rise in supply chain sustainability studies has mentioned/recognised the importance of

the social dimension in addition to the traditional economic dimension (Martins and Pato 2019). Hence currently, the various definitions of supply chain sustainability incorporate and emphasise on impacting the social, economic, and environmental performance, which forms the three Ps of the TBL. A brief description of the various dimensions of supply chain sustainability which forms the TBL is explained below.

Environmental dimension

The environmental dimension represents measurements of natural resources and gives a vivid reflection of potential influences on its viability (Sloan 2010). Miemczyk et al. (2012) also mentioned that the environmental dimension comprises decisions and actions taken that are in the interest of protecting the natural world, with prominence on conserving the ability of the environment to sustain the lives of humans (Neurtey 2015). The environmental dimension also entails tangible resources used in operational activities whilst placing high emphasis on environmental life-support structures without which humanity cannot exist (Neurtey 2015). Examples of such structures comprise of food, water, atmosphere, soil, minerals, materials, and energy of which all of their environmental capacity is to be maintained (Goodland 1995; Neurtey 2015; Sloan 2010). Several empirical studies have used items belonging to the aforementioned broader structures to measure the environmental dimension. Example of the specific items are; reductions in air emissions and waste, increase in the savings of energy, type of energy, ISO certified players, decrease in the use of harmful resources, and reduction in environmental accidents, and footprints left as a result of operational activities (Gimenez et al. 2012; Paulraj 2011). Although the environmental dimension has been explored to some extent, Pullman et al. (2009) argue that the environmental dimension has been less explored simultaneously with the social dimension, whilst the majority of the research also focus less on sustainability at the operational level (Pagell and Gobeli 2009), which this thesis addresses.

From the SCI literature, it is noticed that the majority of firms focus on making profits but less on how their actions can help protect the natural world. It is important for firms to integrate their activities internally and externally with all key stakeholders to create highly commercial products that are environmentally friendly. Integration plays a critical role in achieving this objective. Thus, internal integration enables product design and processes improvement (Ettlie and Stoll 1990), and the efficient use of natural resources (land, water, etc.) (Griffith and Bhutto 2008). Whilst external integration enables firms and their supply

chain partners to maximise their capacity through collaboration and the use of fewer resources to meet demands (Russo and Fouts 1997).

Social dimension

According to Sloan (2010) the social dimension aims to improve and sustain activities that are just and favourable to labour, communities, and regions that the supply chain operates in. Torjman (2000) indicated that the social dimension involves tackling problems such as poverty, and contributing towards social interventions, and creating safe and helpful societies (Neurtey 2015). The social dimension also encompasses workplace conditions, that of the community and institutions (Sloan 2010). According to literature, some of the early work on socially responsible supply chain management and social issues were specifically on bribery (Pitman and Sanford 1994), corruption (Turner 1994), and general ethical behaviour (Wood 1995). However, the broader social concepts can include employment practices, health and safety, local community issues, contractual stakeholders, and general stakeholder dimensions (Bai and Sarkis 2010). For example, Paulraj (2011) measured the social dimension using improvement in overall stakeholder welfare, community health and safety, promoting and engaging in diversity, employees' safety and health, and the right of stakeholders. Hence showing how the social dimension in current research further captures broader aspects of social issues both internally (company related) and externally (for example communities). Thus the social dimension places emphasis on both internal and external stakeholders (Gimenez et al. 2012). Hence, the social dimension aims to have the activities of firms not to be only profitable but should focus and provide social benefits (example well-being, opportunities), assurance (job security, quality of life), diversity, and rights to labour and accountability (Elkington 1994; Schneider 2007) to all supply chain stakeholders. In practice, most companies are known to operationalise their social performance by engaging in a number of social activities as part of their corporate social responsibility (Fombrun 2005).

The SCI literature shows that most firms focus less on practices that are fair and favourable to labour, communities, and regions that they operate in (Sloan 2010). Involving stakeholders in social developmental works, boost supplier and customer satisfaction and the reputation of the focal firm (Zhu et al. 2016). Firms that recognize their employees' talent, through involvement, face less attrition and are considered as the best firms to work for (Welford and Frost 2006). Although these raised arguments show how critical it is to

achieve sustainable supply chains, little research has been done to explore and understand how companies can effectively and efficiently use SCI to impact the social dimension as well as the economic, and environmental dimensions of sustainability (Ahi and Searcy 2013; Asif et al. 2013; Gimenez et al. 2012).

Economic dimension

The economic dimension encompasses all profits earned by a firm, members of the supply chain, and the monetary benefits attained by host nations, regions, and communities of a firm (Sloan 2010). Mahler (2007) (cited in Ho and Choi 2012) indicated that all activities that pursue to gain profits, engage in creating employments, increase customer demands, reduce costs, detect and manage long-term risks and developing long-term competitiveness summarises the economic dimension of sustainability (Neurtey 2015).

In the context of SCI literature, the economic dimension encompasses the operational and financial performance of firms. The majority of studies measure the operational dimension using speed (design, production, and delivery time) (Flynn et al. 2010; Wong et al. 2011), quality (in terms of defects, and product conformance) (Frohlich and Westbrook 2001), flexibility (quick access to demand, volume, and variety) (Flynn et al. 2010; Shou et al. 2018), and cost (increase in productivity due to speed and reduction in product redundancy) (Schoenherr and Swink 2012). For the financial performance, the majority of studies also focus on profits through return on investment, return on sales, growth in sales, and growth in market shares (Flynn et al. 2010; Wong et al. 2011). Holistically, economic sustainability aims to use available resources effectively and efficiently to meet the operational and financial needs of firms and their supply chain stakeholders in both the short and long term.

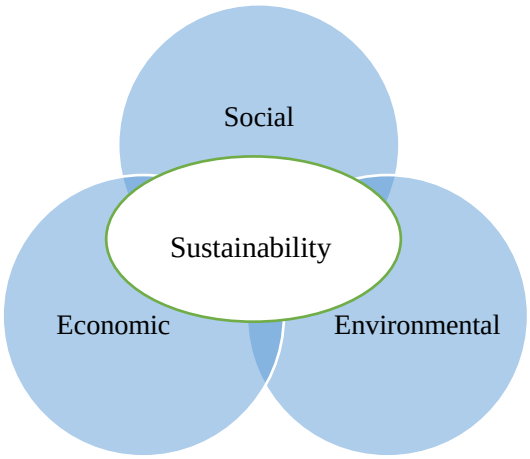
As the majority of the items (e.g. gain profits through return on investment, return on sales, growth in sales, and growth in market shares, create jobs, attract customers, reduce cost, improved quality, wide products and volumes, high productivity, etc.) studied under the economic dimension fall under either the operational and financial dimension of performance, the economic dimension in this thesis will be categorized into two main parts. Thus operational and financial performance. This categorisation will help make the measurement of the economic dimension comparable with existing supply chain performance literature. Existing literature has also supported the assertion that SCI impacts firm economic (operational and financial) performance by enabling an efficient and effective

flow of products and services across and within the supply chain (Swink et al. 2007; Zhao et al. 2011).

Based on the reviewed supply chain sustainability literature, the various metrics used in measuring the environmental, social, and economic dimensions of supply chain sustainability is summarised in Table 2.4. Figure 2.1 and 2.2 show the three main dimensions of the supply chain sustainability construct.

Figure 2.1: **The three main dimensions of supply chain sustainability**

Figure 2.1a: **Triple bottom line**



Source: Elkington (1998)

2.1b: **Graphical representation of the triple bottom line**

Source: Author's construct

Table 2.4: **Sustainability measuring metrics**

Dimension of Sustainability	Metric (Based on reviewed literature in 2.3 and its subsections)
Social Dimension	• Social investments • Employment practices • Annual Employee training time • Health and Safety • Condition of workplace and community • Ethical behavior (bribery, corruption, gender equality, and diversity)
Economic Dimension	• Return on investment • Profit margin • Return and growth on sales • Growth in market shares

	• Productivity (input per output) • Cost, quality, flexibility and speed • Total number of shareholders
Environmental Dimension	• Waste minimization • Type of energy and energy consumption • Water consumption • Use of recycled materials • State and effectiveness of transportation/distribution activities • Effectiveness of training for workers and supply chain partners in environmental issues • Number of suppliers ISO certified • Effectiveness of supplier training in environmental issues • Effectiveness of supplier monitoring

Source: Author's construct

2.4 Gaps and research questions

The two main gaps identified are; (1) Less research has been undertaken to explore and understand how companies can effectively and efficiently use SCI to simultaneously impact the economic, social, and environmental dimensions of sustainability (Ahi and Searcy 2013; Asif et al. 2013; Gimenez et al. 2012) to achieve truly sustainable supply chains (Pagell and Shevchenko 2014) (2) Little research has been undertaken to explore and understand the contextual factors (both internal and external) and conditions in which SCI is most effective (Sousa and Vous 2008; Wong et al. 2011). Thus there is no key model that provides insight into the internal and external factors which contribute to enhancing supply chain sustainability through SCI. The second gap can be supported by the inconsistent SCI-performance results that exist in the SCI literature (Wiengarten et al. 2019; Yu et al. 2013). In support of the two main aforementioned gaps, the following gaps were also identified.

Less research has been done to explore and understand the SCI-supply chain sustainability relationship in a developing and developed country context. Also, most SCI literature reviewed are based on the focal manufacturing firms only excluding the other key supply chain stakeholders. This drawback questions the generalisation and applicability of developed SCI-performance models for different players within and across the supply chain. Additionally, the majority of SCI literature are known to be only survey based with less use of a mixed-method approach. Hence there are less studies that critically explore to identify and understand the main factors the affect the SCI-performance relationship. Appendix A

details the key reviewed papers showing the supporting gaps mentioned. Based on the raised gaps, the man research questions are outlined.

(1) What is the impact of supply chain integration on supply chain sustainability?
(2) What internal and external factors enhance or hinder supply chain sustainability through SCI?

2.5 Conceptual framework

Based on the reviewed literature on SCI, supply chain sustainability, and EU, the identified gaps, and outlined research questions, the proposed conceptual framework for the study was developed (Figure 2.2). It was noticed that the impact relationship can be explored from SCI→ supply chain sustainability and another from EU to the SCI→ supply chain sustainability relationship. Hence, the conceptual framework shows the main constructs to be measured and the direction of the proposed impact.

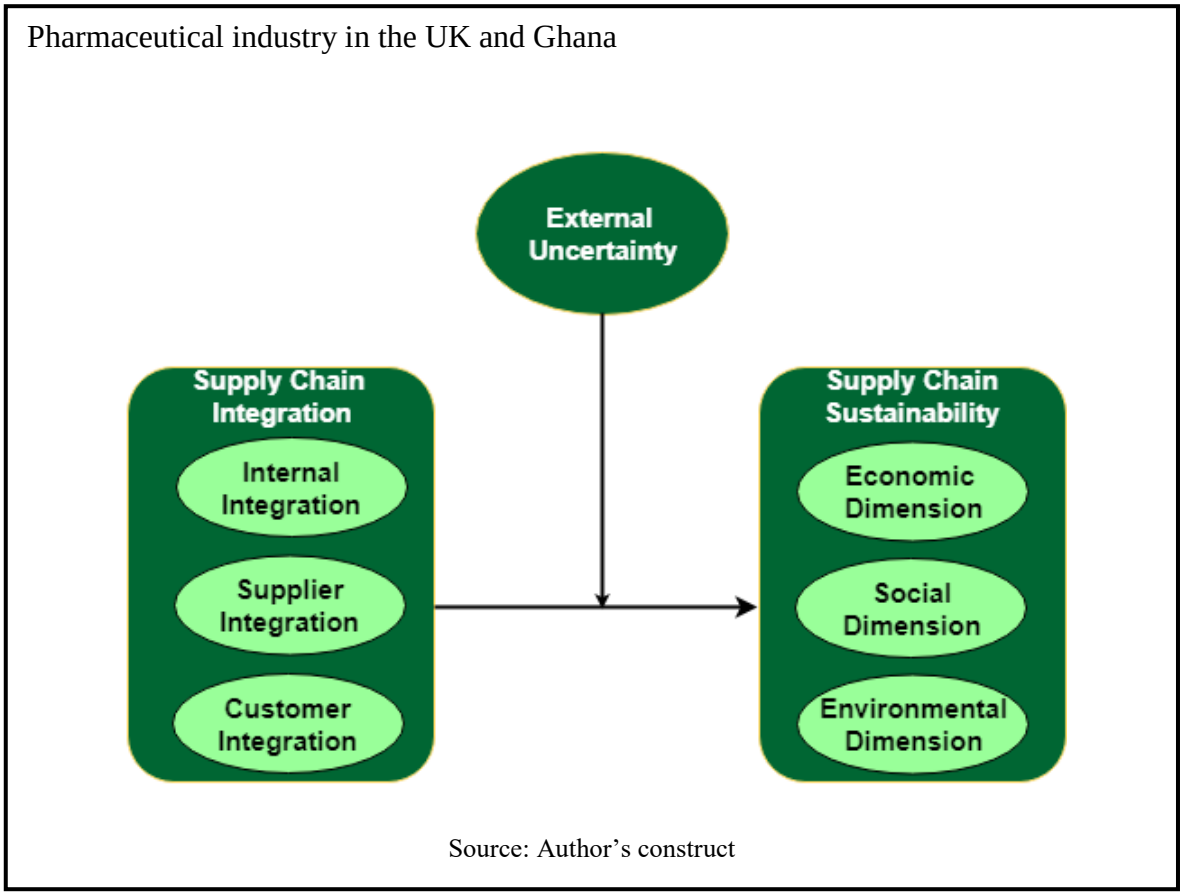


Figure 2.2: **Conceptual framework**

2.6 Summary of literature review

In this chapter, the key constructs SCI, supply chain sustainability, and EU were reviewed. After the review the two main gaps identified were; (1) Less research has been undertaken to explore and understand how companies can effectively and efficiently use SCI to simultaneously impact the economic, social, and environmental dimensions of sustainability (Ahi and Searcy 2013; Asif et al. 2013; Gimenez et al. 2012) to achieve truly sustainable supply chains (Pagell and Shevchenko 2014) (2) Little research has been undertaken to explore and understand the contextual factors (both internal and external) and conditions in which SCI is most effective (Sousa and Vous 2008; Wong et al. 2011). Thus, there is no key model that provides insight into the internal and external factors which contribute to enhancing supply chain sustainability through SCI. Based on the aforementioned gaps the research questions were developed as follows; (1) What is the impact of SCI on supply chain sustainability? (2) What internal and external factors enhance or hinder supply chain sustainability through SCI? As the study focuses on the pharmaceutical industry, an overview of the pharmaceutical industry is presented in the next chapter.

CHAPTER 3

OVERVIEW OF THE PHARMACEUTICAL INDUSTRY

3.0 Chapter overview

As the study mainly focuses on the pharmaceutical industry to study the established conceptual framework (Figure 2.2), it is important to review the pharmaceutical industry and demonstrate how the constructs supply chain integration (SCI), supply chain sustainability, and external uncertainty (EU) collectively fit into the pharmaceutical industry as a whole. This chapter reviews the pharmaceutical supply chain and its structure with a focus on the UK (developed countries) and Ghana (developing countries). The chapter further establishes the issues faced by the pharmaceutical industry and classifies these issues using the three dimensions of supply chain sustainability.

3.1 The pharmaceutical supply chain and its structure

According to Shah (2004) "the pharmaceutical industry is defined as multifaceted processes, operations, and organisations involved in the discovery, development, and manufacture of drugs and medications". The pharmaceutical supply chain, despite the differences on a country basis, has similar *main players* (FDA 2011; Shah 2004), thus ranging from;

(1) Material suppliers; They supply pharmaceutical materials and ingredients for manufacturing companies for drug production.
(2) Manufacturing companies, which can be classified into four groups.
    - Large multinational R&D pharmaceutical companies engaging in branded product manufacturing.
    - Large generic manufacturers who manufacture out of patent products and over the counter products.
    - Home country based local manufacturing firms producing generic and branded products.
    - Contract manufacturers who provide outsourcing services to other pharmaceutical companies.
(3) Pharmaceutical wholesalers/distributors who are responsible for the storage and distribution of drugs manufactured by pharmaceutical manufacturers to retailers.

The distributors may be companies owned by the manufacturing companies or retailers themselves or as 3PL's. There also exist distributors who transport the raw materials for production from the suppliers to the manufacturing company sites.

(4) Pharmaceutical retailers who sell already produced drugs to customers as over the counter or prescribed drugs.

(5) End consumers; These consist of the persons who purchase the drugs directly from the retailers and wholesalers for human consumption.

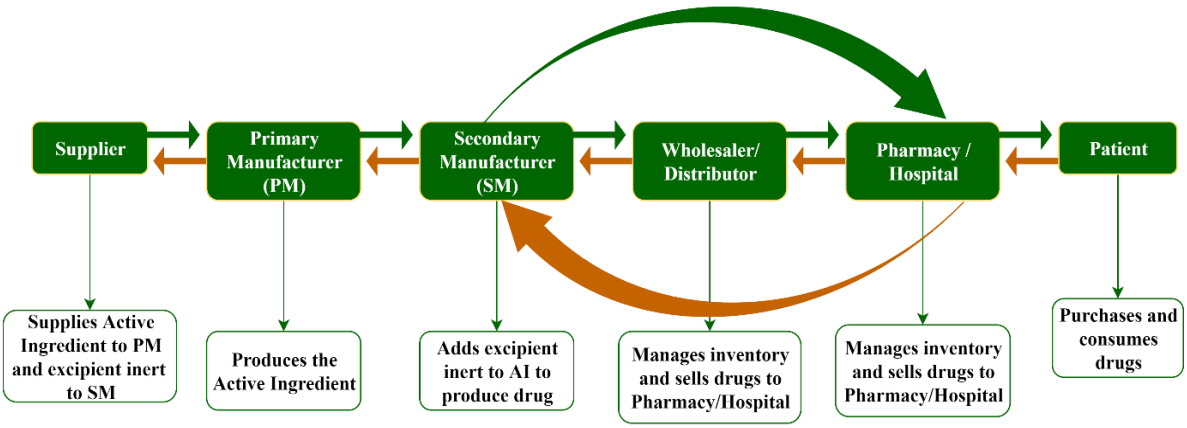
In summary, the pharmaceutical supply chain consists of the material suppliers, manufacturers, wholesalers/distributors, retailers and end consumers (FDA 2011; Shah 2004).

3.1.1 The pharmaceutical supply chain distribution network in developed (UK) and developing (Ghana) countries

A *distribution network* is a system a company uses to get products from the manufacturer to the end consumer (Donkor 2015). In the case of the pharmaceutical supply chain, the distribution network describes the system pharmaceutical companies use to get materials and products from the manufacturer through to the end consumer (Buckley and Gostin 2013). An effective distribution network is vital to a thriving firm as customers can get products/services at the right place and time and in the right quantity. Access to medicines largely relies on how effective supply chains are in transporting products from upstream to downstream the supply chain. Scholars argue that pharmaceuticals are distinct and cannot be treated like other products. Especially due to the high cost, high/complex regulations, and long research duration and the repercussions of drugs not being available, which makes the distribution network more critical to deal with (Breen 2008; Donkor 2015; Macarthur 2007). However, though the distribution network for pharmaceutical products differs from that of other products, for example, is that for the food and drinks, the activities carried out in both networks are similar. For example, the storing and transportation of different products under different temperature zones from supplier to manufacturer, distributor/wholesaler, and through to the retailer and end consumer (Donkor 2015; FDA 2011) whilst following laid down standards/procedures. Figure 3.1 gives a diagrammatic view of the general structure of the pharmaceutical supply chain and further details the key activities each player engages in.

In developed countries (including the UK), private distributors are known as the main distributors of pharmaceutical products for both private and governmental pharmaceutical retailers. Whilst in developing countries the government is known to mainly control and carry out such distribution activities (Yadav and Smith 2012). Also, the regulatory framework in the UK is known to be strong with well-developed capacity and strategies to enforce regulations as compared to developing (Ghana) countries. Due to the strong enforcement of regulations in developed (UK) countries, there is a strong market for both patented and generic drugs whilst that in developing (Ghana) countries is mainly branded generics which is used as a sign for quality. In Ghana, most retail pharmacies serve as the first point of call/contact for most patients in terms of drug dispensing. Whilst for the UK, patients first contact their GP and with an authorised formal prescription, they are then able to obtain prescribed drugs from the retail pharmacies. It is important to note that prescriptions and dispensing of drugs are mainly subject to availability at the retail pharmacies. Hence, raising the need for effective and efficient operational activities throughout the supply chain down to the retail pharmacies, especially in developing countries as the retail pharmacies serve as the first point of contact to patients.

Additionally, it is known that there is fewer presence of intermediaries in the pharmaceutical supply chain distribution network of developed countries, including the UK, as compared to that of developing countries that have a higher presence of intermediaries (Ojokuku et al. 2012). Table 3.1 shows examples of the differences in the structure of the pharmaceutical supply chain in developed countries compared to developing countries.



Source: Author's construct

***Figure 3.1*: General pharmaceutical supply chain distribution network**

Table 3.1: **Differences in the structure of the pharmaceutical supply chain in developed and developing countries**

Factor	Developed Countries	Developing Countries
Payer or reimbursement	• Strong presence of public or private insurance companies • Limited out-of-pocket expenditure	• Mostly out-of-pocket payments. • Growing of private insurance in some markets
Regulatory Structure	• Strong, well defined laws • Good enforcement of regulations	• Weak, fragmented regulatory structures • Weak enforcement of laws
Patent, generic vs. branded	• Market for prescription drugs consist of patented and generic drugs	• Strong market for branded drugs (brand used as sign for quality
Prescription adherence	• Dispensed only with a formal prescription	• Retailers mostly dispense drugs.
Balance of power	• Buyer (insurance companies or national health system) monopoly creates good balance of power between manufacturer and patients	• Balance of power is tilted toward the manufacturer and distribution channel. • Patients have little bargaining power

Source: (Buckley and Gostin 2013; Yadav and Smith 2012)

3.1.1.1 Brief description of the general pharmaceutical supply chain distribution network

Figure 3.1 gives a diagrammatic summary of the key players in the pharmaceutical supply chain and shows how inventory and information flow across the supply chain. Thus, from the supplier to the customer and vice versa. This diagrammatic summary is both in the context of developed and developing countries with a focus on the UK and Ghana.

Firstly the supplier (s) is known for providing raw materials to the primary manufacturers which are needed to produce the active ingredient at the manufacturing stage. The supplier (s) also supplies secondary manufacturers with raw materials needed in addition to the active ingredient produced by the primary manufacturers to produce the actual drug. Secondly, the primary manufacturers use the raw material supplied by the supplier(s) to manufacture the active ingredient needed in all produced drugs. Thirdly, the secondary manufacturer then produces the excipient inert which is added to the active ingredient produced by the primary manufacturer to produce the actual drug. Fourthly, the wholesalers/distributors are known to either buy and own and transport the produced drugs to the retailers or transport the produced drugs to retailers on behalf of the secondary manufacturers. Fifthly, the retailers buy the drugs from the wholesalers or secondary manufacturers directly and sell the drugs

to customers/patients. Retailers sell both over-the-counter drugs and prescription drugs. Lastly, the patients are the ones who buy the produced drugs for consumption.

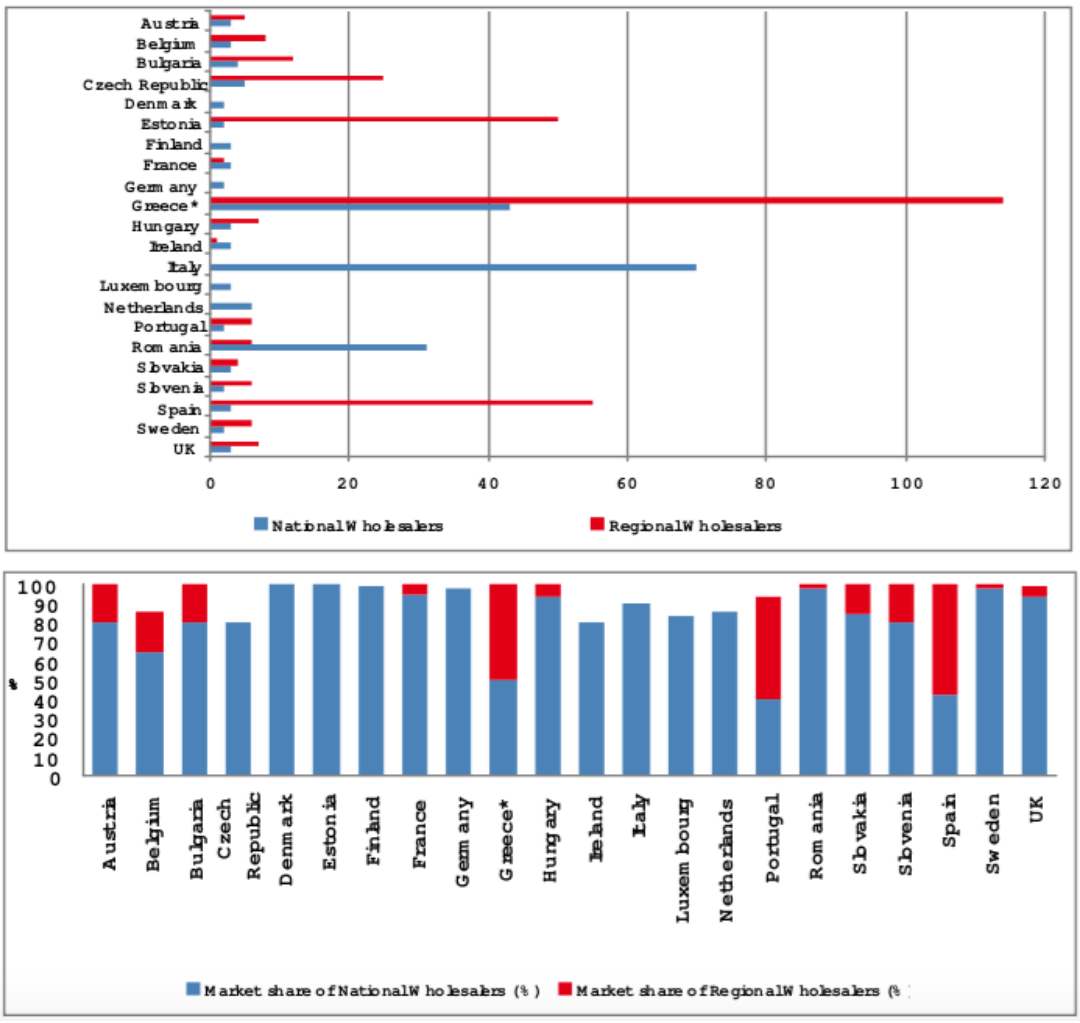
The green arrows moving from the supplier stage straight through to the patient stage show the flow of inventory and information from upstream to downstream of the supply chain. Whilst the dark brown arrows show the reverse flow of inventory and information from downstream to upstream which is also known as reverse logistics.

3.1.2 Market structure in wholesaling/distribution

3.1.2.1 Developed (UK) country context

The majority of countries in Europe including the UK have a mix of both national and regional wholesalers distributing products to retail stores. Thus the national wholesalers are known for distributing the full range of drugs (Full Line Wholesalers) whilst regional wholesalers distribute either a full or partial range of drugs (Short Line Wholesalers). Although the number of wholesalers that distribute pharmaceutical products regionally may be higher than those that distribute nationally, the national wholesalers dictate the direction and major share of the market (Kanavos et al. 2011) (Figure 3.2).

A minority of countries (for example Sweden, and Finland) have single-channel systems where a wholesaler has the exclusive right to distribute drugs for a manufacturer, hence have a stronger market power than wholesalers in multi-channel systems like that of the UK (Donkor 2015; Kanavos et al. 2011; Koh et al. 2003). During the last ten to twenty years, the UK has seen a number of mergers among wholesalers and a reduction in the number of operating wholesaler firms (Vogler et al. 2010). This shift has resulted in the introduction of agency models and fewer wholesaler models in the distribution of pharmaceutical products. Indicating that pharmaceutical manufacturers now supply pharmacies directly (Direct-To-Pharmacy or DTP) by using a single (or multiple) wholesaler (s) as a logistics provider (Agency Model) for a fragment of their product range or entire product range. Similarly, manufacturers can venture into agreements with a fewer number of wholesalers to distribute a fragment or their entire product range. This however results in fragmentations in the wholesaling activities, hence having repercussions on the structure of the wholesale sector (Donkor 2015; Tuma 2005). As a result, there is a need for proper integration of activities between these key players for efficient and effective distribution activities.



Source: Kanavos et al. (2011)

***Figure 3.2*: Description of national and regional wholesaler presence in the UK and other European Union member states**

3.1.3 Issues/challenges in the pharmaceutical supply chain

The pharmaceutical supply chain entails the production of medications, the distribution and transportation of the produced medications, the consumption of produced medications, and the disposal of waste. These activities are carried out by the players of the pharmaceutical supply chain as detailed in the previous section (3.1). According to Shah (2004) historically most management and researchers have focused on the drug discovery and marketing sections of the supply chain. However, there is a shift towards using different strategies to optimise the operations and activities of the players in the pharmaceutical supply chain from upstream to downstream. Further indicating that there is a shift from viewing the supply chain as delivering security of supply at minimum cost, to generating and strategising capability to create value for the customers and shareholders.

At each stage of the supply chain, there are a series of challenges and risk exposed to players of the supply chain, thus from upstream (material supplier) to downstream (customer stage). Although the issues faced in the UK is different to that of Ghana or any other country, there are commonalities with regards to general issues faced at each stage of the pharmaceutical supply chain by pharmaceutical companies despite the geographical differences. The issues largely range from *the production and inventory management issues, distribution challenges, outsourcing and parallel trade issues, counterfeit, recalled and expired pharmaceutical products, waste disposal, and recycling, etc.* (Kanavos et al. 2011; Shah 2004; Yadav and Smith 2012). These identified issues are discussed at each stage of the supply chain in the next subsections.

3.1.3.1 Manufacturers / Manufacturing

Production and inventory management issues

Inventory is any material that a firm holds to satisfy customer demands (Mangan et al. 2012). Inventories can be in the form of raw materials, work in progress materials, or finished products conveyed through the supply chain to the end consumer. To meet the aim of this thesis, the review will be based on issues the pharmaceutical companies face in production and managing inventory throughout the supply chain from upstream to downstream. This is key as the challenges upstream directly/indirectly affect the performance at the end of the chain (retail pharmacies and end consumers).

From an operational perspective, most manufacturing pharmaceutical companies face challenges with regards to responsiveness (Kanavos et al. 2011; Shah 2004). This is very noticeable especially during higher demands for medicines which involve the production of primary active ingredient (AI) and a secondary (medicine formulation) production, due to *production and inventory management challenges.* That is, both the primary and secondary manufacturing undergoes strict production and quality guidance at several points, which mostly results in low production throughput compared to other commodities/products (e.g. grocery) that has less number of quality checkpoints across the entire supply chain. This issue normally results in low capacity utilisation in some pharmaceutical companies. In cases where capacity utilisation is low, companies are known to multitask their production sites by introducing new products (mostly non-pharmaceuticals) to spread the cost across the different products. This strategy also leads to delays especially as pharmaceutical companies have strict requirements for quality / avoidance of cross-contamination of products.

Primary manufacturing

Primary manufacturing mainly engages in the production of the active ingredient (AI) which is used as the main input by the secondary manufacturers for drug manufacturing. The primary manufacturing level is mostly characterised by long task processing times (Kanavos et al. 2011; Shah 2004), which consist of several shifts, hence mostly leading to many inventories being held between the production stages (Donkor 2015). Besides, as the pharmaceutical industry is highly regulated both in the UK and Ghana, the high levels of inventory that are held in the supply chain are subjected to a number of quality control checks at each level of the chain. This leads to the problem of long lead time and delays, as well as higher production costs due to elongated and high inventory holding between the stages of manufacturing. The aforementioned issue also affects the availability and cost of products at the retail pharmacies (Donkor 2015; Shah 2004; Yu et al. 2014). Also, manufacturing companies especially the secondary manufacturers responsible for adding "excipient" to the AI produced by the primary manufacturers face external uncertainty in the form of high competition, and technology regarding which newly manufactured drugs will pass the trials and will be accepted by consumers.

Secondary manufacturing

This stage mainly engages in taking the AI produced by the manufacturers at the primary level and adding *excipient inert* materials to produce the final product (Shah 2004). At this stage, additional processes and packaging are also done to produce the final products. The issue of demand fluctuations is known to be present at the secondary manufacturing level which mostly results in difficulties in forecasting the right amount of inventory needed to be stored or bought at different time intervals to enable achieve effective responsiveness within and across the supply chain (Shah 2004; Shah 2005). As the secondary manufacturing stage depends exclusively on the output (AI) from the primary manufacturers', pharmaceutical companies are compelled to hold excess AI as a result of the long production and testing cycle time at the primary manufacturing level. This act by the secondary manufacturers is to boost their capacity and responsiveness to meet the high product demands by customers down the supply chain in an effective manner. Also, the issue of storing a high amount of AI has been influenced by the high demand and growth of branded pharmaceutical products both in the UK and Ghana. Particularly as these products have complex, long, and costly lead times from the upstream to downstream the supply chain (Donkor 2015; UK Trade and Investment 2013).

Taylor et al. (2006) studied the UK pharmaceutical companies to examine how these companies conform to the Medicines and Healthcare products Regulatory Agency (MHRA) regulation of Good Manufacturing Practice (GMP) and Good Distribution Practice (GDP). According to Taylor et al. (2006) results, numerous inventory management issues were identified as shown in Table 3.2. The issues were classified based on the most frequently reported. According to Taylor et al. (2006) identified issues in Table 3.2, lack of consistent and accurate manufacturing documentation (predominantly as a result of less investment in IT equipment), handling and control of packaging components, and quality management issues were ranked as the main three issues.

Due to these identified issues, it is key to have pharmaceutical companies understand these issues and find integrative ways to manage their inventory. This is important to help the companies become more responsive to uncertain market demands whilst utilizing their capacity and inventory efficiently and effectively (Shah 2004). Shah (2004) further indicated that the change in demand is mostly associated with the business processes rather than external factors. Hence, structuring and integrating the activities of the pharmaceutical manufacturing companies internally and with suppliers (material suppliers and primary manufacturers) and customers (secondary manufacturers, wholesalers, and retailers) is also important.

Table 3.2: **Inventory management issues among UK pharmaceutical companies (2004-2005)**

Category of deficiency	Incidence (%)
Manufacturing documentation	14.3
Handling and control of packaging components	14.3
Quality management	10.7
Evidence of compliance with TSE guidelines	7.1
Line clearance, segregation, and potential for mix-up	7.1
Validation documentation	7.1
Failure to respond to previous inspection findings	7.1
Batch release	3.6
Clearing validation	3.6
Potential for non-microbial contamination	3.6

Source: Taylor et al. (2006)

3.1.3.2. Wholesalers / Distributors

Production and inventory management issues at the wholesalers/distributors

Rossetti et al. (2011) conducted a study that aimed at examining the "forces, trends, and decisions in pharmaceutical supply chain management" which took into consideration that of wholesalers'. In Rossetti et al. (2011) study, it was identified that it is imperative for wholesalers to know that their activities have a great effect on the *responsiveness, quality, and availability of drugs* to patients. This raises the need for critical care and following laid down procedures when carrying out activities at the wholesale level (Donkor 2015).

From the distributor's point of the pharmaceutical supply chain, distributors are known to face inventory management challenges such as the *inadequate flow of information across the supply chain with manufacturers and retailers and other key stakeholders, limited use of technology* as compared to other commodity industries especially in the context of developing countries (Ghana), and *restricted roads and poor transport systems especially in a developing country context like that of Ghana* (WHO 2006). In the context of developing (Ghana) countries, there is an identified issue regarding *limited funds to purchase appropriate vehicles, vehicle maintenance and repairs, fuel and driver salaries, as well as finding an appropriate balance between low distribution cost and service levels* (USAID 2011). Thus if there is a high distribution frequency, transportation cost goes high even though the service level is positively impacted.

Additionally, with reference to the study by Taylor et al. (2006) on Good Manufacturing Practices (GMP) of UK pharmaceutical companies, the study also examined and identified the most frequently reported Good Distribution Practices (GDP) deficiencies. Examples identified were *inventory related issues such as general storage (temperature control and monitoring) which has been identified as a persistent and most reported issue from 2001-2005. In 2005, (Table 3.3)* r*eturns/reverse logistics of pharmaceutical products (waste, damaged, wrong, and expired products) were also identified as a critical problem. Besides, studies show that apart from general storage been the most reported issue, it also has the maximum influence on the quality and availability of drugs to patients down the supply chain (*Donkor 2015; Rossetti et al. 2011; Taylor 2001).

***Table 3.3*: Trends in the most frequently reported pharmaceutical GDP deficiencies in third countries**

Description of deficiency	Ranking by year				
	00-01	01-02	02-03	03-04	04-05
General storage - temperature control and monitoring	3	1	1	1	1
Returns	4	4	11	7	2
Lack of or inadequate written procedures	1	3	2	2	3
Unauthorised activity	-	-	-	-	4
Cold storage - temperature control and monitoring	2	2	3	4	5
Housekeeping and pest control	8	10	5	6	6
Cold chain transportation	-	-	7	8	7
Customer status	13	17	-	-	8
Premises, equipment and collaboration	9	7	4	3	9
Duties of responsible person	5	6	6	5	10

Source: Taylor et al. (2006)

Distribution challenges in developed (UK) countries context

Although from the literature, it can be seen that there have been more development and forceful regulation enforcement in the pharmaceutical supply chain in developed countries compared to developing countries, there still exist some challenges within the distribution network in developed countries like that of the UK.

In developed countries most especially, the structure of the pharmaceutical industry has gone through several changes that have created enormous complexities for distribution activities throughout the supply chain. Although there are differences in the distribution activities carried out in the developed countries, there are identical issues faced by distributors in these countries (Macarthur 2007). Yadav and Smith (2012) mentioned that during the past few years, due to several developments, including *advancements in IT and logistics, increased bargaining power of consolidated retailers, and a more active role of manufacturers in the distribution of drugs,* wholesalers are subjected to the persistent issue of high cost and competitive pressure. Based on these developments and issues, the worth of some components of the distribution network has frequently been questioned in context to the services delivered and the overall cost of these services (Donkor 2015).

The *squeezing of wholesalers within the distribution network* is also known as another major issue. Kanavos and Wouters (2014) mentioned that wholesalers' are faced with the issue of

offering a fraction (mostly 1.5-3.5 %) of their allowable margin as a discount to retailers mainly to preserve and ensure continuity of their operations. Several wholesalers are getting out of the job market as a result of the high squeeze on their margins. In the UK for instance, the distribution model is known to have experienced major modifications in the past 5 years with the development of agency and reduced wholesaler engagements with approximately 11% of pharmaceutical products been delivered by short-line wholesalers (GIRP Database 2010 cited by European Union 2014). Due to this development, the number of full-line wholesalers' is decreasing whilst that of short-line wholesalers' is rather increasing. Also, in the case of personalised pharmaceutical products, wholesalers are known to offer discounts (adding up to about half whilst in some instances even more) of their allowable margin (12.5%) to retailers. This serves as a barrier for distributors to *achieve marginal profits that can be reinvested into their operational activities to ensure maximum growth that can match up with other retail sectors (an example is the food sector) that are now more technology inclined* (Donkor 2015).

In recent years, it has also been noted that there is the existence of high *competition among wholesalers* for retail operations which has progressively increased. This is mostly in the developments in IT and logistics, and also in the form of having *manufacturers who are more concerned in creating direct vertical links with pharmaceutical retailers, which is known as the Direct-To-Pharmacy type of operations.* Although this comes with the advantages of decreasing fragmentation in the supply chain, manufacturers and retailers are in a way obliged to create their own wholesale distribution network which requires high fixed and operating cost (European Union 2014). Moreover, the rise in Direct-To-Pharmacy in mostly the developed countries (including the UK) has resulted in the introduction of other distribution models, for example, the *sole agency* model. With the sole agency, the manufacturer engages directly with its customers by using a sole wholesaler that operates in the form of a logistics provider (Yadav and Smith 2012). Other introduced models also include the Reduced Wholesaler Model (RWM) that normally has a manufacturer select a few numbers of wholesalers (mainly a maximum of three) as logistics providers. Wholesalers known to engage in the sole agency model are not able to offer the competitive discounts offered by other wholesalers, as technically they do not own and have full control over the pharmaceutical products been sold to the manufacturer's customers. Such squeeze on the operational activities of the wholesalers (which tremendously affects their financial

state) is seeing a great number of these wholesalers go out of the wholesale job market (Donkor 2015; Kanavos and Wouters 2014).

Florence and Lee (2011) also indicated that due to the high rise in demand for *personalised drugs*, this has also amounted to seeing a number of problems in the UK's distribution channel. Especially as thousands of these *personalised drugs* are to be produced, transported, and monitored as each branded product has a distinctive supply chain requirement (Donkor 2015).

Distribution challenges in developing (Ghana) countries context

The challenges associated with transportation and distribution activities by wholesalers/distributors in developed countries (UK) is similar to that of developing (Ghana) countries. Thus, challenges ranging from; wholesalers faced with the high cost and competitive pressure in recent years as a result of several developments including advancements in IT and logistics, increased bargaining power of consolidated retailers, a more active role of manufacturers in the distribution of drugs (e.g. DTP), and high squeeze on wholesalers/distributors profit margins. Aside from these challenges, in the context of Ghana, most wholesalers/distributors face the *issue of combining the duties of drug importation and distribution even though most of these wholesalers have low capacity to carry out these activities effectively and efficiently.* This issue is linked to the high importing nature of the Ghana pharmaceutical industry. Also, there are difficulties for wholesalers/distributors to reach most especially rural areas due to *poor transport infrastructure*. The few wholesalers who take on this challenge also face difficulty during the last mile. These wholesalers mostly factor in this challenge of requiring *more time and resources for exceptionally long deliveries extending to sparsely populated villages* far from a paved road, and further from a supply centres into the cost price of products. In addition, based on the fragmented nature of the pharmaceutical supply chain in Ghana and the existence of several intermediaries makes the chain very vulnerable to introducing falsified or counterfeit drugs into the supply chain (USAID 2011; Yadav 2015; Yadav and Smith 2012).

3.1.3.3 Counterfeit, re-called, and expired pharmaceutical products

The introduction of counterfeit drugs, recalled or expired drugs into the pharmaceutical supply chain has been on the rise globally (EFPIA 2020). The Pharmaceutical Security

Institute reports that between 2011 and 2015 the global incidence of drug counterfeiting has increased by 51%, with 2015 seeing the highest levels of counterfeiting to date. Thus, a 38% increase when compared with 2014. Although this issue is on a rise globally, it is predominant in developing (Ghana) countries than developed (UK) countries. For example, in the UK supply chain alone, only 11 cases of fake medicines were detected between 2001 and 2011. However, in both the developed and developing context, all the aforementioned issues are largely caused by inadequate supervision of the distribution network mostly operationalised through random checks by customs or a delegated official, non-compliance with quality standards in the delivery process of the pharmaceutical industry, and less rigorous and efficient counterfeit detection methods ranging from laboratory-based methods to SMS texting (Amegashie-Viglo and Nikoi 2014; Naughton et al. 2016).

Counterfeit drugs have a high risk of been contaminated, and/or comprising of the wrong dosage or have no active ingredient in them which poses a lot of health concerns to the end consumer. These health concerns are mostly in the form of preventable side effects, prolonged sickness, and in rare cases with vulnerable patients death occurs. On the side of the government, there is also a loss of tax revenue. However, there have been calls for effective integration between stakeholders of the pharmaceutical supply chain to curb the issue of counterfeit, recalled, and expired drugs. A typical example of the integrative activities is to have *a proper authentication process* for drugs in the supply chain. In the UK, according to the falsified medicines directive (FMD), the term 'authentication' relates to the final scanning of drugs and the subsequent decommissioning of a product at the point of supply to the patient to ensure authenticity. Whilst the Drug Quality and Security Act (DQSA) detect the authenticity of drugs at every point of sale throughout the pharmaceutical supply chain. Both FMD and DQSA use serialisation and verification approaches to their detection activities (Naughton et al. 2016).

3.1.3.4 Outsourcing and parallel trade issue in both developed and developing countries

The pharmaceutical companies in both developed and developing countries continue to increasingly make use of third-party logistics companies (3PL's) through outsourcing. However, this increasing approach is making the pharmaceutical supply chain more complex than before. Thus, most of the 3PL's are faced with the issue of having less advanced resources to efficiently and effectively match up with the high rise in operational and distribution activities in the pharmaceutical supply chain globally. This challenge also

affects the effective flow of information regarding consumer demands, the flow of materials and products across the supply chain, as well as a cause of redistribution of pharmaceutical products from less expensive demographics to expensive demographics. The latter issue is technically known as *parallel trading* (Ricci 2006).

Parallel trading

Parallel import happens when the price for a drug is lower in the country of export and parallel export occurs when the price is higher in the country of destination compared to the country of export (Donkor 2015; Ricci 2006). In the context of this thesis, parallel export denotes the export of pharmaceutical drugs meant for use by end consumers in; 1. The UK to other European countries; 2. Ghana to other African Countries.

Although the UK has seen the issue of drug shortages on a continuous basis (All-Party Pharmacy Group (APPG) 2013) the level at which this issue is been experienced has escalated drastically. Parallel trade, operationalised through the export of drugs (by mainly wholesalers') meant for the UK to other European markets, is known as one of the main drivers for the cause of drug shortages. The exportation activity of parallel trade is legal in the European Union and for that matter the UK as well. Such legality has made the tackling of the parallel trade issue and it accompanied complexities, such as drug shortages, more difficult to curb. Precisely in the UK, the issue of parallel trade is affecting the proper running of the pharmaceutical chain to enable meet the exact needs and demands of end consumers (APPG 2013; Costelloe et al. 2014; Donkor 2015).

The pharmaceutical market in the UK and among other European markets is in a way different because price settings for products are regulated by national/international authorities. However in other industries, for example, that of the food industry, prices for products are largely regulated and set by manufacturers or retailers (APPG 2013). In addition to the aforementioned way of setting prices, the continuous selling price reduction for personalised drugs, and the unstable exchange rate for the pound sterling and that of Euro, have contributed to the significant price differences we see for pharmaceutical products in the UK as compared to the European countries (APPG 2013; Donkor 2015; McKee 2015). To support the raised argument, Bart (2008) also mentioned that the way in which prices are set and monies repaid to pharmaceutical players in the UK and the European countries have contributed to the inconsistent prices for same/similar pharmaceutical products between the

UK and the European countries. The aforementioned issue of price variations, in addition to the European Union single market that allows free and fast transportation of goods among members, have exacerbated the issue of parallel trade. Thus, most pharmaceutical players are exporting drugs meant for the UK market to other European countries mainly for higher profits (Donkor 2015). In many cases, the issue of parallel trade has been known to cause a mismatch between the supply and demand of pharmaceutical products in the UK. Hence resulting in drug shortages that put the health of patients in the UK at risk (Killick 2006). The European Medicines Group, and the Chief Executive of the Association of the British Pharmaceutical Industry (ABPI), Stephen Whitehead, mentioned that parallel trade has been one of the key drivers for the issue of drug shortages and unavailability (APPG 2013; Donkor 2015).

With parallel trade, most of the products are relabelled and repackaged which increases the chance of having errors, whilst making it difficult for pharmaceutical players to distinguish between imitated and original products. This creates the need for pharmaceutical companies to integrate with their 3PL's to thoroughly manage the increasingly changing pharmaceutical supply chain demands. This will increase the smooth operations of the company, ensure high drug safety and quality, efficient production level, high responsiveness, and impacts on company profit margins and that of stakeholders (APPG 2013).

3.1.3.5. Regulatory issues

Regulation is defined as "a rule or directive made and maintained by an authority" (Oxford dictionary 2018). Regulations are laws imposed by authorities to make people/organizations follow the desired code of conduct. In the context of the pharmaceutical industry, governmental agencies through their regulation (Hall 2000; Preuss 2005; Zhu et al. 2005) influence the activities of firms that impact how these firms can be sustainable economically, socially, and environmentally.

According to the ABPI (2018) regulatory affairs is a broad domain that encompasses manufacturing and clinical trials, to obtaining a marketing authorisation (MA), labelling, distribution, monitoring safety, and throughout the entire lifetime of medicines. According to the UK legislation, ones a manufacturer's new product passes trials, an application is made to the UK authority to gain marketing authorisation. As the product is launched, there are several UK regulations used to ensure the risk-benefit balance of the products is consistently

monitored, labelling and packaging of products are kept up to date and quality standards are maintained throughout the lifespan of the medicines (ABPI 2018; UKGOV 2017). The regulatory process outlined applies to pharmaceutical products in Ghana as well. However, there are specific regulations formulated by authority bodies at the national level, which differ across countries and affect the activities of the pharmaceutical firms with their suppliers and customers in various ways. In the UK, the Medicines and Healthcare Products Regulatory Agency (MHRA) formulates the pharmaceutical regulations whilst in Ghana the Food and Drugs Authority (FDA) formulates regulations.

Globally, the pharmaceutical industry has seen a proliferation of regulatory change over the years, and the ability of the industry to implement these changes in an integrative, cost-efficient, and timely manner across their supply chains has tested the capabilities of the pharmaceutical industry (Delloitte 2018; Maini 2004).

UK context

Introduction of the Falsified Medicine Directive

The pharmaceutical manufacturers in the UK and in other European countries are to implement (by the end of 2020) the new regulation known as the Falsified Medicine Directive. This new regulation will demand manufacturers to attach unique serial numbers to their packages. These serial numbers will be verified by pharmacists as they dispense medicines to patients. This is to ensure pharmacies dispense the right product from the original manufacturer to ensure patient safety (EFPIA 2016). However, to have a rigorous system, the regulation demands that manufacturers, pharmacists, distributors, and hospitals are to work collaboratively. Current issues being faced are securing funding for the system, data security, educate the public about the regulation and system, building systems in each participating country, and integrating end-users into the system.

Ghana context

Regulations in the Ghana pharmaceutical industry aims to (1) have all persons get access to medicines, (2) have quality assurance for all accessed drugs, (3) have a sustainable supply chain and proper use of medicines by patients (Harper and Gyansa-Lutterodt 2007). Some of the key regulatory issues in the Ghana pharmaceutical industry are limited capacity for regulations enforcement, fragmented supply chain which makes regulations enforcement and monitoring difficult, and lack of funding and investment into enforcing regulations

concerning quality improvement. Some of the less enforced regulations is that of pricing pharmaceutical products (Yadav and Smith 2012). Thus, different levels of margins are applied to pharmaceutical products. Manufacturers have a range from 10-40%, wholesalers normally add 10-20% whilst retailers have a margin of 20-50% averagely (Harper and Gyansa-Lutterodt 2007).

3.1.3.6 Unique issues

Ghana context

The Ghana distribution network is known to be less regulated compared to that of the UK and other developed countries. There is also less capacity to produce essential drugs that meet international standards. Hence there is a heavy reliance on importations which are mostly subjected to high uncertainty and vulnerable to the introduction of imitated drugs into the pharmaceutical supply chain. Moreover, drugs which are produced locally usually have high manufacturing cost which affects the selling price of the drugs compared to imports from mostly China and India. According to Enyinda et al. (2009) in the Ghana pharmaceutical industry for example, out of 3,000 drugs registered with the Food and Drugs Board (FDB) only 900 are locally manufactured (cited in Amegashie-Viglo and Nikoi 2014). The issue of highly relying on imported drugs was also mentioned by Harper and Gyansa-Lutterodt (2007). They further indicated that with the Ghana pharmaceutical industry, 30% of the drugs are locally manufactured whilst 70% are imported mostly from China and India. This creates the issue of high competition uncertainty and excessive pressure on the local pharmaceutical manufacturing companies as most customers in the Ghanaian context opt for the cheaper products from China and India. The existence of several intermediaries in the Ghanaian pharmaceutical supply chain causes fragmentation in the chain. This also makes the chain vulnerable to counterfeit introduction as there are more handling points by different players across the supply chain.

UK context

Anticipated issue based on Brexit

Most of the pharmaceutical companies have established their European headquarters in the UK due to the free movement among European Union member states and unrestricted access to the European Union market. This has led to the creation of jobs and a boost for the UK economy at large. However, due to Brexit (thus when the UK finally leaves the European Union completely), the pharmaceutical companies are likely to face challenges. The

challenges will range from restricted movement and procedures in integrating with their suppliers, customers, and partners especially beyond the borders of the UK. This might also motivate the majority of the pharmaceutical companies to relocate their headquarters from the UK which will affect the employment rate in the pharmaceutical sector in the UK. The benefits of the single market constituting access to the wider European market by UK pharmaceutical companies will be subjected to risk when Brexit takes effect.

3.1.4 Categorisation of identified pharmaceutical issues

All the key identified issues from the review of the pharmaceutical supply chain in developed and developing countries with a focus on the UK and Ghana are summarised in Table 3.4. The identified issues are categorised under the three dimensions of supply chain sustainability. Thus, the identified issues are categorised based on the dimension of sustainability (thus either the economic dimension, social dimension, or environmental dimension or on all the three aforementioned dimensions of sustainability) they have an impact on. Based on the previous review on SCI, this thesis proposes that each of the identified issues can be curtailed through the use of SCI. This further indicates the relationship between SCI and supply chain sustainability (Table 3.4).

3.2 Conclusion

In this chapter, the pharmaceutical supply chain in both the UK (developed countries) and Ghana (developing countries) were reviewed. After the review, all the identified issues facing the pharmaceutical industry were classified under the economic, social, and environmental dimensions of supply chain sustainability. Also based on the review on SCI in chapter 2, various dimensions of SCI were given as a proposed solution in tackling the identified issues facing the pharmaceutical industry. Based on the review in chapter 2 and 3, the posited hypotheses based on the mentioned research questions are detailed in the next chapter.

***Table 3.4*: Pharmaceutical issues and proposed SCI solution**

Supply chain sustainability	Supply chain stage	Issues	Reference	Proposed solution
Economic	Production	Delays in production (multitasking and GMP issues)	1,3,19	II
		Excess inventory due to long processing times and multiple tiers. Affects lead times, increases the cost of production and availability of drugs to end consumers	17	II, SI, CI
		High competition and technology uncertainty	17	II, SI, CI
		Long production and testing cycle at manufacturing stages resulting in high inventory holdings	1	II
		High manufacturing cost	1,16,17	II, SI, CI
	Distribution	Parallel trade issue	3,7,19	II, SI, CI
		Unsafe and Counterfeit drugs	15,16	II, SI, CI
		Re-called and expired drugs	11,15	II, SI, CI
		Limited funds to purchase appropriate vehicles, maintenance, repairs, fuel and driver salaries *	17	II, SI, CI
		Less efficiently designed route systems to balance between low distribution cost and service levels	9,12	II, SI, CI
		Competitive pressure and uncertainty: IT advancement, Unexpected demand	19	II, SI, CI
		Squeeze on wholesalers profit margins	6	II, SI, CI.
		Issue of combining the duties of drug importation and distribution even with low capacity	17	II, SI, CI
		More time and resources for exceptionally long deliveries extending to sparsely populated villages. Affects cost.	12,17	II, CI
	Retail	High cost and competitive pressure	2,8,16,17	II, SI, CI
		High retail cost due to high distribution cost	16	II, SI, CI
	Entire chain	Demand and Finance Fluctuations affecting supply chain responsiveness	17	II, SI, CI
		Strict and numerous quality checkpoint throughout the supply chain which causes delays	1	II, SI, CI
		Lack of consistent and accurate documentation and information flow (mainly due to less investment in IT equipment's/infrastructure	1,17	II, SI, CI
		Limited use of technology, resulting in less flow of information across the supply chain	17	II, SI, CI
		General storage (temperature control and monitoring) issues.	1	II, SI, CI
		Fragmented nature of the pharmaceutical supply chain	2,12,17	II, SI, CI
		Inadequate supervision of the distribution	2,6,16	II, SI, CI
		Lack of well-functioning transport system *	17	II, SI, CI
		Brexit: anticipated to affect trade and movement (less integrated supply chain) **	14	II, SI, CI
		Drug shortages	3,12,19	II, SI, CI
		Poor transport systems / poor transport infrastructure *	17	II, SI, CI
		Weak fragmented regulatory structures and poor regulatory enforcement *	12,16,17	II, SI, CI

		Most patients buy drugs with out-of-pocket money and have less bargaining power compared to developed countries where mostly the NHS creates a good balance between manufacturers and patients *	12,13	II, SI, CI
Environmental	Production	None found	NA	
	Distribution	Re-called and expired drugs	15	II, SI, CI
		Less appropriate waste, damaged, wrong and expired products disposal	11	II, SI, CI
	Retail	Inappropriate waste, damaged, wrong and expired products disposal	11	II, SI, CI
	Entire chain	Inadequate supervision of the distribution activities. Leading to falsified/contaminated drug introduction	2,16	II, SI, CI.
		Heavy reliance on importations mostly subjected to high uncertainty and vulnerable to the introduction of imitated drugs	4,5	II, SI, CI
Social	Production	None found	NA	
	Distribution	Unsafe /Counterfeit drugs	16	II, SI, CI
		Re-called, expired and waste disposal health issues	11	II, SI, CI
		Limited funds to purchase appropriate vehicles, maintenance, repairs, fuel, and driver salaries *	17	II, SI, CI
	Retail	competitive pressure and uncertainty: IT advancement, bargaining power of retailers affecting wholesalers	17	II, SI, CI
	Entire chain	Inadequate supervision of the distribution activities	2,16	II, SI, CI
		Fragmented nature of the pharmaceutical supply chain	2,6,10,17,18	II, SI, CI.
		Brexit: anticipated to affect trade, movement, funding, drug availability and regulations **	14	II, SI, CI

Note: 1. **: Peculiar Issues mostly to developed countries. 2. *: Peculiar Issues mostly to developing countries. II- Internal Integration, CI- Customer Integration, SI- Supplier Integration. 3. Listed issues with no asterisks are issues for both developed and developing countries.

Reference and given codes

Reference	Taylor et al. (2006)	Yu et al. (2014)	Costelloe et al. (2014)	Enyinda et al. (2009)	Harper and Gyansa-Lutterodt (2007)	Kanavos and Wouters (2014)	Killick (2006)	Wouters et al. (2017)	Chandani et al. (2012)	Rossetti et al. (2011)
Given code	1	2	3	4	5	6	7	8	9	10
Reference	Xie and Breen (2012)	Buckley and Gostin (2013)	Yadav and Smith (2012)	PwC (2018)	Naughton (2016)	Wirtz et al. (2017)	Yadav (2015)	Maiga and Williams-Jones (2010)	Bigli (2013)	
Given code	11	12	13	14	15	16	17	18	19	

CHAPTER 4

THEORETICAL FRAMEWORK

4.0 Chapter overview

This chapter gives details on the theoretical foundation for the research and proposes the hypotheses for the research. The chapter first presents the use of the stakeholder theory for the SCI-supply chain sustainability relationship. Followed by the contingency theory for the EU and SCI- supply chain sustainability relationship. The use of the dynamic capability theory for both aforementioned relationships is also presented. The chapter further proposes the hypotheses for the impact of SCI on supply chain sustainability, and the moderating role of EU on the SCI- supply chain sustainability relationship. Based on the theoretical foundation and proposed hypotheses, the theoretical framework for the research was developed and presented.

4.1 SCI-supply chain sustainability relationship: The stakeholder approach

Many scholars from different disciplines mainly started applying the stakeholder theory after the seminal works of Freeman (1984) titled "Strategic Management: A Stakeholder Approach", and Mitchel et al. (1997) titled "Toward a Theory of Stakeholder Identification and Salience: Defining the Principle of Who and What Really Counts". However, only a few applications of the stakeholder theory has been applied in SCI studies, which this thesis addresses. A stakeholder denotes a person or group that has either a direct (primary stakeholder) or indirect (secondary stakeholder) impact on an organisations activities or is impacted by the activities or outcome of an organisation (Freeman 1984; Waddock et al. 2002). The given definition of a stakeholder shows the importance each stakeholder has on the activities or overall outcome of an organisation. Depending on the activities of a company, priorities might be placed on either the primary, secondary, or both primary and secondary stakeholders. In the context of this thesis, both primary (manufacturers, wholesalers, distributors, retailers, pharmaceutical regulators) and secondary (national pharmaceutical trading associations) stakeholders in the pharmaceutical supply chain are considered as both play key roles in achieving supply chain sustainability (Wolf 2011) throughout the supply chain.

Theoretically, this thesis first integrates the stakeholder theory in studying the SCI- supply chain sustainability relationship. The stakeholder theory is defined as the combination of a firm fulfilling its business goals toward its stakeholders whilst maintaining the morals and values in managing the organisation (Friedman and Miles 2002). The given definition suggests that for a company to positively impact supply chain sustainability (and further achieve a truly sustainable supply chain) demands the involvement of all the key stakeholders within/across the supply chain (Wolf 2011). That is, the joint effort of all the supply chain stakeholders in strategic and/or operational decisions/activities are essential to positively impact the social, economic, and environmental performance of the focal firms and that of suppliers, customers, and other key stakeholders across the supply chain. Drawing from this argument, this thesis applies the stakeholder theory by collecting data from the key stakeholders (manufacturers, wholesalers, distributors, retailers, pharmaceutical regulators, and national pharmaceutical trading associations) in the pharmaceutical supply chain to study how the pharmaceutical companies can use SCI to improve their economic performance and that of supply chain stakeholders whilst maintaining ethical and environmentally friendly processes and products throughout the supply chain. Hence, meeting the set research questions.

4.2 SCI-supply chain sustainability relationship: The contingency approach

There was an assertion that the application of best practices in different areas leads to an increase in performance (Voss 1995). However, the acceptance of the aforementioned argument became questionable over time. Thus as different industries, company sizes, and contexts were explored using the best-acclaimed practices, some studies started recording no significant relationship between the practices and performance (an example is Dow et al. 1999; Powell 1995). Based on these inconsistencies, some scholars started to argue that the adopted practices are contingent on the context in which there were applied (Sousa and Voss 2002). Especially as some scholars also stated that there were difficulties in operationalising the best practices (Dooyoung et al. 1998; Maddow 1995) due to a mismatch between the practices and the organisational context (Sousa and Voss 2001, 2002). These arguments led to the high rise in not only exploring the application of identified practices but also the context in which they are effective. Hence maintaining a fit between the adopted practices and the context of the organisation, underpins the assumption of the contingency theory.

This thesis uses the contingency approach to test and explain the moderating role of EU on the SCI- supply chain sustainability relationship. Contingency theory suggests that there should be a fit between a firm's internal business structures and its external environment (Donaldson 2001). This indicates that the structure of an organisation is streamlined by the environment in which the organisation operates. This supports the argument that there is no one fits all method (Flynn et al. 2010) for organizations (Scott and Cole 2000). Drawing from the contingency theory, it can be said that as the environment in which the pharmaceutical companies in the UK and Ghana operate in are different, the processes and structure of the companies will also differ in both cases. Hence, different levels of SCI and different dimensions of SCI may be prioritised in both the UK and Ghana context or in cases where the companies are exposed to either low or high EU. This thesis applies the contingency theory by considering pharmaceutical companies in Ghana (developing country) and the UK (developed country) and explores how the different levels of EU in these two contexts moderate the SCI- supply chain sustainability relationship similarly and differently. Apart from Ghana and the UK capturing the different levels of EU exposed to pharmaceutical companies in developing and developed countries respectively (Yadav and Smith 2012) the pharmaceutical industry in both countries is particularly vulnerable to increases in complexity, cost, regulations, and different levels of uncertainty. These characteristics make it important in studying the influence of EU on the SCI- supply chain sustainability relationship. Besides, as end consumers form part of the focal firms' environment (Flynn et al. 2010) it can be said that the demands, requirements, actions, and behaviour of consumers will also shape the processes and structure of the pharmaceutical companies. Hence, the thesis also explores how the pharmaceutical companies in both the UK and Ghana integrate with their customers to generate capabilities needed to impact their supply chain sustainability performance.

4.3 SCI-supply chain sustainability relationship: The dynamic capability approach

The dynamic capability theory was introduced as an extension of the resource-based view (RBV). Thus, RBV basically looks at the resources available to firms that can be used to gain competitive advantage. However, the dynamic capability theory extends this assertion to include the fact that, it is imperative for firms to increase their performance by not only creating resources but to reconfigure and extend resources (Teece et al. 1997). This is very important as companies are now operating in highly uncertain environments. Based on this underpinning, Teece et al. (1997) refer to the term *dynamic* as the ability to develop

competencies that can match-up with the changing nature of the environment. The uncertainties range from supply and demand, market changes, technology, and actions of competitors. In addition, Teece et al. (1997) also describe *capability* as the ability of a firm to strategically reconfigure resources both internally and externally available to the firm to meet changing needs (Ofori-Amanfo 2014). Based on these two key terms, dynamic capability has been defined to depict the ability of a firm to modify its distinctive resources purposely to meet up with the changing environment (Aslam et al. 2018; Augier and Teece 2009). Others also defined the theory of dynamic capability as the capacity of a firm to create/modify/extend its resources to attain a high economic value (Beske et al. 2014; Helfat et al. 2007). Dynamic capabilities enable firms to gain a competitive advantage over competitors with similar/same resources. Although the use of the dynamic capability is increasing in the field of SCM (Blome et al. 2013; Fawcett et al. 2011), its application with other key theories (e.g. stakeholder and contingency theory) is limited.

Aside from the stakeholder and contingency theory, this thesis further uses the dynamic capability theory to explore how the pharmaceutical companies create/modify/extend resources through effective/efficient SCI to impact supply chain sustainability. In the context of supply chain sustainability, the given definition of dynamic capability suggests that for focal companies and their supply chain partners to impact their economic, social, and environmental performance, there is a need for the companies to rely on generated dynamic capabilities through SCI. Additionally, as currently, the external environment is getting more erratic, it is important for firms to have dynamic capabilities to achieve competitive advantage (Teece et al. 1997). Thus, firms need to thrive on effective and efficient internal, supplier, and customer integration. This will generate the ability for supply chains to create, extend, or modify resources to achieve higher economic value than their competitors (Beske et al. 2014; Helfat et al. 2007). This will also enable companies to effectively and efficiently generate or transform generated resources through SCI, to positively impact economic with no negative impact on social and environmental performance within/across the supply chain to achieve truly sustainable supply chains (Pagell and Shevchenko 2014). Based on the raised argument, this thesis applies the dynamic capability theory by exploring how the pharmaceutical companies create/modify/extend resources through effective/efficient SCI to impact supply chain sustainability whilst exposed to the dynamic external environment that the companies operate in.

4.4 Hypothesis development

4.4.1 The impact of supply chain integration on supply chain sustainability

4.4.1.1 The impact of supply chain integration on the economic dimension

Supply chain management (SCM) is based on the integration of all activities that add value to customers, from the product design and supply stage to the delivery stage (Gunasekaran and Ngai 2004). Practitioners and researchers have recognised that firms need competitive resources beyond their own boundaries to gain economic competitive advantage as firms currently compete on a supply chain basis rather than on a firm-to-firm basis (Flynn et al. 2010). Hence indicating the need to collaborate with suppliers and customers across the supply chain to gain competitive advantage. A typical example was given by Cockburn (2004) in his study on the changing structure of the pharmaceutical industry in the USA. The study indicated that most large pharmaceutical firms in the USA had integrated supply chains, from drug discovery through clinical development, regulatory affairs, manufacturing, and marketing stages. This was known to enable these large pharmaceutical firms to develop the needed capabilities to effectively manage product market interactions with suppliers, regulators, and end-users which increased productivity, the meeting of specific customer demands, as well as gaining of competitive advantage.

A number of empirical studies have proved that SCI (both internal and external integration) has a positive impact on firm economic performance. Thus, SCI enables firms to improve upon their operational and financial performance by facilitating an efficient and effective flow of products and services across (suppliers and customers) and within (focal firm) the supply chain (Swink et al. 2007; Zhao et al. 2011). Many have also argued that internal integration is a fundamental dimension (Flyn et al. 2010; Yu et al. 2013) which does not only improve operational (quality, flexibility, cost, flexibility) (Wong et al. 2011) and financial (Flyn et al. 2010) performance, but also influences the impact of external integration on performance (Schoenherr and Swink 2012; Yu et al. 2013). Several researchers have also shown enormous support for the positive impact on operational (Jitpaiboon et al. 2013; Wiengarten et al. 2019) and financial (Frohlich and Westbrook 2001; Yu et al. 2013) performance through integration with suppliers. Thus, through supplier integration, suppliers are able to understand the specific needs of the focal companies which ensure quality, and quick transaction and delivery (Flyn et al. 2010) of products and services and flow of information. Some also found an increase in product development (Koufteros et al. 2005) and innovation performance (Zhu et al. 2017) through supplier integration.

Moreover, customer integration is known to promote coordination among the involved partners within and across the supply chain, whilst enabling the generation of core competencies (Flynn et al. 2010). Thus, partners are able to share adequate/accurate demand information, which increases speed (reduces design time) (Wong et al. 2011), improves quality (reduces defects) (Frohlich and Westbrook 2001), flexibility (quick access to demand) (Shou et al. 2018), cost (increase in productivity due to speed and reduction in product redundancy) (Schoenherr and Swink 2012), and responsiveness (Flynn et al. 2010) for supply chain players.

Although many have established a positive SCI-performance relationship (Wiengarten et al. 2019; Yu et al. 2013) other researchers also found that SCI does not always improve firm performance. Thus there are instances were SCI has a negative (Koufteros et al. 2005; Vereecke and Muylle 2006) and insignificant (Flynn et al. 2010; Yu et al. 2013) relationship with performance. Negative impact in the context of not achieving a higher value (mostly monetary) of performance as measured against the value of input for implementing or practicing SCI. These inconsistencies indicate that the relationship between SCI and performance is contingent on many factors such as the kind of environment and how exposed firms are to uncertainty (Wong et al. 2011). Despite these results inconsistencies, the majority of the literature shows that SCI (customer integration, internal integration, supplier integration) has a positive (as shown in Table 4.1) impact on firm's operational and financial performance. Based on the raised arguments, the following hypotheses are suggested:

H1a1: Internal integration will positively impact the economic performance of members within the supply chain

H1a2: Customer integration will positively impact the economic performance of members within the supply chain

H1a3: Supplier integration will positively impact the economic performance of members within the supply chain

4.4.1.2 The impact of supply chain integration on the social dimension

Good social practices are known to improve the social condition of workers through increased morale, reduction in work absenteeism, and improvement in workers' commitment to work which reflects in the productivity of the firm (Welford and Frost 2006).

***Table 4.1*: Impact of supply chain integration on economic performance**

Author	Dimension of supply chain integration	Impact / Relationship	The specific aspect of economic performance impacted
Yeung et al. (2013)	SI	P	Operational performance
Scannell et al. (2000)	SI	P	Operational performance (cost and flexibility)
Rosenzweig et al. (2003)	SI, CI	P	Competitive capability and business performance
Frohlich and Westbrook (2001)	SI, CI	P	Operational performance
Narasimhan et al. (2010)	II	P	Operational performance
Wong et al. (2011)	II	P	Operational performance
Swink et al. (2007)	II	P	Operational performance
Cao and Zhang (2011)	II, EI	P	Collaborative performance and firm performance
Schoenherr and Swink (2012)	II, EI	P	Operational performance
Mackelprang et al. (2014)	II, EI	P	Firm performance
Song et al. (2017)	II, EI	P	Firm performance (operational and financial)
Danese et al. (2013)	II, EI	P	Firm responsiveness
Huo et al. (2016)	II, EI	P	Competitive performance
Flynn et al. (2010)	II, EI	P	Operational and business performance
Narayanan et al. (2011)	CI	P	Firm performance
Narasimhan and Kim (2002)	II, EI	P	Product and market diversifaction
Griffin and Hauser (1996)	CI	P	Marketing and R&D
Koufteros et al. (2005)	SI	N	Innovation, quality and profitability
Flynn et al. (2010)	SI	N	Insignificant relationship with firm performance
Stank et al. (2001)	SI	N	Operational performance
Gimenez and Ventura (2005)	SI, CI, II	N	Integration in the logistics-marketing interface does not lead to reductions in costs, stock-outs and lead-times
Swink, et al. (2007)	SI, CI, II	N	Manufacturing-based competitive capabilities and business level performance
Stock et al. (2000)	SI, CI, II	N	Organizational performance
Cuijpers et al. (2011)	II	N	Cost in the form of delays and project terminations
Koufteros et al. (2005)	II	N	No direct relationship with operational performance
Vereecke and Muylle (2006)	SI, CI	N	Operational performance and procurement

Note: II- Internal Integration, SI- Supplier Integration, CI- Customer Integration, N- Negative, P- Positive

Gold et al. (2013) indicated that practices that tackle the social interest of workers help to improve the motivation and skills of the workers. Based on this assertion, it can be argued

that when firms integrate their operations among internal operations, there is an increase in transparency as information is effectively and adequately shared among workers. Hence giving the workers a sense of involvement in every aspect of activity of the organisation to achieve the firm's goal. This can serve as a source of motivation for workers whilst helping workers have a sense of been perceived as an important assert through their integrative involvement in most activities. This can also boost the morale of workers and help reduce incidences of absenteeism. Welford and Frost (2006) specifically indicated that firms that have their employees' talent recognised (through their involvement) face less attrition and are considered as the best firms to work for. Aside from these benefits for the workers and the focal firm, it can be argued that when the firm's best of abilities is exploited internally, it does not only reflects in the kind of products and services received by the customers but also influences the level and type of socially responsible activities rendered to customers and suppliers. Hence the social benefit derived from internal integration is argued to also reflect on the customers and suppliers and not only the focal firm. Based on the raised empirical evidence of the impact of internal integration impact on social performance, the suggested hypothesis is:

> *H1b1: Internal integration will positively impact the social performance of members within the supply chain.*

The outcome for H1b1 may seem obvious due to the aforementioned argument that when companies adopt SCI, employees are more involved in activities, and the needs of employees are well understood. Hence, the study will further measure the impact of the external uncertainty on the social performance of members within/across the supply chain (4.4.2). However, H1b1 will be measured to prove conformance with previous studies as different environmental contexts are been considered in this study.

Integration with partners (suppliers, customers, etc.) of the supply chain increases transparency (Gold et al. 2013) and helps to equally share responsibilities previously carried out by individual members among partners. Sharing such responsibilities only does not increase the capacity of supply chain members but also helps to reduce the time that members use in performing activities. When companies integrate their operations both internally and externally, employees of the focal firm, the suppliers, and customers are more involved in activities, and the needs of these stakeholders are well understood and met. Understanding

the needs of employees also helps provide the needed conducive environment for employees to be more productive whilst protecting their basic fundamental rights as employees. Additionally, involving suppliers and customers in social developmental works/projects carried out by focal firms helps to boost supplier and customer satisfaction, and the reputation of the focal firm which leads to gaining competitive advantage (Zhu et al. 2016). This can be supported by the assertion drawn from the CSR Europe survey report in the year 2000 that showed that in Europe 1 in 5 consumers are willing to pay more for products that are ethical and environmentally friendly (Cheah et al. 2007). Some have also argued that through customer and supplier integration, supply chain partners are able to share adequate/accurate demand information, which helps to identify and tackle the social interest of customers (Flynn et al. 2010). Whilst others also argue that conflict of interest can be resolved through supplier integration (Scannell et al. 2000; Wong et al. 2011) which improves social relationships between involved partners.

In the context of firms socially helping deprived communities through social works, pharmaceutical multinationals have been criticised for not sufficiently meeting the needs of less privileged communities regarding access to medicine (Leisinger 2005). This indicates the high need for pharmaceutical companies to improve their social performance by integrating their activities with suppliers and customers. This will improve the availability of drugs to customers in less developed communities and countries (Cheah et al. 2007). Based on the raised argument concerning the impact of external integration on social performance, the thesis posits the following hypotheses:

H1b2: Customer integration will positively impact the social performance of members within the supply chain.
H1b3: Supplier integration will positively impact the social performance of members within the supply chain.

4.4.1.3 The impact of supply chain integration on the environmental dimension

The importance of maintaining the natural environment has gained recognition among all businesses and individuals. This is attributed to the known fact that the depletion of the natural environment is affecting all humans and creatures on the planet earth. This known fact has placed pressures and raised the call for firms to adopt effective and efficient strategies such as SCI to improve activities throughout the supply chain. This is to enable a

positive impact on the environment and out of which firms can also simultaneously gain a competitive advantage.

Kaira (2011) indicated that integration of internal activities among internal functions too can increase a firm's capabilities, and improve resource utilisation for firm activities such as logistics. When companies integrate and incorporate environmental concerns in their rules, regulations and policies, this creates the platform for the firms and their supply chain partners to reduce waste and improve their operational and environmental performance (Russo and Fouts 1997).

In the creation of new products and services which are environmentally sustainable, firms are to strategically integrate the activities of their internal functions. Thus internal integration is known to remove departmental barriers (Flynn et al. 2010) which facilitates improved and environmentally friendly processes/products through joint development, efficient resource utilisation, and waste reduction. When internal departments integrate their activities and share adequate and timely information, the needs of customers can be efficiently and effectively channelled across functions. Hence such firms are able to tailor every department's activity in fulfilment of the overall customer requirement in a more sustainable way.

Internal integration helps inter-departments to improve product design and processes (Ettlie and Stoll 1990), and improves the efficient use of natural resources (e.g. land, water, etc.), which affects the environment positively (Griffith and Bhutto 2008). Based on these assertions, it can be argued that when firms integrate their internal activities, it also impacts on the customers by providing customers with environmentally sustainable products. Whilst suppliers also benefit by consistently providing environmentally sustainable raw materials to the focal firms. Based on the reviewed impact of internal integration on environmental performance, the thesis posits that:

> *H1c1: Internal integration will positively impact the environmental performance of members within the supply chain*

In addition, when firms integrate with their supply chain partners, there is a high tendency of reducing environmental penalties as a result of the firm's activities (Suansawat 2013).

Thus integrating with supply chain partners who are keen on incorporating environmental rules/regulations in their activities can enable firms and their supply chain members to tackle environmental issues more fully (Griffith and Bhutto 2008). Integrating with external players facilitates affective planning and operationalisation of environmental activities such as recycling, reusing, and less use of hazardous materials throughout the supply chain (Suansawat 2013). Efficiently integrating activities such as transportation and logistics enables supply chain members to maximize their capacity (fewer delivery trips hence reduction in CO2 emissions) and use fewer resources (e.g. fewer packaging materials, space/land of warehouses) to meet specific customer needs. Through supplier integration, focal companies can engage in adequate information sharing and joint planning with suppliers which reduces mistakes and waste (Flynn et al. 2010) in operational activities within and across the chain. Whist, integration with customers also enables supply chain partners to jointly share capacity, which helps to reduce waste (Swink et al. 2007; Wong et al. 2011) in the supply chain. Based on the raised arguments, the following hypotheses are suggested:

H1c2: Customer integration will positively impact the environmental performance of members within the supply chain

H1c3: Supplier integration will positively impact the environmental performance of members within the supply chain

Based on all the posited hypotheses, thus from H1a, H1b and H1c, under the section *the impact of supply chain integration on supply chain sustainability,* the main hypothesis proposed is:

H1: Supplier chain integration will positively impact the sustainability performance of members within the supply chain

4.4.2 External uncertainty and the SCI-supply chain sustainability relationship

EU generally describes the degree to which a firm's external environment is characterised by unexpected change (Fynes et al. 2004). However, the contingency approach denotes a fit between internal business structures (strategic and operational) and its external environment (Donaldson 2001). Drawing from this theory, some have argued that the type and strength of the relationship between SCI and performance are influenced by the level of EU (Slater

and Narver 1994; Wong 2013) exposed to firms from their operating environment. Some also argue that EU exposed to firms is known to vary according to the product type or industry a firm operates in (Fisher 1997). An example is that of the automotive industry where technology uncertainty is mostly experienced due to the high complexity of parts. Such complexities are known to result in delivery delays and quality problems (Oh and Rhee 2008). To mitigate this uncertainty, supply chain players need to share adequate/timely information and align their objectives. Ragatz et al. (2002) empirically indicated this through their survey on high-technology companies, where it was noticed that some aspects of supplier integration process were more likely to be exposed to technology uncertainty which resulted in significant performance (cost, quality, and cycle time) improvement (Wong et al. 2011). Slater and Narver (1994) also indicated that firms with high technology and exposed to rapid change will benefit more from the SCI-performance relationship compared to stable technology markets (Wong 2013).

Most researchers have suggested that firms are to monitor market shifts consistently and make accurate changes to products to satisfy the dynamic needs of customers. Literature has also indicated that one key strategic way to manage a competitive environment is through effective integration and information sharing with supply chain partners (Wong et al. 2011). Thus, firms operating in a highly competitive environment are likely to have a greater need for effective, efficient, and consistent SCI than firms in less competitive markets (Gupta and Govindrajan 1991). This gives an indication that competition uncertainty can also affect the impact of SCI on supply chain sustainability.

Operations management literature has extensively provided empirical evidence to support the assertion that higher demand uncertainty results in higher costs within the supply chain (Ragatz et al. 2002). This is mainly caused by the mismatch between demand and supply due to unpredictability. To mitigate such mismatch, supply chains exposed to demand uncertainty are expected to be flexible enough in the activities of sourcing, manufacturing and distribution (Goyal 2005), which can be achieved through SCI. Through SCI, firms can also reduce their product delivery lead-time (Fisher et al. 2009) to enable an effective response to uncertain demands. These arguments show that for firms to react and mitigate the negative effects of demand uncertainty, they need to be agile and align their operational strategies with key players in the supply chain (Reichhart and Holweg 2007). The raised

arguments support the assertion that supply and demand uncertainty can affect the impact of SCI on supply chain performance.

To support the raised arguments on how different levels of EU impact SCI operationalisation, Wong et al. (2011) demonstrated that in high EU, except for the customer integration and delivery relationship, the relationship between external integration and delivery, and flexibility is strengthened, but not with cost and quality. Wong et al. (2011) further showed that under high EU the relationship between internal integration and cost and quality is strengthened, but not with delivery and flexibility. Thus delivery and flexibility are argued to be time-based performances, hence both performance measures are sensitive to external factors (Lai et al. 2008; Wong et al. 2011). On the other hand, the cost and quality performance outcomes are known to rely more on the internal fit and structure of the firm, hence both performance measures are less sensitive to external factors (Ragatz et al. 2002). In highly uncertain environments, it is known that customer integration (and not supplier integration) plays a key role in capturing adequate, accurate, and timely demand information that feeds and drives the entire functioning of the chain (Wong et al. 2011).

Besides, a study by Wiengarten et al. (2013) found out that logistical capabilities available to firms significantly affect the impact of a firm's external integration on firm performance. Thus, the state of logistical capabilities available to firms affects the extent to which the focal firm may benefit from close collaboration of activities with its supply chain partners and how precise these firms can make predictions regarding supply chain activities. This indicates that the level or state of logistical capabilities available to firms can create uncertainties, which impacts the performance of firms. Also with regards to how regulatory policies impacts supply chains, a study by Costa (2017) on how pharmaceutical regulatory policies in Brazil impacts supply chain resilience showed that the pharmaceutical industry is highly regulated and faces challenges such as inadequate communication between firms and regulatory bodies, long lead-times to obtain certifications/licenses and unclear regulations. Although Costa (2017) argued that such a situation motivates firms to integrate, these challenges also create uncertainties that can affect the integration activities of firms within the pharmaceutical supply chain. Based on the raised arguments on the impact the various dimensions of EU have on the SCI-performance relationship, the following hypotheses are suggested.

H2a: The relationship between customer integration and (1) economic (2) social (3) environmental performance will be significant and stronger for high EU.

H2b: The relationship between supplier integration and (1) economic (2) social (3) environmental performance will be significant and stronger for low uncertainty

H2c: The relationship between internal integration and (1) economic will be significant and stronger for high EU, but not for (2) social (3) environmental performance

Based on all the posited hypotheses, thus from H2a, H2b, and H2c, under the section *external uncertainty and the SCI-supply chain sustainability relationship*, the main hypothesis proposed is:

H2: External uncertainty will moderate the impact of supply chain integration on the supply chain sustainability performance of firms.

4.5 Theoretical framework

Based on the reviewed theories (4.1 - 4.3), literature, and developed hypotheses, the theoretical framework for the study was developed showing the main constructs and the suggested hypotheses. Thus, it was noticed that the impact relationship can be explored from SCI→ supply chain sustainability and another from EU to the SCI→ supply chain sustainability relationship. Table 4.2 shows how the reviewed theories were used for each research question and for that matter the suggested hypotheses, whilst Figure 3.1 shows the proposed framework.

4.6 Summary

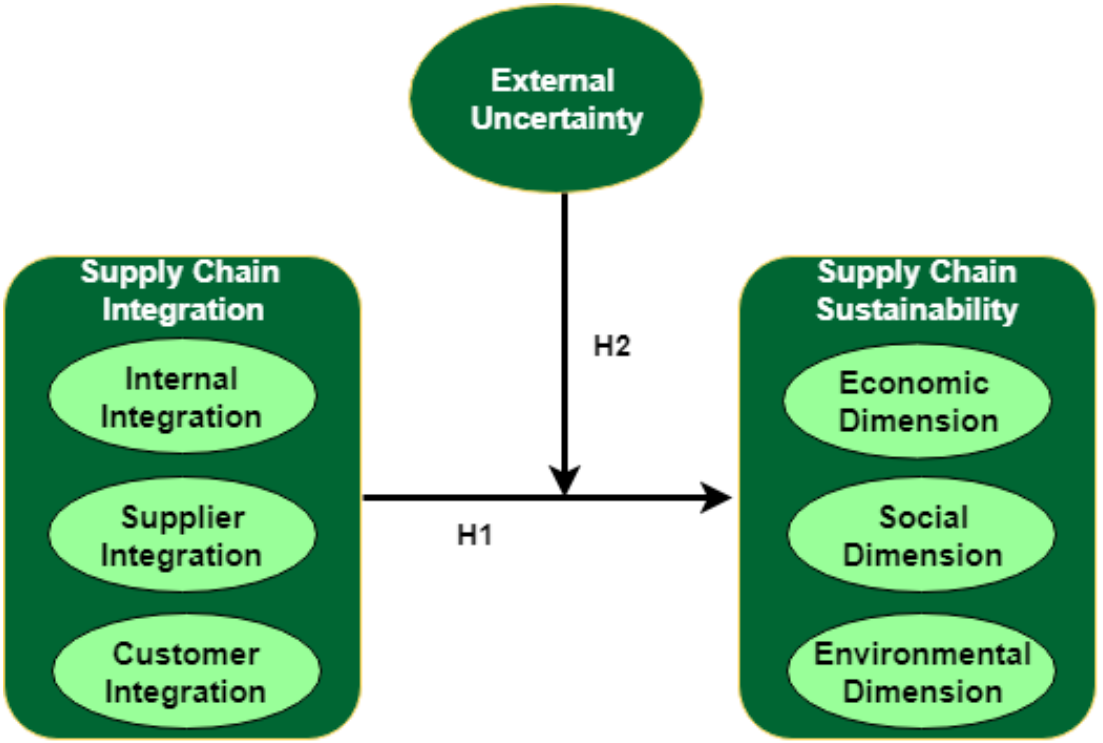
In this chapter, the stakeholder theory, contingency theory, and dynamic capability theory were used to support the way in which this thesis analyses the SCI-supply chain sustainability relationship whilst considering the role of EU on the aforementioned relationship. The various hypotheses were posited to support the research questions whilst the theoretical framework for the study was also developed. The theoretical framework shows the main constructs and the two main suggested hypotheses. The framework is shown in Figure 4.1. The methodology to be applied to answer the research questions and posited hypotheses are detailed in the next chapter.

Table 4.2: **Research questions, hypotheses, and applied theories**

Research questions	Hypotheses	Theory used (where applicable)
(1) What is the impact of supply chain integration on supply chain sustainability?	H1: Supplier chain integration will positively impact the sustainability performance of members within the supply chain.	This thesis applied the dynamic capability theory by exploring how companies create/modify/extend resources through effective/efficient SCI to impact supply chain sustainability. The stakeholder theory was applied by considering manufacturers, wholesalers, distributors, retailers, regulators, and national trading associations in studying the SCI- supply chain sustainability relationship.
(2) What internal and external factors enhance or hinder supply chain sustainability through SCI?	H2: External uncertainty will moderate the impact of supply chain integration on the supply chain sustainability performance of firms.	The contingency theory was applied by exploring how EU affects the SCI- supply chain sustainability relationship. To throw more light on the aforementioned relationship, this thesis also compared the results among the companies in Ghana and the UK. This thesis also applied the dynamic capability to explore how the companies create and modify resources to adapt with their uncertain environment.

Source: Author's construct

Pharmaceutical industry in the UK and Ghana



Source: Author's construct

Figure 4.1: **Theoretical framework**

CHAPTER 5

RESEARCH METHODOLOGY

5.0 Chapter overview

This chapter details the philosophical assumptions underpinning the research. The specific assumptions tackled were based on the paradigm, ontology, epistemology, and methodology. The chapter further details the research method, research design, pilot study, sample and data collection, and data analysis.

5.1 Paradigm - Philosophical assumptions underpinning the research

Research works are carried out based on guided philosophical assumptions and positions which belong to a particular paradigm or different paradigms. Paradigm is defined as an organising framework which entails theories, concepts, set of assumptions, beliefs, and principles that forms a direction for a discipline to interpret it concerned subject matter, as well as research methods considered to be suited to generating knowledge (Mingers 2001; Powers and Knapp 2006). The aforementioned argument indicates that after identifying and selecting a framework or paradigm, it is important to adhere to it philosophical assumptions about the nature of reality (ontology), knowledge (epistemology) and methodologies, as all research does work within paradigms (Midgley et al. 2017; Mingers and Brocklesby 1997). Although there are a number of paradigms, aside from what this thesis adopts (critical realism - CR) (Bhaskar 1975), positivism and interpretivism are the most widely known and used paradigms, especially in the field of management (Saunders et al. 2011). For clarity purposes, Table 5.1 justifies why this thesis uses CR and not positivism and interpretivism. Although we justify this in the following sub-sections also, we focus on the CR only and explains how it helps to answer the thesis research questions.

5.1.1 Ontology

Ontology asks the questions of the nature of being or the nature of reality. In the context of CR it is argued that that there are different ways of being, or things do exist in different ways. Bhaskar (1975) indicates that entities/structures/organisations are made of powers (whether observable or not) that continuously interact and produce events. Supporting the assertion

***Table 5.1*: Paradigm and the thesis research questions**

Paradigm	Positivist	Interpretivist	Critical realism (CR)	The fit of selection with the thesis research question
Ontology	• The world is independent of our own perception. • Focuses on what can be observed and measures what is observed.	• Whether the real word exists or not, we have no direct access to it. • Reality is what we socially and individually construct and interpret.	• There are different forms of being or reality. • Sorts to uncover generative mechanisms and underlying structures of what is being studied. • Society and organisations are structures that are based on power. They systematically reproduce the existing hierarchies. • Recognises the existence of both external social structures and individual beliefs and understandings. -Reality exists in different forms (observable and unobservable) and needs to be accessed from different perspectives.	(1) What is the impact of supply chain integration on supply chain sustainability? Taking a CR approach will enable analyse the external social structures of the pharmaceutical companies to establish the impact of SCI on supply chain sustainability. Although this focuses on the observable, the thesis also focuses on identifying the mechanisms behind the established relationship which can be analysed through the beliefs and interpretations of the researcher. (2) What internal and external factors enhance or hinder supply chain sustainability through SCI? The internal and external factors are the unobservable factors behind what we observe "SCI impacting supply chain sustainability". Taking a CR approach will enable the researcher to identify the mechanisms (in this case internal and external factors) that influence or hinder the SCI- supply chain sustainability relationship. From the raised arguments, it is evident that CR presents the best lens to explore/analyse or answer the outlined research questions.
Epistemology	Objectivism; Observations should be separated from the beliefs of the researcher or observer.	Subjectivism; knowledge can only be knowledge of individual's meanings and interpretations of the world. Thus, truth is a matter of authenticity	• Aware and precautious of the limitations of social theory whether positivist or interpretive. • Theories validated by their ability to reveal what is not observable or	(1) What is the impact of supply chain integration on supply chain sustainability? CR gives the platform to objectively analyse the SCI- supply chain sustainability relationship, whilst additionally taking into consideration that there are limitations in the form of ignoring unobservable mechanisms. Hence, giving room to explore the unobservable in research question 2.

		of individual interpretation.	known to inform social participants.	(2) What internal and external factors enhance or hinder supply chain sustainability through SCI? The interpretation of the researcher is needed to identify and understand the internal and external factors (which are not observable) which enhance or hinder the SCI- supply chain sustainability relationship. Hence CR fits in answering both research questions.
Methodology	• Experimental and statistical. • Focuses on generating statistical models from data.	• Hermeneutic (concerned with understanding) and phenomenological. • Based on conversation, dialogue, and interpretation.	• Supports the abductive approach. Use of mixed methods. • Combination of methods from different paradigms to meet set research questions.	(1) What is the impact of supply chain integration on supply chain sustainability? As an objective approach is taken, survey data will be used out of which statistical models will be generated to establish the impact of SCI on supply chain sustainability. (2) What internal and external factors enhance or hinder supply chain sustainability through SCI? Interview and observation. As a subjective approach is been used, interviews and observations of the activities of the pharmaceutical companies will be used to enable identify the internal and external factors which enhance or hinder supply chain sustainability through SCI. Hence a mixed-method approach that fits into CR will be used to answer the research questions.

CR: Critical realism Blue text: Justifies the use of CR to meet research questions

Source: (Archer et al. 2013; Bhaskar 1975; Guba and Lincoln 1994; Mingers and Brocklesby 1997; Saunders et al. 2011).

that there is the existence of different objects/entities which have different features. This was further made evident by Bhasker who defined reality as both intransitive and stratified (Archer 1998). Intransitive describes reality as existing independently of human whilst stratification describes actions between mechanisms, the events created out of such a mechanism, and the events that are experienced (Mingers et al. 2013). Three domains were generated from the stratification; 1. Empirical, which entails events as we observe/experience it, hence enabling both research questions (Table 5.1) for this thesis to be empirically measured; 2. Actual, where events occur whether experienced, interpreted, or not; 3. Real, which entails the causal mechanisms and describes how the structures of entities interact to produce events. Hence enabling identify the internal and external factors which enhance or hinder the SCI-supply chain sustainability of which the research questions aim. Holistically, it can be seen that the critical realist argues that to satisfactorily know the nature of being, it is imperative to adopt a pluralistic approach that CR offers by using different ways to know the nature of being as being exist in different ways. Relating this argument to this thesis, adopting an ontological stance of CR will enable analyse the impact of SCI on supply chain sustainability objectively and also understand and interpret the mechanisms (internal and external factors) which influence the impact of SCI on supply chain sustainability. Moreover taking a CR stance will enable understand how the SCI-supply chain relationship behaves in an operating environment characterised by high and low EU. Using CR will also enable this thesis to avoid reducing the nature of the constructs (SCI, supply chain sustainability, EU) been studied to things that can only be empirically observed or reduced to the human knowledge. But rather from a critically realistic and pluralistic point of view (Mingers et al. 2013).

5.1.2 Epistemology

In the social sciences discipline, research is mostly based on the two main types of epistemological stance, thus objectivism used by the positivist and subjectivism used by the interpretivist. However, the epistemological stance of CR recognises that there are limitations in adopting each one of the aforementioned epistemological stance. Hence CR argues that both the objective and subjective epistemological stance can/should be integrated into one research to answer set research questions (Mingers et al. 2013). Teddlie and Tashakkori (2009) indicated that in real practice, researchers' work can be thoroughly related to seeing epistemology as working on a continuum, instead of two different sides. CR supports that there are different ways of knowing things or gaining knowledge which helps

to uncover interesting perspectives about the problem been studied as compared to adopting a single epistemological stance. In the context of this thesis, using CR gives the researcher the platform to adopt both the objective and subjective stance to fully meet the set research questions. Thus the subjective stance will enable the researcher to gather data through interactions with the pharmaceutical companies (and experts) and observing their operational activities. Through which in-depth data can be gathered to identify and interpret the unobservable internal and external factors which influence the SCI-supply chain sustainability relationship. Meaning that the CR approach enables the researcher to incorporate his interpretations into the work. The qualitative data will also be used to crosscheck the proposed conceptual framework and possibly refine it. Moreover, for the objectivity that CR offers, it will give the researcher the platform to objectively gather statistical survey data from the companies which will be used to test this thesis's suggested hypotheses. The objective approach will aid gather less interactively interfered data (survey) which is also needed to statistically establish the impact of SCI on supply chain sustainability in the pharmaceutical industry in Ghana and the UK as a whole. The objective stance will also enable this thesis to statistically test the influence of the identified internal and external factors which influence the SCI-supply chain sustainability relationship. Hence integrating both objective and subjective epistemological stance which CR presents provides the diverse perspectives needed to meet the set research questions for this thesis.

5.1.3 Methodology

As CR embraces the use of different methods from different paradigms (paradigm commensurability), mixed-method will be adopted as this approach enables the research questions for this thesis to be met. The mixed-method is defined as a combination of qualitative and quantitative research in a study (Greene et al. 1989). Aside from the complexity and less literature on the phenomena (the impact of SCI on supply chain sustainability) been studied in this thesis, mixed-method will provide a better opportunity to gather both observable and unobservable data needed to meet the set research questions. This thesis specifically uses the interview and survey method to answer the set research questions.

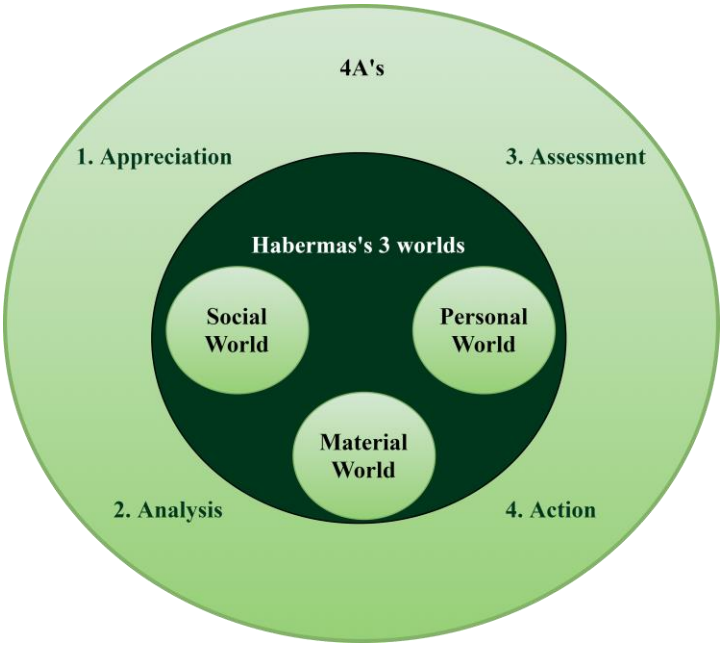
In further justifying the use of mixed methods to answer the different perspectives that the two research question sorts for in this thesis, Habermas argues that the world is complex and it is made up of the social (what we participate in), personal (what we personally experience), and material (what is objectively observed) dimensions (Mingers and Brocklesby 1997).

These dimensions also reflect in the set research questions for this thesis which raises the need to use the mixed-method approach. Thus, the qualitative approach through the participation in interviews (social dimension), practically observing and experiencing (personal dimension) the operational activities of the pharmaceutical companies will enable identify and interpret the mechanisms (e.g. the internal and external factors) that influence the SCI-supply chain sustainability relationship. Moreover, the quantitative approach through the collection of survey data (material dimension) will enable the thesis to statistically establish the impact of SCI on supply chain sustainability. As CR argues that there are different perspectives to being or reality, this thesis uses a rigorous developed framework to map out how the different methods will be used to meet the different perspectives of the research problem been tackled in this thesis.

5.1.3.1 Mapping research methods

A rigorous framework for mapping research methods (Figure 5.1 and Table 5.2) produced by Mingers and Brocklesby (1997) will be adopted. The framework makes use of Harbermas's three worlds and Mingers and Brocklesby (1997) 4As (thus Appreciation, Analysis, Assessment, and Action).

Firstly, the research began with the description and diagnosis of the problem "the impact of SCI on supply chain sustainability and how this impact is moderated by EU in the context of developed and developing countries". The diagnosis of the stated problem is based on the researcher's previous experience in the field of logistics and supply chain management as well as the use of literature, observation, and interview (*Appreciation*). The interview will be used to further understand the observed problem and also assess the developed framework and identify the structural interactions within and between the main constructs. Survey will be used to gather objective/statistical data and to test the suggested hypotheses (*Analysis*). The analysis and discussion will help know why the problem exists as it is and the statistical relations. Recommendations and or other steps to help solve the issues will also be identified (*Assessment*). There will be a discussion of recommended steps and their implementation to bring about the expected changes (*Action*).



Source: (Habermas 1984 cited in Mingers 2001; Mingers and Brocklesby 1997)

***Figure 5.1*: Framework for mapping methods using Habermas's 3worlds and Mingers & Brocklesby (1997) 4As: A diagrammatic view.**

***Table 5.2*: Mapped research methods in the context of this research**

	Appreciation of current situation	Analysis of the situation	Assessment of possible changes	Action
Social world	Interview, observation	Thematic analysis		
Personal world	Interview, observation	Thematic analysis		
Material world	Survey questionnaire	Statistical analysis	Modelling	Modelling

Source: Author's construct

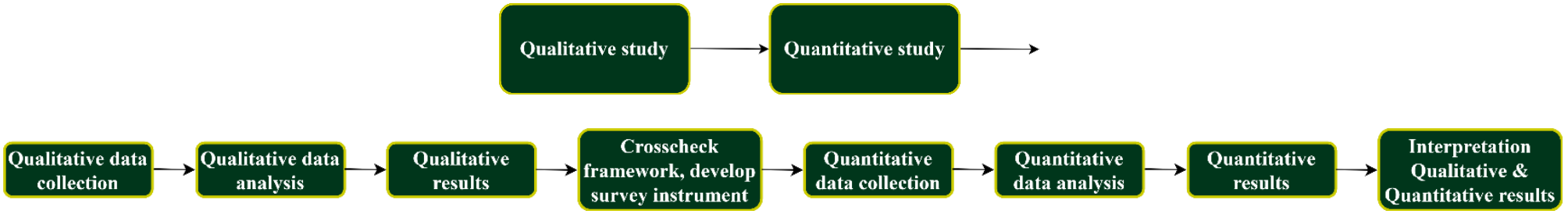
5.1.3.2 Design, timing, and mixing of mixed methods

In the context of this research, among the four (explanatory, exploratory, triangulation, and embedded) types of mixed methods (Table 5.3), exploratory (sequential) mixed-method will be used. Thus, qualitative research through the use of interview will firstly be used to crosscheck the developed conceptual framework, the structural interactions, and to form the basis on which the survey questionnaire will be developed. With the quantitative research, the survey method will be used to test the suggested hypotheses. Figure 5.2 shows how the sequential mixed method will be applied in the research. This framework helps to systematically apply and integrate the strength of the different methods.

***Table 5.3*: Design, timing, and mixing of mixed methods**

Design type	Timing	Mixing
Exploratory	Sequential	Qualitative→Quantitative
Explanatory	Sequential	Quantitative→Qualitative
Triangulation	Concurrent	Qualitative → Integration Quantitative
Embedded	Sequential / Concurrent	Quantitative + Qualitative Quantitative + Qualitative → Integration Quantitative

Source: **(**Creswell 2009; Mingers 2001)



Source: (Creswell 2009; Morse 1991)

***Figure 5.2*: Sequential (exploratory) mixed method**

5.2 Research method

The mixed-method approach was used (Yin 2002). Firstly, the qualitative method was used to uncover mechanism, trends in thoughts and opinions concerning the SCI-supply chain sustainability relationship, and to develop ideas for the quantitative research as less literature also exist on the SCI-supply chain sustainability relationship. Secondly, the qualitative method was used to gather in-depth data to identify and propose a framework that provides insight into the internal and external factors which enhance or hinder supply chain sustainability through SCI which informed the quantitative research. The quantitative approach was used to gather quantitative data to test the suggested hypotheses for the proposed framework. The quantitative method was used to quantify the measured impacts and generalise the results for the entire population. Hence, using the mixed-method enabled the thesis to draw firmer and rigorous conclusions using results from both the qualitative and quantitative methods (Yin 2009). Thus, findings from both quantitative and qualitative sources are known to provide a holistic perspective of a phenomenon been studied which amounts to generating better results (Walliman 2011). The sequential exploratory timing system was used. In this case, interviews were initially conducted. Based on the interview results, the survey study was informed and conducted.

5.3 Research design

For the qualitative research, interview was used whilst for the quantitative research, the survey research design was adopted. However, for the data instrument, a semi-structured interview questionnaire and survey questionnaire were used for the qualitative and quantitative research respectively.

5.3.1 Semi-structured interviews

As less empirical studies exist on SCI impact on supply chain sustainability, the interview technique was used to gather in-depth data on the impact of SCI on supply chain sustainability and how this impact is moderated by EU. The interviews helped the researcher to understand the theoretical underpinnings of SCI on supply chain sustainability from the perspective of pharmaceutical supply chain managers and experts (Creswell and Maitta 2002; Walliman 2011). The in-depth interview data also enabled the researcher to crosscheck the developed framework (chapter 3). The assessment of the framework was also used to

develop the survey questionnaire, hence increasing the accuracy and internal validity of the survey results.

5.3.2 Survey

According to Andersen (1998) the survey method is an appropriate method to use when the number of respondents is high and the number of constructs to be considered is low. This condition justifies the survey's suitability for this thesis as the research considers a large sample size of 231 pharmaceutical companies with a lower number of key constructs, which is, SCI, EU, and supply chain sustainability. Apart from the survey questionnaires enabling gather factual, clear, and straightforward data, the survey enabled access to a large number of pharmaceutical participants from a wide geographical area both in Ghana and the UK, out of which generalization was made. The survey method is cost-effective, extensive (describes the characteristics of a large population), flexible, dependable, has good statistical significance, and no or little subjectivity.

5.4 Scope of the study

The pharmaceutical industry in developed and developing countries is exposed to diverse and different uncertainties, supply chains, and regulations respectively (Shah 2004; Yadav and Smith 2012). These dissimilarities are highly noted among the pharmaceutical industry in the UK and Ghana. Hence to capture these variations in the framework to be proposed, it was key to select pharmaceutical companies from both the UK and Ghana. Chapter 2 details the context of the pharmaceutical supply chain in both Ghana and the UK.

From a developed country perspective, the UK was selected as they also house a number of world-leading pharmaceutical companies. These companies have large market sizes and contribute significantly to global economies (Christel 2018; Ellis 2019) by supplying essential drugs to the majority of medical stores, health centres, and households globally. For example, GlaxoSmithKline and AstraZeneca which are UK companies are ranked among the world's fifteen largest pharmaceutical companies (Christel 2018). Most of the pharmaceutical companies operating in the UK also have same/similar operations in most European countries. This makes it justifiable to select companies and institutions in the UK as it gives a representation of the pharmaceutical market in the UK (developed country) and

to a certain extent, Europe. To support this representation, a giant institution that represents all the key pharmaceutical players in both the UK and Europe is considered.

From a developing country perspective, Ghana was selected on the same basis as having giant pharmaceutical companies known for their significant market sizes in West African and most African countries. These companies contribute significantly to the economies in Africa (Sulaiman and Boachie-Danquah 2017) by supplying essential drugs to the majority of the health facilities and households in West Africa and most parts of Africa. For example, Ernest Chemist which is the oldest and the largest pharmaceutical company in Ghana operates in Ghana, Nigeria, Gambia, Cameroon, Mali, and other African countries. Other giant multinational companies in Ghana are Tobinco Pharmaceuticals, Oson's chemist, Danadams, and Mpharma. These companies also contribute significantly to the economies in Africa through their supply chain activities (Sulaiman and Boachie-Danquah 2017). Many world-leading pharmaceutical companies (e.g. Pfizer; GlaxoSmithKline, AstraZeneca, etc.) also partner with some of the leading pharmaceutical companies in Ghana to reach the majority of the African market. Based on this analysis, the results from the study give a representation of the pharmaceutical market in Ghana and to some extent, a number of African countries.

5.5 Pilot study for quantitative research

A pretest was performed on the developed survey questionnaire prior to the actual distribution. 7 participants, consisting of 3 pharmaceutical companies, 1 international and 1 national pharmaceutical association, and 2 academic experts participated in the pretest. With the 3 pharmaceutical companies used, they consisted of players in the manufacturing, wholesale and distribution, and retail categories respectively. The participants were contacted with the developed questionnaire via email whilst feedback was received both via email and telephone. The types of pretest used were the "respondent debriefing" for the pharmaceutical companies and "expert evaluation" for the academics with high expertise in SCI and supply chain sustainability in the pharmaceutical industry. Useful and helpful suggestions were received from the participants. Based on the suggestions, data "confidentiality" and "anonymous" information for respondents was added to the cover letter, for the background section 2 new answer options for 2 different questions were added

whilst 1 answer option was changed for one of the questions. Lastly, additional explanatory information was added to one of the questions under the SCI construct.

5.6 Sample and data collection for the qualitative and quantitative study

5.6.1 Semi-structured interview

Eighteen (18) leading pharmaceutical players in both the UK and Ghana were selected. As this thesis adopts an inductive approach, Siggelkow (2007) proposes that limited cases can be used as far as the cases are applied as motivating further research and justifying more refined conceptualization. In total, 18 pharmaceutical companies and institutions were used, selected using purposive and convenient sampling (Ferlie et al. 2005).

The factors "financial worth" and "size of market or market share" were used as the criteria for identifying the pharmaceutical company as leading. The national associations which govern the general activities of all the pharmaceutical players in Ghana (National Pharmacy Council (NPC)), UK (National Pharmacy Association (NPA)), and Europe (European Federation of Pharmaceutical Industries and Association (EFPIA)) were also selected. The leading players were selected and focused on as the majority of these companies control the majority of the pharmaceutical market in each country.

A contact list of Ghana companies and national institutions to be studied was obtained from the Pharmaceutical Manufacturers Association of Ghana (PMAG) and the Pharmaceutical Society of Ghana virtual platform. That of the UK was retrieved from the National Health Service (NHS) – UK database and the Association of British Pharmaceutical Industry (ABPI) virtual platform. The European Federation of Pharmaceutical Industry Association (EFPIA) which was selected houses all the key manufacturing companies in the UK and Europe. This list served as the pool from which the participants were later selected.

The 18 companies and institutions were selected from a list of leading pharmaceutical companies and institutions generated from the created pool. The companies are classified as leading based on their high financial and market sizes as compared to other companies in the pharmaceutical industry (Christel 2018; Ellis 2019; Sulaiman and Boachie-Danquah 2017). Following a theoretically guided approach in selecting cases affect the external validity of the findings (Gibbert et al. 2008; Yin 2002). As the thesis considers the *supply*

chain of the pharmaceutical industry, it was key to select companies at each level of the chain from both the UK and Ghana. Thus, manufacturers, wholesalers and distributors, retailers, and national pharmaceutical associations and institutions or regulators. The manufacturers and wholesalers can also be classified as final product suppliers. Only high ranking subordinates, consisting of supply chain managers, CEOs, and experts were considered for the interview as they have more knowledge on the phenomenon been studied. Using this approach increases the reliability of the results (Philips 1981). For Ghana, 11 pharmaceutical companies comprising of 4 SME's, 6 large companies, and 1 large national regulatory body were used. For the UK, 7 pharmaceutical companies were used. This comprised of 4 large companies, 2 SME's, and 1 large multinational pharmaceutical institution.

Sixteen interviews were conducted face-to-face and two via telephone. With consent, thirteen of the interviews were digitally recorded and transcribed for coding and analysis. Field notes were taken during and after the sessions. Five interviews were not recorded due to company policies and regulations. However, the interviewees gave ample time for notes to be taken during the interview and immediately after. The interviews took 40 -150 minutes.

5.6.2 Survey

As the actual number of pharmaceutical players (manufacturers, wholesalers, distributors, and retailers, regulators, etc.) in the UK and Ghana pharmaceutical industry is unknown, this study adopts the 5:1 rule of thumb (Hair et al. 2010). Thus each independent variable should have a minimum of 5 responses. Relating this rule to this thesis, the gathered sample of 231 is deemed sufficient. As the pharmaceutical industry is known as a highly restrictive and regulated industry, whilst the unit of analysis is set at the company level (one respondent per company), the thesis set a sample size at a minimum total of 200 responses. This threshold falls in line with the minimum number of responses needed to generate adequate and meaningful results from structural equation modelling which this thesis adopts (Chen and Paulraj 2004; Hair et al. 2010). Moreover, the pharmaceutical companies selected are multinational companies and the majority of them operate in different countries which increases the generalization power of the results. Example, Sanofi pharmaceutical operates in UK and in the majority of the countries in Europe whilst Ernest chemist from Ghana operates in most of the West African countries with great market shares.

A list of the UK companies was retrieved from the National Health Service (NHS) – UK, Association of British Pharmaceutical Industry (ABPI), and the European Federation of Pharmaceutical Industries and Association (EFPIA) virtual platforms. Whilst that of Ghana was from the Pharmaceutical Manufacturers Association of Ghana (PMAG) and the Pharmaceutical Society of Ghana, through which a database was created. The researcher also used his own industrial contacts due to the restrictive nature of the pharmaceutical industry. Simple random and convenience sampling were used due to the restrictive nature of the pharmaceutical industry. For each company, the researcher identified a respondent who is at the managerial level, likely to have in-depth knowledge about SCI (Flynn et al. 2010) and supply chain sustainability. Selected companies were contacted via phone and email after which a generated link from qualtrics was sent for the companies to complete the online survey. Noticing how reluctant some of the companies were in replying to the initial emails, the researcher adopted a face-to-face approach were printed questionnaires were given out and collected in a few weeks. The questionnaire was administered to a total of 895 pharmaceutical companies in Ghana and the UK. A total of 280 completed responses were received. 49 responses were deleted due to missing data. A total of 231 usable responses were used representing a 31.3% response rate. Chapter 6 details the information about the respondents.

5.7 Questionnaire design

All the constructs were adopted from the reviewed literature in chapter 2. This approach ensured that all the domains needed to be considered to accurately measure the constructs are tackled. Thus, SI, CI and II (Flynn et al. 2010; Narasimhan and Kim 2002), EU (Chang et al. 2002; Ragatz et al. 2002), economic performance (Flynn et al. 2010), social performance (Bansal 2005; Paulraj 2011), and environmental performance (Bansal 2005; Paulraj 2011; Zhu et al. 2010). All the constructs were measured on a seven-point (1-7) Likert scale which gives more flexibility in terms of answer options for the respondents. The specific items for each variable or dimension are detailed in Table 5.4.

Table 5.4: **Variables and items**

Variables and questionnaire items	**Likert Scale**
Supplier Integration	***(1 = not at all; 7 = extensive).***
Share information to our major suppliers through information technologies	
Have a high degree of strategic partnership with suppliers	

Have a high degree of joint planning to obtain rapid response ordering process (inbound) with suppliers	
Our suppliers provide information to us in the production and procurement processes	
Our suppliers are involved in our product development processes	
Internal Integration	***(1 = not at all; 7 = extensive).***
Have a high level of responsiveness within our plant to meet other department's needs	
Have an integrated system across functional areas under plant control	
Within our plant, we emphasize on information flows among purchasing, inventory management, sales, and distribution departments	
Within our plant, we emphasize on physical flows among production, packing, warehousing, and transportation departments	
The utilization of periodic interdepartmental meetings among internal functions	
Customer Integration	***(1 = not at all; 7 = extensive).***
Have a high level of information sharing with major customers about market information	
Share information to major customers through information technologies	
Have a high degree of joint planning and forecasting with major customers to anticipate demand visibility	
Our customers provide information to us in the procurement and production processes	
Our customers are involved in our product development processes	
Operational Dimension	***(1 = strongly disagree; 7 = strongly agree).***
Our company can quickly modify products to meet our major customer's requirements.	
Our company can quickly introduce new products into the market.	
Our company can quickly respond to changes in market demand.	
Our company has an outstanding on-time delivery record to our major customer.	
The lead time for fulfilling customers' orders (the time which elapses between the receipt of customer's order and the delivery of the goods) is short.	
Our company provides a high level of customer service to our major customer.	
Financial Dimension	***(1 = much worse; 7 = much better).***
Growth in sales	
Return on sales	
Growth in profit	
Growth in market share	
Return on investment (ROI)	
Social Dimension	***(1 = much worse; 7 = much better).***
Improvement in overall stakeholder welfare or betterment	
Improvement in community health and safety	
Reduction in environmental impacts and risks to general public	
Improvement in occupational health and safety of employees	
Improved awareness and protection of the claims and rights of people in community served	
Employees receive periodic training	
Environmental Dimension	***(1 = much worse; 7 = much better).***
Reduction of waste water	
Reduction of solid wastes	

Reduction in air emission	
Decrease in consumption for hazardous/harmful/toxic materials	
Decrease in frequency for environmental accidents	
Improve a company's environmental situation	
Increase in energy saved due to conservation and efficiency improvements	
Decrease in improper drug disposal	
Decrease in improper solid/liquid wastes disposal	
External Uncertainty	***(1 = extremely low; 7 = extremely high)***
Our customers often change their order over the month	
Our supplier's performance is unpredictable	
Competitors' actions regarding marketing promotions are unpredictable	
Our plant uses core production technologies that often change	
Process technologies employed in plants are complex	
Core product technologies often change	
Regulations often change	
Product prices often change	

5.8 Data analysis

Thematic analysis was used in analysing the interview data whilst statistical analysis was used for the survey data.

5.8.1 Thematic analysis

Thematic analysis was used to analyse and compare the interview data from the various respondents, and to establish deeper content of the impact of integration on supply chain sustainability. The interview data were examined to identify common patterns out of which the key themes were generated. A three-stage coding (detailed in Table 5.5) was used which was carried out both manually and using the Nvivo software to ensure rigorousness. The key step by step processes used for the thematic analysis both manually and using the Nvivo software is presented in Table 5.5.

The thematic analysis was performed for each company and on a cross-company basis. The analysis for each company was used to identify the key issues faced by each company in integrating their supply chain activities. How these issues impact supply chain sustainability and whether the companies are truly sustainable were also analysed. The cross-company analysis (Miles and Huberman 1994) was used to identify patterns of similarities and differences in issues faced by the companies. The issues were also compared among companies in the UK and Ghana.

***Table 5.5*: Key steps for the analysis**

Key Steps	Purpose	Example (where applicable)	Manual	Nvivo12
Transcribed all recorded interviews.	To obtain all the interviews in a single transcription form to enable coding/analysis.		Yes	
Read the transcription, and read over again.	To familiarize with the data and start to identify important issues.		Yes	
	To Understand the data from the participants perspective.		Yes	
Coding	To identify key issues, meanings and themes from the data.			
1st order coding, using a line by line approach.	Meanings were identified and key issues were labelled in a descriptive format. This process is data-driven.	Wholesalers integrate their operations with each other.	Yes	Yes
2nd order coding (based on 1st codes).	The first codes from the 1st order coding were further coded to generate the categories. This process is also data-driven.	External integration	Yes	Yes
Grouping of all same 1st codes under the 2nd codes.	To generate and group all the codes for each category to form the sub-theme.	2nd code (External integration): 1st codes "Wholesalers integrate their operations with each other", "Sales are communicated in real-time with partners".	Yes	Yes
3rd order coding (based on 2nd coding and theory).	The sub-themes were reviewed and grouped and the actual themes were generated. Themes relative to a wider conceptual and theoretical context.	Supply Chain Integration	Yes	Yes
Generation of qualitative framework based on themes.	To show the direction and relationship of impact among the key themes. The framework shows how to achieve the ultimate output.			Yes

Source: Author's construct

5.8.2 Statistical analysis

Firstly, a number of preliminary analysis were performed to clean the data and measure the reliability and validity of the collected survey data (detailed in chapter 7). This thesis checked for missing data, outliers and normality, non-response bias, common method bias. The thesis further performed exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) to support the measure of validity and reliability of the collected survey data. The stated hypotheses were tested using structural equation modelling (SEM), multigroup analysis, multivariate analysis, hierarchical regression, and bootstrapping. A brief description of a few preliminary and main analysis are detailed. For clarity purposes, the rest of the descriptions are detailed in chapter 6 simultaneously with the presentation of the findings.

5.8.2.1 Validity and reliability

Validity refers to the extent to which a particular construct is accurately measured (Heale and Twycross 2015). In relation to this thesis, validity is used to verify how well the relationship between SCI and supply chain sustainability is measured. However, reliability measures how accurate an instrument is. In this case, how accurate the developed questionnaire for this thesis is. Hence checking for validity and reliability is essential to ensure that used instruments measure exactly what they are supposed to measure and can produce the same results when processes are repeated. In this study, three main approaches were used to examine validty;

Content validity

Content validity measures the extent to which a research instrument accurately measures all aspects of a construct (Heale and Twycross 2015). In other words, how accurate does a used instrument cover all the areas it is supposed to cover for a specific variable. Relating this definition to this thesis means that, did the used questionnaire measure all the dimensions or domains it is supposed to measure for the SCI, supply chain sustainability, and EU constructs. Ensuring that there is adequate content validity is important especially for the drawing of inferences. Content validity is assessed through a theoretical approach rather than statistical. In the context of this thesis, the review of the literature, and the review of questionnaire by experts were used to attain content validity.

Firstly, all the used variables were based on a detailed review of the literature (chapter 2). This approach ensured that all the selected variables and their respective items cover all the areas of the constructs been studied. Secondly, three academics, two industry experts, one international and one national pharmaceutical associations were invited to review and validate the scales. This approach enabled receiving feedback from the key pharmaceutical stakeholders from which the actual data was later collected. The received feedback was used to improve the confidentiality and wording of a few items in the questionnaire. Moreover, the received feedback from the qualitative study was also used to improve the sustainability construct by adding two more items to the environmental dimension scale.

Convergent validity

Convergent validity is used to measure the extent to which the questionnaire items within a particular construct are correlated. Some studies use the factor loadings from the exploratory factor analysis (EFA) to validate convergent validity. The factor loadings threshold is mostly dependent on the sample size. Thus the higher the sample size, the smaller the threshold for the factor loadings (Field 2009). However in this thesis, as the sample size is above 200, the used threshold for the factor loadings is 0.40 (Hair et al. 2011) (Table 5.6). The thesis further used the average variance extracted (AVE) to confirm convergent validity (Hair et al. 2011). Many researchers consider the AVE as a more strict approach in measuring convergent validity than composite reliability (Malhotra and Dash 2011). Thus, Malhotra and Dash (2011) argue that for composite reliability, the majority of the calculated variance may be due to error. This thesis adopted a threshold of 0.50 for AVE (Hair et al. 2011) as it is the most used threshold in management studies.

***Table 5.6*: Factor loadings and sample size**

Sample size	Factor loading deemed sufficient
70	0.65
85	0.60
100	0.55
120	0.50
150	0.45
200	0.40
350	0.30

Source: (Costello et al. 2005; Statwiki 2020)

Discriminant validity

Discriminant validity measures the level at which the various constructs are different and uncorrelated with the other constructs in the used questionnaire. Thus the discriminant validity measure enables researchers to ensure that the items used for a particular construct mainly measures that specific constructs but not the other constructs. Hence, items under a specific loading should strongly correlate with the other items under the same factor but not with items in other factors. First, the pattern matrix from the EFA was analysed to check for discriminant validity. Thus, variables are expected to load significantly on one factor only. However, in cases where there are cross-loadings, the two factor loadings should differ by 0.2. Second, discriminant validity can be checked using the square root of the AVE. Fornell and Larcker (1981) argue that the square root of the AVE must be greater than the correlation among any pair of the constructs to indicate discriminant validity. In this thesis, all the calculated square root of the AVE were greater than the correlation values among the various constructs. Hence, satisfying the rule of thumb that the correlation between a construct and itself should be greater than with other factors.

For **reliability measurement**, various researchers/studies have adopted different approaches, however, the widely used approaches are the calculation of Cronbach's alpha, and composite reliability (Hair et al. 2010; Hair et al. 2011).

Cronbach's alpha

Cronbach's alpha indicates the extent to which items in a scale are closely related (Cronbach 1951). Cronbach's alpha is known to be the most widely used approach to verify reliability in scales (Forza 2002). Cronbach's alpha also defines the extent to which items on a scale measure the same underlying construct/concept. Hence using Cronbach's alpha enables to determine the internal consistency of the items for the various constructs. The values for calculated alpha ranges between 0 and 1. Higher values denote greater reliability of the scale whilst lower values denote poor reliability of the scale. The majority of operations management studies adopt a threshold of 0.70 to indicate good scale reliability (Hair et al. 2010). Hence, this thesis adopted the same threshold as indicated.

Composite reliability

Composite reliability also measures the extent to which items in a questionnaire measure the intended concept. However, this measure is mainly used when engaging in confirmatory

factor analysis (CFA). Fornell and Larcker (1981) defined composite reliability as an "indicator of the shared variance among the observed variables used as an indicator of a latent construct". Hence, composite reliability can be thought of as being equal to the total amount of true score variance relative to the total scale score variance (Brunner and Süß 2005). The widely used threshold to indicate adequate composite reliability is a value greater than 0.7 (Fornell and Larcker 1981; Hair et al. 2010). This study adopted the same widely used threshold.

5.8.2.2 Exploratory factor analysis (EFA)

EFA is a statistical analysis mainly used to derive the main correlation among a data set (Hair et al. 2010). The EFA was mainly used in this thesis to crosscheck/derive the factor structure of the collected survey data and also prepare the dataset for the CFA analysis. This thesis used the Maximum likelihood as the approach maximises the differences between factors and provides estimates for the model fit. (Statwiki 2020). Deriving the model fit at this stage is important to help spot any model fit issues before moving on to the CFA analysis. The thesis adopted the Promax rotation which is most ideal for large datasets as used in this thesis (Chen and Paulraj 2004). The selected number of factors from the EFA was based on the eigenvalues, scree plot, the total proportion of variance explained, and the literature.

- Eigenvalues are used to measure the variance explained by a particular factor. The rule of thumb is to maintain factors that have eigenvalues equal to or greater than 1 (Pett et al. 2003; Rahn 2020; Statisticssolutions 2020a).
- Scree plot shows a plot for the eigenvalue and the number of factors to retrieve. The rule is to maintain the factors that are plotted before the curve levels off at the elbow area (Pett et al. 2003; Rahn 2020; Statisticssolutions 2020a).
- The total proportion of variance explained argues that factors explaining the least of 60% should be used (Pett et al. 2003; Rahn 2020; Statisticssolutions 2020a).
- Literature (detailed in chapter 2) was also used to determine the number of factors to retrieve. Thus, the identified dimensions as revealed in the literature was also used as a guide to retrieve the right number of factors that correspond to theory.

5.8.2.3 Confirmatory factor analysis (CFA)

The final output from the EFA was used for the CFA analysis. CFA is a multivariate statistical procedure that tests how well the variables represent the number of used constructs (Statisticssolutions 2020b). The CFA was conducted to check for the convergent validity, discriminant validity, and unidimensionality of the measurement models. The CFA was also used to confirm the factors and focus on the key items that measure the various constructs. Through this, the thesis was able to model how the developed framework fits the collected survey data well. Although a wide range of fit indices are used by different researchers to check how well a model fits data, the literature supports the general assertion that one fit indices' should not be over-relied upon but rather different fit indices should be used to collectively ascertain or assess fit. However, this thesis adopts the most widely used indices in operations management which are chi-square/degrees of freedom (X^2/df), incremental fit index (IFI), Tucker-Lewis Index (TLI), comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR) (Hu and Bentler 1999). The various cut-off points for the aforementioned fit indices are detailed in Table 5.7.

- **X^2** measures the actual and predicted matrices. An X^2/df value between 1-5 is deemed good. The X^2 has a drawback of been sensitive to sample size and correlation among variables. Thus the higher the sample size and correlation among the variables, the poorer the fit (Hooper at al. 2008; Hu and Bentler 1999; Statwiki 2020).
- **IFI, TLI, CFI** are all incremental fit indices that avoid using the X^2 in its raw form but rather compares it to a base model. Incremental fit indices have the advantage of not been sensitive to sample size (Hooper at al. 2008; Hu and Bentler 1999; Statwiki 2020).
- **RMSEA** is an absolute fit index that measures the inconsistency among the population. Hence enabling the assessment of the population (Hooper at al. 2008; Hu and Bentler 1999; Statwiki 2020).
- **SRMR** is an absolute fit index that measures the discrepancy between the sample covariance model and that of the model (Hooper at al. 2008; Hu and Bentler 1999; Statwiki 2020).

5.9 Conclusion

In this chapter, CR was detailed and justified as the main philosophy underpinning this thesis. The chapter justified the use of CR and also showed how CR helps to explore and answer the set research questions for this thesis from the ontological, epistemological, and methodological point of view. Details of how the interview and survey method were designed, collected, and analysed to answer the research questions were also presented. Details of the qualitative results which was carried out first before the quantitative study is presented in the next chapter.

Table 5.7: **Fit indices and cut-off points**

Measure	Terrible	Acceptable	Excellent
X^2/DF	> 5	> 3	> 1
IFI, TLI, CFI	<0.90	<0.95	>0.95
RMSEA	>0.08	>0.06	<0.06
SRMR	>0.10	>0.08	<0.08

Source: (Hu and Bentler 1999; Statwiki 2020)

CHAPTER 6

INTERVIEW FINDINGS AND ANALYSIS

6.0 Chapter overview

This chapter details the interview results and analysis from 18 leading pharmaceutical companies, national pharmaceutical institutions, and regulators in Ghana and the UK. The interview findings were purposely used to crosscheck the initially developed conceptual framework (Figure 2.2, page 30), and to also inform the development of the survey questionnaire (Appendix C**)**.

This chapter gives a brief background description of the interview respondents, details the interview themes and analysis, the newly generated themes, and lastly the newly developed conceptual framework.

6.1 Interview participants

Eighteen (18) respondents (Table 6.1) from leading pharmaceutical companies, comprising of manufacturers, wholesalers and distributors, retailers, and national pharmaceutical associations from both the UK and Ghana were interviewed. Only highly ranked subordinates, consisting of supply chain managers, CEOs, and experts were considered as they have more knowledge on the phenomenon been studied (Philips 1981). For Ghana, 11 pharmaceutical companies comprising of 4 SME's, 6 large companies, and 1 large national regulatory body were used. For the UK, 7 pharmaceutical companies were used. This comprised of 4 large companies, 2 SME's, and 1 large multinational pharmaceutical institution.

6.2 Interview themes and analysis

The collected interview and observation data were critically analysed to identify common patterns out of which we generated key factors (themes) (Table 6.2) and a proposed framework (Figure 6.1 and 6.2). The interview was based on the themes SCI, supply chain sustainability, and EU. Additional themes generated after the interview engagement were product innovation, leadership style, resource constraint, and patient satisfaction (Table 6.2). Although different players, ranging from pharmaceutical manufacturers, wholesalers,

Table 6.1: **Interview respondents**

Respondent code	Company given code	Position/role	Years at current company	Type of player	Company classification	Country
RES-1	1. C1. 2. C2	1. CEO 2. Registration and License Officer	14years	1. Wholesaler and Retailer 2. Regulator	1. SME 2. Large institution	Ghana
RES-2	C3	Head of Research and Product Development, Pharmacist by profession	6 years	Manufacturer, Wholesaler and Distributor, Retailer	Large company	Ghana
RES-3	C4	Production Manager	16 years	Manufacturer, Wholesaler and Distributor, Retailer	Large company	Ghana
RES-4	C5	Operations Manager	9 years	Wholesaler	Large company	Ghana
RES-5	C6	Deputy Marketing Manager, Pharmacist	4 years	Manufacturer, Wholesaler and Distributor, Retailer	Large company	Ghana
RES-6	C7	Supply Chain Manager	14 years	Manufacturer, Wholesaler and Distributor, Retailer	Large company	Ghana
RES-7	C8	Market Access Manager	N/A	Association for key pharmaceutical players in Europe and the UK	Multinational pharmaceutical institution	UK/Europe
RES-8	C9	Managing Director / Owner, Pharmacist	8 years	Manufacturer	SME	Ghana
RES-9	C10	Public Affairs Manager	N/A	Association for all key community pharmacies in the UK	Large company	UK
RES-10	C11	Customer Service and Distribution Manager	3 years	Wholesaler and Distributor	SME	Ghana
RES-11	C12	Director / Pharmacist	2 years	Manufacturer and Retailer	SME	Ghana
RES-12	C13	Assistant Store Manager	N/A	Retailer	Large company	UK
RES-13	C14	Production Manager	6years	Manufacturer and Wholesaler	Large company	Ghana
RES-14	C15	Pharmacist	6 years	Retailer	Large company	UK
RES-15	C15	Pharmacist	7 years	Retailer	Large company	UK
RES-16	C16	Pharmacist / Supply Chain Expert	N/A	Retailer	SME	UK
RES-17	C17	Pharmacist / Supply Chain Expert	N/A	Retailer	SME	UK
RES-18	C18	VP, Global Head of Medical Writing and Medical Information	N/A	Pharmaceutical research company	Large company	UK

RES: Respondent. C: Company RES-1 currently occupies both mentioned positions but in separate organisations

1. UK context: SME's- Annual turnover of less than £25m, employees less than 250, and gross assets less than £12.5m. Large company: More than £25m turnover, 250 employees and £12.5m gross assets (UKGOV, 2012). 2. Ghana context SME's: Less than 30 employees. Large company: More than 30 employees.

retailers, and regulators, were interviewed from both UK and Ghana, the majority of the issues identified are identical across both countries. However, issues that are explicitly associated with players from each country are made clear in the results.

***Table 6.2*: Generated key factors (themes) from analysis**

Key factors (Themes)		Key dimensions (where applicable)	Included in semi-structured interview theme	Newly generated theme after interview
Supply Chain integration		*Internal integration*	✓	
		Customer integration		
		Supplier integration		
Supply chain sustainability		*Economic*	✓	
		Environmental		
		Social		
External uncertainty		*Technology*	✓	
		Regulations		
		Demand and Supply		
		Currency		
Internal and external contextual factors (IECF's)	Resource constraint	*financial*		✓
		human		
	Product innovation			✓
	Leadership style			✓
	Patient satisfaction			✓

6.2.1 Supply chain integration

Various key SCI factors (RQ1) that impact supply chain sustainability were identified from the sampled data. This is summarised in Table 6.3. The results show that although SCI impacts on all the dimensions of supply chain sustainability, all the enablers/effective and efficient SCI key factors adopted by the sampled companies mainly target the economic dimension. Please note that in the context of this study, *effective* denotes achieving perceived outcome, whilst "efficient" denotes attaining effectiveness with the least possible resource available. Moreover, "ineffective" denotes unable to achieve perceived outcome whilst *inefficient* denotes unable to achieve perceived outcome with the least possible resource available. For the impact level rating of the SCI key factors, low/high denotes not only been (in)effective and/or (in)efficient, but also identified (by the researcher) using the interview findings as contributing lowly (low rating) /strongly (high rating) to providing *maximum value* to the customer at *low cost* and *high speed* (Flynn et al. 2010). Thus each SCI key

factor was assessed using the interview findings and juxtaposing how the findings contribute to providing *maximum value at low cost and high speed.*

From Table 6.3, it is also noticeable that although some companies have a positive impact on all the dimensions of supply chain sustainability through a specific SCI key factor, none of the companies have truly sustainable supply chains per this definition: to positively impact the economic with no negative impact on social and environmental dimensions within/across the supply chain (Pagell and Shevchenko 2014). Table 6.3 details *only* the SCI key factors whilst the other identified general factors which also impact the supply chain sustainability dimensions are detailed in Table 6.4.

***Table 6.3*: Key supply chain integration factors and their impact on supply chain sustainability**

SCI Dimension	SCI Key factors and their impact sign	Impact level rating	Supply Chain Sustainability		
			Economic	Social	Environmental
Internal Integration	Monthly departmental meetings (-)	High	C3	C3	C3
	Inadequate internal communication (-)	High	All companies	C3,C7	NIDI
	Unsynchronized departmental activities (-)	High	C4,C7,C9	NIDI	NIDI
Customer Integration	Use of market reps to communicate sales to customers (+)	Low	C3,C4,C5,C6,C7	C4,C5	NIDI
	Use of country reps: Make use of own scientific offices to communicate OR Host by customer at local site (+)	High	C3,C5,C8	C3,C5, C8	NIDI
	Use of distribution zone reps (+)	Low	C3,C4,C7,C13	C3,C4, C7	NIDI
Supplier Integration	Information sharing among local importers sourcing from same supplier only (+)	Low	C1,C5	C1	NIDI
	Barter trading among importers (+)	High	C1,C5	C1,C5	C1,C5
	Sharing market authorization(+)	Low	C4,C5,C14, C15	C4	NIDI
	Capacity sharing (+)	High	C3,C7,C9,C17	C3,C7, C9	C3,C7,C9
	Companies host major foreign suppliers at local site (+)	High	C5	C5	NIDI
Entire supply chain	Lack of communication across the chain (-)	High	C1,C8,C11, C12,	C8,C11	NIDI
	Less integration among players due to price differences (-)	High	C5,C9,C8,C15,C16,C17, C18	C8	C8

Note: (-): Inhibitor/ Ineffective and/or inefficient (+): Enabler/Effective and/or efficient
NIDI: No identified direct impact C: Company. E.g. C1 = Company 1

In general, although efforts are been made by the companies to integrate their operations and activities internally and externally, more effort is needed by the companies to engage in effective and efficient SCI to achieve supply chain sustainability.

> *It's getting slowly a little better, you get to see areas with a bit more integrated collaboration between the manufacturers and the suppliers and the customers and if you compare it with other areas of the economy we are like 20 years behind (REF-7).*

The analyses of the SCI results are detailed in the sub-sections titled internal integration, supplier integration, and customer integration.

6.2.1.1 Internal integration

The results showed that generally, the companies use emails, telephones, and WhatsApp for communicating across different functions within the organization. The general key issue of less efficient and effective internal integration was noticed among all the sampled companies. Thus, from both the UK and Ghana respondents. This issue was mainly shown through inadequate direct and on-time communication, and unsynchronized activities among internal functions. All these issues were known to affect the efficiency and effectiveness of internal operations.

> *This becomes more stressful when you demand something from another department and their schedule doesn't fit in with your request due to less efficient, unsynchronized and inconsistent communication which ends up in longer hours of wait and massive delays (RES-2).*

In support of RES-2 statements, the production manager for one of the leading pharmaceutical manufacturers in Ghana also stated:

> *There is less direct and inadequate communication among various departments in the company (RES-3).*

The majority of the respondents indicated that there are efforts being made to integrate and communicate across the various functions, however, these efforts are not adequate. In support of this, the majority of the manufacturing companies (both UK and Ghana) indicated

the use of periodic or mostly monthly meetings to integrate their activities, of which some of the companies perceived as ineffective and inefficient.

> *We integrate our activities with other departments within the company. We communicate and share ideas during product development meetings held every month as well as through intranet (memo). We communicate informally as well throughout the day depending on the necessity. However, activities are integrated with internal departments mostly through monthly meetings which mostly leads to delays (REF-2).*

In a typical manufacturing company, the general protocol followed to share information and integrate operational activities internally before an order is placed from suppliers are shown below:

(1) Data from the inventory keepers is shared with the operation manager for the operations department

(2) The manager analyses the data in juxtaposition with their budget, stock level, and market demands

(3) The order is then generated by the operations manager

(4) Orders sent forth to all necessary departments (mostly procurement, administration, and quality control/assurance)

(5) Quality assurance then generates the specifications and procurement places the order.

(REF-3; REF-4)

From the results, it is clear that there is inadequate sharing of information across different departments, especially on a real-time basis. However, this was more profound among the Ghana companies than that of the UK. Generally, the pharmaceutical industry is known to engage in complex activities on a *day to day* basis which is critical to meeting the overall set goals for companies. Hence having *monthly* meetings were most details of activities are shared among various internal functions is highly likely to pose as a challenge as indicated in the results. The long duration for sharing information internally will not only affect the efficiency and effectiveness of internal operations but also how responsive the companies are to customer demands and external uncertainties.

6.2.1.2 External integration

Customer integration

Generally, the manufacturers and wholesalers (from both the UK and Ghana) were known to make use *of sales representatives and or marketing representatives* to communicate with customers. These representatives mainly solicit and introduce their products to customers (e.g. retailers, hospitals, etc.) but share less information on other vital operational activities. For example, product development. For the UK representatives in Ghana, they do have their own scientific offices set up and registered as a business entity. These scientific offices are managed by the UK companies' country representatives who serve as a link between the manufacturers, wholesalers, and retailers in Ghana. The country representatives visit each of these players and *pass on gathered information* (mostly product and sales history) not only to the parent UK company but also amongst the Ghana manufacturers and wholesalers and their retail customers.

> *For the multinational companies each have their own scientific offices in the country or their country managers do the promotions. So they serve as the coordination between us as importers and between us and retailers (REF-4).*

On the other hand, some of the multinational country representatives are hosted by their existing local customers (manufacturers or wholesalers) in Ghana. Hence, allowing all sales and distribution to go through the local distributors hosting the UK company's representative. The operations manager for arguably the biggest one of the leading wholesale companies in Ghana stated:

> *So for now, we are importing from about 20 companies but then for the ones we are hosting their reps are about 2 companies. For these two companies, we host their reps and pay for their remuneration (RES-4).*

Also, some customers (mostly the retailers) were also known to contact wholesalers through telephone calls, emails, or by walking directly to the wholesaler's premises with their own generated product list. The operations manager for arguably one of the biggest wholesalers in Ghana stated:

Some will also generate their own sales list and walk into our premises and purchase the products and go. The only integration there is sales relations that happen. Beyond that, we don't do any form of relationship at that level (REF-3).

In addition, two of the leading manufacturers in Ghana indicated the use of a distribution strategy for integrating with their customers by classifying the locations of their customers into zones. Tobinco pharmaceuticals, for example, has 140 zones in total. Each zone has pharmacists and medical representatives who drive demand by meeting customers at least once a week. The supply chain manager for one of the leading pharmaceutical manufacturers and distributors in Ghana stated:

If I count for the Greater Accra region and Eastern region we have divided these places into zones so if you mention a place like spintex, labadi, cantonment, teshi-nungua they all belong to a one zone called C1. Within these zones we have pharmacists and medical reps, these people drive demand from hospitals and pharmacies. The pharmacists are more knowledgeable about the products so they will visit the pharmacy or the hospital, talk to the doctors about the products. So when they get the orders they inform the sales reps in that zone (REF-6).

Although the pharmaceutical players in Ghana and the UK are making a great effort to integrate their activities with customers, it is evident that less integration exists for carrying out other vital operational activities, such as product development. Additionally, most of the customer integration activities occur only at the point when products are been purchased by retail customers. Patients (or consumers) were also not fully engaged by the retailers and wholesalers to give consistent feedback on purchased products and services. That not-withstanding, there are identified state institutions and non-governmental organisations (NGO's) that participates in periodic (mostly every 2 years) market surveys to gather feedback from patients. However, the majority of the companies perceive these surveys as not been able to quickly uncover/capture the evolving day to day challenges or issues that patients face from purchasing and using specific pharmaceutical products and services.

Supplier integration

Generally, all the sampled companies mainly use emails, telephones, and WhatsApp for communicating with suppliers. Nevertheless, as mentioned in the previous section, the big

multinational companies operating in Ghana make use of their *own country representatives* who serve as a link between the manufacturers and wholesalers in Ghana and the multinationals from different countries who are the suppliers. The Ghana manufacturers and wholesalers were known to integrate with the multinational suppliers by mostly hosting the multinationals *country representatives at their local sites.* The operations manager for arguably the largest and leading pharmaceutical wholesaler and distributor in Ghana stated:

> *So for now, we are importing from about 20 companies but then for the ones we are hosting their reps are about 2 companies. For these two companies we host their reps and pay for their remuneration and the multinational company reimburses us for the services. Although we have a direct communication line, this also makes it easy for us to communicate with the multinational as they have a specific rep on the ground that is specifically attending to the particular multinational (REF-4).*

The majority of the sampled companies *classified at the same level in the supply chain* mostly integrate their operations through information sharing and barter trading. This is mainly influenced by the fact that (1) the *companies source their products from* the same big multinational supplier and (2) most importantly the companies *share the same market authorisation* of the big multinational supplier. This form of integration was more profound among the sampled Ghana companies than that of the UK. Moreover, players at the same level in the chain integrate purposely to facilitate the sharing of products from the same multinational supplier among the local companies. Aside from this *creating/increasing capacity for the companies,* it also facilitates flexibility and market responsiveness during times of drug shortages. However, there is less integration among players (1) classified on the same level in the supply chain but sourcing products from different multinational companies (2) players who are not at the same level in the supply chain.

> *At that level, we have good integration because with a particular multinational brand you will have about 2 or 3 or 4 importing the same product from that manufacturer and so it may be Pfizer but maybe 3 local partners importing it. At that level there is integration, importers/distributors integrate their operation when importing from the same supplier (REF-4).*

To support the raised argument on barter trading, one of the wholesalers in Ghana stated:

> *Wholesalers, however, they do trade together. Sometimes they do barter trade. For example, if C4 brings X products and C5 is importing Y products, they do exchange some of these products in order to be more flexible in variety. Hence as a retailer, I depend on a wholesaler who stocks the majority (>70%) of the products that I need (RES-1).*

In support of RES-1 statements about barter trading among players mostly located in the same level of the chain, the supply chain manager for one of the leading pharmaceutical manufacturers in Ghana also stated:

> *Wholesalers' barter trade in order to be flexible, integration happens mostly among players in the same stage in the chain sharing of market authorisation among companies, Importers/distributors integrate their operation, especially when importing from the same supplier (REF-6).*

The manufacturers and wholesalers were known to have an average of 10-15 suppliers from which finished pharmaceutical drugs are purchased. All the leading pharmaceutical companies in Ghana (most especially the manufacturers) were known to *import the majority (about 70-80%) of their finished drugs* demanded by their respective markets from oversees. Thus, the manufacturers in Ghana manufacture only about 20-30% of their total demands. This high level of importation coupled with high importation lead time (*40-45 days averagely)* was known to make the management of the supply chain very complex. Hence, maintaining effective and efficient integration with suppliers is key to thrive in the pharmaceutical industry especially in Ghana.

> *We are into manufacturing and importation. 70-80% of our final products are imported. So what we do here is between 20-30%. All these products come into one basket then we distribute to the public. There is a high demand that currently as we speak we can't meet the demands for paracetamol in Ghana (REF-6).*

To support the raised issue of high importation lead time, the operations manager for one of the Ghana pharmaceutical manufacturers and distributors indicated:

> *Most of our suppliers are middlemen, so to speak which makes it difficult to meet market demands especially as delivery from suppliers takes an average of about 40-45 days. Can the customer be waiting for you to receive your input after this? So this is the main problem. And this is not peculiar to us only but the entire pharmaceutical industry in Ghana and I'm sure it is the same for the sub-region as well (REF-3).*

The majority of the respondents especially those in Ghana, indicated that importing a high amount of finished products and raw materials over a long distance (especially India and Europe) poses unpredictable issues of *transportation disruption and quality issues* during the entire process of importation. As currently there are no inputs (Example, Active Ingredient) manufacturers in Ghana and fewer inputs manufacturers worldwide, the sampled manufacturers mostly end up airlifting products and raw materials which *add up to their operational cost*. In addition, it was noticed that imported products and raw materials mostly takes longer than estimated to clear at the various country ports due to less effective communication and integrated clearing processes between the port operators and the manufacturers and wholesalers. This issue is known to incur high operational costs for the importers due to high demurrages. But, this issue of *long port processes* was more profound with the port in Ghana than that of the UK. Interestingly, the UK respondents do anticipate that there might be a change to also experiencing longer port processes due to Brexit.

> *Then shipment problems, especially clearing at the port. Even as we sit now there is a lot of demand for products and far back as October-November 2018 that orders were placed, up to date we haven't received them yet. Some of them are even sited at the port (REF-3).*

Furthermore, it was identified that for products sold in partnership with external companies, two (manufacturer and wholesaler) of the companies in Ghana indicated that information on sales is communicated in real-time with the external partners. The *software used for this process is called XMT.* A few of the UK companies were also known to communicate with their suppliers on a real-time basis.

From the results, it was noticed that the pharmaceutical players in Ghana face more numerous operations challenges as the players have no raw material (mainly Active Ingredient) manufacturers. Additionally, as the players in Ghana are more subjected to experiencing less efficient port processes and quality uncertainty during transportation, coupled with the huge amount of finished product importation, this makes the operationalization of supplier integration more crucial in Ghana. The less effective/efficient port processes in Ghana may be attributed to the less use of state of the art equipment and technology. Though, in the UK and other developed countries, port operators are known to seamlessly synchronize their activities with importers and suppliers as compared to that of Ghana. This seamless synchronization facilitates efficient integration among the pharmaceutical players and their suppliers which also affects the efficiency of transport and port processes.

6.2.2 Supply chain sustainability

After the individual and cross-company analysis, *all* the identified factors (Table 6.4) enabling and inhibiting supply chain sustainability (RQ2), and their correspondence to SCI, were categorised under the triple bottom line (Table 6.4). The most mentioned supply chain sustainability factors from Table 5.4 are detailed subsequently.

6.2.2.1 Economic dimension

The high cost of operations and low-profit margins were mentioned by all the UK and Ghana companies. The companies also lamented on high tariffs for utility, lack of funds from external bodies and internally due to adopted leadership style and mismanagement, high cost of energy, lack of price regulation, delays in payment from customers, high cost of labour especially pharmacists and biological scientists, highly saturated downstream market, and high cost and duration of research and development (R&D), just to mention a few. All these are detailed below and in Table 6.4.

Cost and profit

The majority (about 80%) of all the respondents indicated that in terms *of profit*, their companies are not making enough however they are "sustainable". Meaning that the sampled companies are not making the estimated profits that can facilitate huge investment in R&D, match up prices of the highly saturated downstream market, and introduce new products to gain competitive advantage. Whilst about 20% of the respondents indicated that their

companies have not made any profit for the past at least two years. The issue of low-profit margins (both UK and Ghana sampled companies) was mainly attributed to the high cost of operations and the highly saturated downstream market by wholesalers and retailers.

> *Over the past 5 years we established we haven't been profitable, yes we haven't. There have been cases where our funds have been held up in other countries we operate in like Gambia, Cameroon, Mali. You export to these countries and they don't pay on time (RES-6).*

To support the raised issue of the saturated downstream market, the CEO for one of Ghana pharmaceutical wholesalers and retailers indicated:

> *Now about every 400 metres you see a retail facility. The average retailer has a mark-up of about 30%. The big retailers about 35-40%. We are not making enough but we are sustainable (REF-1).*

All the manufacturing companies indicated that their high operational cost is also largely due to the highly intensive and costly *research and development (R&D)* process. Thus, as the companies strive to be more innovative to tackle new and dynamic health issues, intensive R&D investments that are costly are largely relied on. For example, in the development of a new pharmaceutical product, only 1 out of 10,000 medicine discoveries and tests make it to the market. The market access manager for arguably the largest pharmaceutical association in Europe lamented on this issue:

> *A lot of the people don't understand that it is only 1 out of 10,000 medicines that actually make it to the market so you start off with 10,000 potential discoveries of a new compound and actually only 1 makes it on the market as the final product. That means you have 99,999 failures and those failures need to be accounted for (REF-7).*

Also, all the respondents from both the UK and Ghana indicated a *high cost of production and operations.* This issue was expressed in forms such as high utility tariffs, high cost of power (e.g. fuel), high cost of labour especially for pharmacists and biological scientists, long duration and high cost of research and developments (as initially indicated), and new

developments in the form of additional cumbersome test procedures, just to mention a few. An example of the costly cumbersome test procedure is the use of HPLC's for testing newly developed products. Each HPLC is known to cost about $60,000.

> *When you go to some of these local companies they do not do that, yeah, maybe they will test the final product but not the various stages that went into coming out with the final product and testing is expensive. We do use HPLC's for testing and one HPLC can cost you about $60,000. You walk into some of these companies and they don't have the HPLC so there is even a doubt about their accuracy results (REF-6).*

All the interviewed manufacturers in Ghana explicitly indicated that the importation of pharmaceutical products is significantly cheaper than manufacturing drugs locally. Yet, the local manufacturers are able to reach the targeted market quicker, as importation takes a duration of mostly 3 months from Asia. Even though importation from Europe takes an average of 4 weeks, the importation and product cost is expensive (compared to the importations from India) which increases the cost. For highly sensitive and fundamental manufacturing products which demand shorter lead times, for example, the Active Ingredients (AI), the majority of the companies airlift such supplies which also adds up to the cost of operations. It was identified that about 99.9% of the manufacturers in Ghana do import all their raw materials for manufacturing. *The high importation coupled with long port processes, especially in Ghana, results in having the goods of the importers (manufacturers and wholesalers) incurring high demurrages and affecting the company's flexibility and dependability performance.* All the interviewed manufacturers and wholesalers from Ghana mentioned that aside from *the long importation duration and port processes,* importers are unable to pay for their imported products. This is mainly due to the *high cost of operations, low-profit margins, and less available sources of financial support for the pharmaceutical companies*. This issue further incurs more charges for the importers and affects their *relationship with the multinational suppliers* due to payment delays. Thus, some importers arrange to make final payments after the supplied products arrive at the final port of destination. In the pharmaceutical field, this type of arrangement and payment is known as the cash again document (CAD).

> *We face money issues. The last time I checked, we realized we have products worth 3.5million dollars at the port. We buy our input in two financial terms. One is Letter*

of Credit of which the banks in Ghana and the country of importation agree on your behalf but you pay the bank in your country. The other one is called cash again document (CAD) where the supplier agrees to send the product but when the products get to your port, you make sure you pay the supplier before the final document is given for you to go clear the products. So if you don't have enough money to pay for the worth of the goods and even go on to pay for the duty then it becomes a problem. This is the main issue we face (REF-3).

Furthermore, 40% of the total (both UK and Ghana) respondents could not give details of the actual financial standing of their companies. This was mainly attributed to the *type of leadership style* adopted by the company leaders, which hinders financial transparency. Most of the companies are structured in a way that allows only a few company leaders to have full control over the company's wealth. They decide where, when, and how to invest the company monies without a collective effort with other key stakeholders. The leadership style adopted was known to affect the collective ability of internal and external stakeholders in finding well targeted and appropriate mediums for securing needed funds. On the issue of adopted leadership style, the operations manager for the largest and oldest pharmaceutical manufacturer in Ghana indicated:

Yes, we should make profits. Yes, companies do publish these things in their reports but unfortunately, we don't do that into detail. This is mainly controlled by the owner of the company, yes one-man Company. Even to the extent that the chief accountant does not know the full size of the elephant (RES-3).

To support the raised issue of how adopted leadership style impact firm performance, the supply chain manager for arguably one of the leading pharmaceutical manufacturers in Ghana indicated:

Autocratic leadership and structure are also affecting our lack of funding. Decisions are mostly solely taking by the owner which sometimes leads to financial mismanagement (RES-6).

***Table 6.4*: Supply chain sustainability factors from cross-case analysis enabling and inhibiting supply chain sustainability**

Supply chain sustainability	Supply chain stage	Supply chain sustainability factors	Enabler	Inhibitor	Correspondence of factors to SCI
Economic	Production	High cost for active ingredient (AI) importation		✓	II,SI
		High cost for power/energy		✓	II
		High port charges		✓	II, SI, CI
		Frequent technology change is costly		✓	II
		High minimum order points for local importers		✓	II, SI
		Highly expensive testing procedures		✓	II, SI
		Squeeze on manufacturers profit margins		✓	II, CI
		Quality issues		✓	II, SI
		High cost for equipment and facilities to be GMP compliant		✓	II, SI
		High cost for R&D		✓	II, SI
		High number of drug failures		✓	II
		Long lead time for drug model development, testing, and approval		✓	SI
		Cross-contamination of drugs		✓	SI
		Long production and testing cycle resulting in high inventory holdings		✓	II
		High manufacturing cost for locally produced drugs affects the selling price of these drugs		✓	II,SI,CI
		Expensive local manufacturing due to high tariffs *		✓	SI
		Over-reliance on foreign suppliers for raw materials *		✓	II,SI
		Long lead time for most raw materials *		✓	SI
		Good efficacy for locally manufactured drugs *		✓	II
	Distribution	Inadequate storage capacity to meet high demands		✓	II,SI
		Parallel trade		✓	II,SI
		Counterfeit and Expired drugs		✓	CI,SI
		Limited funds to purchase appropriate vehicles, maintenance, repairs, fuel and driver salaries		✓	II,SI
		Long port processing times		✓	II,SI
		High storage cost due to long port processes		✓	II,SI
		High demurrages		✓	SI
		High transportation cost		✓	II

		High cost for raw material importation due to less local input manufacturers		✓	SI
		Road constraints and Traffic constraints in major cities		✓	II,SI
		Competitive pressure and uncertainty: IT advancement, DTP		✓	II,SI,CI
		Squeeze on wholesalers profit margins		✓	II,SI,CI
		Less efficiently designed route systems to balance between low distribution cost and service levels		✓	II
		Squeeze on wholesalers profit margins		✓	II,CI
		Issue of combining the duties of drug importation and distribution even with low capacity		✓	II,SI,CI
		Regulation differences in West Africa incur high cost for transportation activities *		✓	II,CI
		Less efficiently designed route systems to balance low distribution cost and service levels*		✓	II,SI,CI
		Less sophisticated software to optimize distribution*		✓	II
		Issue of combining the duties of drug importation and distribution even with low capacity*		✓	II,SI,CI
		More time and resources for exceptionally long deliveries extending to sparsely populated villages. Affects cost. *		✓	II,CI
		Expired drugs		✓	II
	Retail	High cost and competitive pressure		✓	II,SI,CI
		Saturated market affecting profit margins		✓	II,CI
		High use of MCA's due to high cost of operations and hiring pharmacists *		✓	II
		Lack of funds		✓	II,SI,CI
	Entire chain	Reduction in government funding support		✓	SI
		Long lead times due to lack of funds		✓	II,SI
		Unfavourable credit periods		✓	SI,CI
		Fewer profit margins		✓	II,SI,CI
		Improper forecast leading to shortages and expiries		✓	II,SI,CI
		Weak pharmacovigilance		✓	II,SI,CI
		Drug shortages and unavailability		✓	II,SI,CI
		Proper disposal of waste is costly		✓	II,SI,CI
		Frequent technology changes are costly		✓	II,SI,CI
		Payment delays		✓	II,SI,CI
		The high cost of operations affecting profit margins		✓	II

		Drug counterfeits		✓	II,SI,CI
		High competition affecting profit margins		✓	II,SI,CI
		Limited use of technology, resulting in less flow of information across the supply chain		✓	II,SI,CI
		Fragmented nature of the pharmaceutical supply chain		✓	II,SI,CI
		Unregulated prices *		✓	SI
		Prices are regulated **	✓		SI
		Falsified Medicine Directive **	✓		II,SI
		Less internal transparency especially with finance which affect supply chain activities		✓	II
		None found			
Environmental	Production	Use of ethical materials sourced from ethical suppliers	✓		II,SI
		Use of non-recyclable materials		✓	II,SI
		Re-called and expired drugs		✓	II,SI
		Improper waste, damaged, wrong and expired drug disposal		✓	II,SI,CI
		Re-use of recycled water	✓		II
		None found			
	Distribution	Gifting customers products termed/perceived ethical		✓	CI
		Inadequate supervision of the distribution activities. Leading to falsified drug introduction		✓	SI,CI
		None found			
	Retail	Climate change leading to shortages and unavailability		✓	II,SI
		None found			
	Entire chain	Been environmentally friendly is not economically viable		✓	II,SI,CI
		Not environmentally conscious		✓	II,SI,CI
		Improper waste and expired drugs disposal		✓	II,SI,CI
		Use of non-recyclable materials		✓	II
		Education on proper drug disposal	✓		II,SI,CI
		Good environmental practices, not a requirement for selecting suppliers or customers*		✓	II,SI,CI
		Heavy reliance on importations mostly subjected to high uncertainty and vulnerable to the introduction of imitated drugs*		✓	II,SI
		Use of Effluent plant and Septic tanks	✓		II

		None found			
Social	Production	Limited funds to purchase appropriate vehicles, maintenance, repairs, fuel and driver salaries		✓	II,SI
	Distribution	High use of MCA's sometimes results in administering interacting drugs *		✓	II
		Free transport for staff	✓		II
		Bargaining power of retailers affecting wholesalers		✓	CI
		None found			
	Retail	Pay/Salary is OK	✓		II
		Gender discrimination avoidance	✓		II
		None found			
	Entire chain	Hiring is based on expertise	✓		II
		Engagement in numerous Corporate Social Responsibility activities	✓		II,CI
		Fragmented nature of the pharmaceutical supply chain		✓	II,SI,CI
		Weak pharmacovigilance *		✓	SI,CI
		Free accommodation for the majority of the employees *	✓		II
		Falsified Medicine Directive **	✓		II,SI

Note: **: Peculiar Issues mostly to the UK (developed countries) *: Peculiar Issues mostly to Ghana (developing countries). Listed issues with no asterisks apply to both the UK and Ghana companies. II: Internal integration SI: Supplier integration (embodies not only raw material and product suppliers but also regulators and governmental bodies as they issue various licenses and operational regulations for the pharmaceutical companies) CI: Customer integration. II, SI, CI***: Currently, no integration / no effective and/or efficient integration causing a negative impact.*** II, SI, CI***: Effective and/or efficient causing a positive impact***

In addition to the cost issue, most of the respondents from both the UK and Ghana indicated the issue of payment delays from customers. In the context of Ghana, for example, a single contract from the Ghana government (identified as the major customer) covers a year full of demanded supplies at specific intervals with specific quantities. Even though such contracts were known to be ideal for the manufacturers, the government is known to constantly delay (up to a year or more) payment of awarded contract (s). The manufacturers and wholesalers in Ghana also indicated that customers in the form of hospitals, clinics, and retailers demand long/high credit periods mostly beyond 120 days. However, the credit periods given to the same manufacturers and wholesalers by their suppliers mostly average between 60 to 90 days, or 120 days maximum. This creates huge financial slack issues for manufacturers and wholesalers which affects their ability to pay for imported products on time (*dependability*). This was known to also affect the relationship and trust among these players.

> *When your bills are due with your multinationals, probably it's a computer that puts your account in red and says OK your company owes this bill or these bills are delayed. Whether it's a day or two, it just flags up your account. You can't go and tell the multinational company that the people on the ground are not paying and so I also want to delay my payments for X number of days. It's a reputational issue. I have a hospital that used about over 25% of my total products that I imported last year and they owe me for over 6 months, they have requisitions. I have product sitting in the warehouse with a shelf life of just about 18 months, do I give the product out or not. That will affect the total expiries I will have in a year (RES-4).*

Another factor identified to affect profit margin was the lack of price regulation. This issue was largely emphasized by the sampled Ghana companies. As there are no price regulations in Ghana, some of the companies were known to highly price their products. Most of these high prices use up to a 70% margin on the cost price. On the other hand, the majority of the companies reduce their product prices below reasonable margins purposely to compete with the cheaper products from India. These price differences affect sales and profit margins. For the UK and other European countries, authorities are known to regulate prices mostly at the national level and reimburse products from manufacturers to retailers, sometimes drive the purchasing price from manufacturers below a reasonable threshold. This is known to affect

the cost of operations and profit margins of the manufacturers whilst some manufacturers end up redrawing from the market completely which is known to affect drug availability.

> *The average retailer has a mark-up of about 30%. The big retailers about 35-40%. Some do a 70% margin on their cost price. There is no price regulation in Ghana (RES-2).*

To support the argument of regulated prices and some of its associated effects, the market access manager for the largest pharmaceutical association UK and Europe stated:

> *Prices are set at national levels however they vary quite a lot between countries. A lot of the medicines that member companies sell they don't sell on the open market but they sell on the reimbursement by the authorities so sometimes the authority drives down the price below a certain threshold and the manufacturer decides to completely redraw from the market then it is something we consider lack of availability (RES-7).*

The change in customer attitude was identified as another contributing factor to the fewer profit margins experienced by the pharmaceutical companies in both the UK and Ghana. Thus, customers now compare prices a lot before making purchases. This change in attitude has caused marginal price reductions for products among pharmaceutical companies especially with big multinational companies, purposely to remain price competitive on the market.

> *Customers compare prices a lot and big retailers are now cutting down their prices by buying their products in bulk to receive discounts from wholesalers (RES-1).*

Moreover, to help increase sales and profit, retailers have geared toward the trend of introducing non-pharmaceutical products (for example, perfumes, cosmetics, and groceries). This concept is widely adopted by the majority of retail pharmacies in the UK as compared to Ghana. However, as this operational strategy/trend is quite new in the Ghana setting, the sampled retailers were quite uncertain to firmly conclude whether the strategy is helping increase sales and profit margins or not.

Now the retail pharmacy is shifting from a traditional point of view where only drugs are sold but now where other products like perfumes, and provisions are sold. Now it is like the supermarket. This is to help attract buyers into their shops, but I can't tell if it is working (RES-1).

Although many factors were known to affect the cost and profit margins of the pharmaceutical companies, the most dominant factors mentioned by the companies are the intensive investment in R&D by the pharmaceutical manufacturers whilst the wholesale and retail market are exposed to a highly saturated downstream market. In Addition to the most dominant factors, in both the UK and Ghana, getting access to funding is one of the critical issues faced by the pharmaceutical players. This issue is known to not only affect the profit margins of the companies but also how innovative they can be in developing and introducing new products into the market to tackle the ever-evolving complex diseases.

Quality

The respondents gave a variety of definitions for the term "quality". One of the respondents (REF-8) for a manufacturing company in Ghana defined quality as following all the necessary laid down procedures or processes whilst another manufacturing company respondent (REF-3) defined quality as efficacy. REF-8 further defined quality as having a manufactured product work effectively for its intended purpose under the shortest possible time after been taken by a patient. In ensuring quality, the manufacturers adhere to a series of cumbersome test procedures and use up-to-date sophisticated technology like that of the HPLC's for testing new products. Companies also make use of temperature-controlled facilities to keep ingredients and manufactured products at their required temperatures throughout their life cycle in order to maintain quality. Having a high quality, per the definitions given, was known to positively affect how the company's brand is perceived which further improves sales rate and profit margins.

In the Ghanaian market, our products are deemed to be a bit expensive than other brands and there is a reason for that. Because of the quality, we build into the product. Our main competitive advantage is quality and our reputable brand name, it has become so conspicuous. The name has become a household name and people are ready to buy. We have gotten to the point where anything we produce here and we say it is from us people are ready to buy (RES-3).

In comparing the state of manufacturing equipment which is more tailored towards good manufacturing practices (GMP), the UK (and most developed countries) companies were known to have more sophisticated technology than those in Ghana (and most developing countries). This notwithstanding, the manufacturing companies in Ghana and other developing countries produce pharmaceutical products which are mostly of equal efficacy, and even sometimes found (through market surveys) better than those produced in developed countries. Thus, the manufacturers in Ghana were known to produce products from less top-notch manufacturing plants with good quality features mostly in the form of efficacy.

Some of the common quality issues been faced by the players (both UK and Ghana) especially with importations and long-distance transportation are: the likelihood of products getting contaminated as they come into contact with other shipped products, uncertainty about the original quality of imported AI, and high cost to manufacture, import and maintain quality products. However, it was noticed that these issues are more profound among the Ghana companies as they rely heavily on imported raw materials and products. To further emphasize on the aforementioned quality issues, some of the selected comments from the respondents are shown below:

> *Because we (Ghana) are not manufacturers of AI we always need to source AI from outside. Assuring the quality of the AI importation is a major problem and because we order in small quantities for our research, we mostly end up air-lifting the products which add up to cost. Small quantities like 25kilos maximum depending on the product type. Roughly it costs around $15,000-$20, 000 (REF-2).*

To support the raised issue on the likelihood of getting imported products contaminated, the Head of Research and Product Development for one of the leading pharmaceutical manufacturers in Ghana further indicated:

> *Excipients are not to contain certain bacteria according to regulations. However, during their mode of transport, they get contaminated. It issue is very unpredictable and difficult to handle from our end (REF-2).*

To support the indicated issue of the high cost of manufacturing quality products, the production manager for arguably the leading and oldest pharmaceutical manufacturing companies in Ghana stated:

> *We talk about products been original and all that and there is a lot of professors we are paying to research and build the product. So quality is very expensive. Our main competitive advantage is quality. Thus depending on the quality, even though everyone is producing a good thing, one works better than the other. So that is where we get the advantage. And I think people are getting into it (REF-3).*

Coaching products were identified as the main pharmaceutical products that are more susceptible to quality issues.

> *Yes with the quality issues we face, it is mostly with the coaching products. With the other ones, for instance, we have warehouses where we have it temperature controlled but the thing is if the products leave your hand to other wholesalers who controls what they do, yes you have no control as you cannot go and exercise regulatory control over them as it becomes the responsibility of the regulators but then I think they look at you as the importer and put the responsibility on you (REF-4).*

From the results, it was noticed that although the quality issues are more profound among the Ghana companies as they rely heavily on imported raw materials and products, it is evident that players from both the UK and Ghana face quality issues. Although players in Ghana have less sophisticated equipment and technology, some were known to produce products of equal and acceptable quality as compared to that of players in the UK and other developed countries.

Counterfeit products

Counterfeit pharmaceutical products were known as one of the main issues facing pharmaceutical players in both the UK and Ghana. The majority of the sampled companies mentioned that counterfeit products are mostly smuggled into the pharmaceutical value chain resulting in loss of tax revenue for the government. Aside from having counterfeit products saturating the downstream market, it was known that some customers prefer purchasing these counterfeit products because they are cheaper in terms of price which affects the sales

of the pharmaceutical companies. The majority of the counterfeit products also have the wrong composition of the ingredients and/or wrong dosages which puts the health of patients at risk.

Over the years, the pharmaceutical industry in both developing and developed countries has introduced different measures to curb the issue of counterfeit. From a developing country perspective, the issue of counterfeit is mainly tackled by encouraging importers to source products from reputable brands (mostly located in Europe) whilst having the National Pharmacy Council (NPC) perform regular market checks from time to time.

In the UK and Europe, the pharmaceutical industry introduced the Falsified Medicine Directive (FMD) in February 2019 as a means to eliminate counterfeit products from the legal chain. The FMD comprises about 2,000 manufacturers, 20 nationals, and 140,000 pharmacies. The FMD works by having serial numbers placed on all manufactured pharmaceutical products by the manufacturer. Along the chain, as the products move from upstream to downstream, the serial number is used to check the authenticity of the products from one point to the other. This is repeated throughout the chain up to the point of sale to patients at the retail stores. After the introduction of the FMD, the main issue being faced by the pharmaceutical players especially the retailers is the "generation of false alerts". The false alert is mostly associated with wrong FMD scanner readings by the pharmacists as most of them are not familiar with the FMD information technology (IT) system yet.

> *What happens today is some of the pharmacies the scanners, for example, this is a concrete example, instead of reading capital letters in the serial number they read small letters and this automatically means the system doesn't recognise that serial number so it generates an alert. So that is one simple but there are others as well (REF-7).*

As most of the national authorities have recognised that the false alert is mostly due to administrative errors but not necessarily because the products are fake, the "stabilization period" has been introduced. The stabilization period is to allow pharmacists to dispense drugs to patients even though false alerts might be generated. This period is to enable patients to get access to their drugs whilst stakeholders put in rigorous measures to reduce the number of recorded alerts drastically.

However today, a lot of the member states and the competent authorities recognise the fact that this happens and they are allowing the so-called stabilization period where pharmacies can still dispense the products to customers even though they generate the false alert. Because they recognise that this is an administration reason (REF-7).

From the results, although counterfeit products are recognised as a consistent issue affecting the level of sales and profit margins for companies, jeopardizing the safety of drugs and the health of patients, from the Ghana perspective, a less practical and efficient solution has been put in place to tackle this issue. For the UK and Europe, the introduction of the FMD serves as a more practical and efficient strategy of tackling counterfeit especially as all the players in the supply chain play a critical and collective role at each stage of the chain. Reducing the rate of experiencing counterfeits will not only protect the quality and safety of drugs for human consumption but will go a long way to positively affect the sales and profit margins of the pharmaceutical companies and government revenue.

Flexibility and delivery

Generally, the manufacturing companies classified as SME's had a product variety range of 15-25. For example, Propharm, a manufacturing company in Ghana, has 21 different products that span from the hematinics, antacids, cough syrups, hand sanitizers, and multi-vitamin syrups. The large manufacturing companies were also known to produce both liquids and solids whilst the majority of the SME's produce liquids only. This trend is attributed to the fact that the liquids require less sophisticated technology and are not as complicated to produce as compared to producing solids. In terms of manufacturing volume, for a single product, the companies normally produce thousands of such products within a year. This helps the companies to be flexible due to high levels of unpredictable demands. For example, Propharm produced about 624,000 bottles of Multiferox and 200,000 bottles of Simplelinctus syrup for the year 2018.

The majority of the pharmaceutical companies (both the UK and Ghana) involved in the activity of drug distribution make an average of 7-12 facility deliveries in a day. The majority of the manufacturing companies classified as SMEs are known to outsource their distribution activity whilst the large companies undertake their own distribution. Home delivery of pharmaceutical products to patients was also known to be less practiced by the majority of

the bricks and mortar pharmaceutical retailers in both Ghana and the UK. However, this was more profound among the Ghana settings.

> *With distribution, I currently don't have any fleet. So if you deliver only four times and you go and buy a fleet of trucks or vans that wouldn't be ideal as you can use that money for something else. So I have a friend that I outsource the distribution activity to which is cost-competitive. So probably when there is a change in demand and the pattern of distribution, we might get our own fleet (REF-8).*

To support the raised argument about most of the large firms carry out their own distribution, the operations manager for one of the leading wholesalers in Ghana stated:

> *In total each of the marketing people who go out to do distribution has a vehicle. For now, we have 4trucks that are carrying goods from Accra, which has our central warehouse, to Kumasi, and then to other places we may want to transport bulk goods. Other than that we also have our flatbed trailers that cut out goods from the port to the central warehouse. Then salon cars for managers and other officials (REF-4).*

Although from the results, it was showed that effective/efficient distribution plays a critical role in a companies' responsiveness, the majority of the distributors and wholesalers in Ghana have no rigorous technology to optimize their distribution activities. Thus less sophisticated software for routing and scheduling distribution activities was highly noticed in the Ghanaian setting.

6.2.2.2 Social dimension

The key social factors derived from the interview were: ethical behaviour, gender diversity, appropriate work environment, pay/salary, corporate social responsibility (CSR), staff training, employee health care, employee social benefit, and no discrimination, just to mention a few. All these are detailed in Table 6.4 and below**.**

Socially, it was noticed that all the sampled pharmaceutical companies are making efforts to improve their social performance. For the pharmaceutical companies in Ghana, some of the specific *CSR activities* identified were: the donation of pharmaceutical products each time

there is a disaster: engage in building hospitals blocks, e.g. the children block for Komfo Anokye teaching hospital in Ghana-Kumasi: a charity called "Box Foundation" gives scholarship to two brilliant but needy orphans to study Pharmacy at Kwame Nkrumah University of Science and Technology-Kumasi each year: supply water to local communities: supply pharmaceutical products to support outreaches organised by mission clinics and church hospitals: participates in activities like medical screening, donations to orphanages, providing school blocks and boreholes to less developed communities outside Greater Accra. The majority of these social activities are also been engaged by the sampled UK companies.

The majority of the sampled companies in the UK and Ghana provide several benefits to their employees. However, this was more profound among the sampled companies in Ghana. For example, C5, which is the biggest pharmaceutical wholesaler in Ghana, houses over 80% of its staff, pays utility, and transports the workers to and from work. This helps to reduce the financial burden on the workers and make their stay comfortable. In both the UK and Ghana, the majority of the players also pay for their employees' pension plans and provide free health care for their employees, employees' dependents, and spouses (e.g. C4 and C5).

The sampled companies in both the UK and Ghana were known to invest *in training their employees* periodically. The companies carried out the training both internally and externally. Internally denotes providing training at the companies' job site by selected experts whilst externally denotes employees traveling to a different institution for training. For example in Ghana, most of their employees travel overseas (USA, India, and Europe) to receive specific forms of training.

> *We have the training calendar for the whole year. So we do 'internal training' and 'external training' where employees sometimes travel beyond the shores of the country to receive specific/different forms of training. Like for example in the next month, I will be in Bologna for an exhibition where we will see and learn about new equipment, see new suppliers and new materials, etc. (REF-3).*

Furthermore, 50% of all the respondents indicated that their *pay is comfortable* whilst all the respondents mentioned that their working environment is safe and okay. It was also noticed that the companies in both countries employ people based on their skills, ability to learn,

ability to adapt to systems, and a desire to achieve targets. Thus there is *no discrimination with regards to race and gender* when hiring. All the companies were known to invest more in *employee training* in other to strengthen their resource base. This was identified as one of the strategies the companies use to stay innovative and competitive in the pharmaceutical industry. For example, Ernest Chemist, which is the oldest and one of the most competitive pharmaceutical companies in Ghana, uses 5% of their annual salary to train employees.

All the companies interviewed emphasized engaging in ethical behaviour. Thus, from the sourcing of raw materials and products from ethical suppliers, putting the right information about products on the market for consumer safety, avoiding discriminatory work practices, and consistently following the various pharmaceutical codes of conduct, Good Manufacturing Practices (GMP) and Good Distribution Practices (GDP). The respondent for EFPIA- an institution that houses all the major pharmaceutical companies in the UK and Europe, stated:

> *They are very ethical. We comply with all the rules and regulations. I think we use cutting edge technology and medicines to help people manage their disease and some cases cure their disease. I think there is a huge value we bring to society but sometimes it is not appreciated. Not so more as compared to other industries with regards to ethical issues (RES-7).*

The results give an indication that companies, both in the UK and Ghana are keen on improving their social performance as this is known to affect the economic performance of these firms. Thus companies known to positively impact/influence their workers and society are perceived as "good" brands of which customers and suppliers are willing to engage and associate with. However, the results showed that the Ghana companies were engaged in more social practices than that of the UK companies. This may be influenced by the critical human resource constraint faced by the Ghana health sector.

6.2.2.3 Environmental dimension

The key factors identified for the environmental performance were: environmental consciousness, improper drug disposal, environmental dimension gives no economic benefit, drug disposal is costly and time-consuming, CO2 emissions, recycling, drug disposal and it education awareness, waste disposal, noise reduction.

Generally, the sampled companies in the UK and Europe had a greater awareness of the economic benefits of being environmentally sustainable than the companies in Ghana. Even though there is less environmental regulation enforcement in Ghana, the majority lamented that pricing is what drives business in Ghana and the developing countries but not to be environmentally sustainable.

> *What drives the business here is the pricing but not to be environmentally sustainable. That concepts haven't gotten here yet. However, there are customers who look out for specific brands of products as they use this as a reference point to guarantee quality (REF-3).*

To support the raised issue of less environmental regulation in the Ghana setting, the director for one of the Ghana manufacturing companies stated:

> *I'm been environmentally conscious because I decided to do and believe that companies are not only to make money but to help the community and protect the environment. So I do it not because there is any tight environmental regulations or pressure from regulators. Moreover, there are no tight regulations here (REF-8).*

To support the raised issue of the Ghana companies having less awareness of the economic benefits of environmental performance, one of the registration and license officers for the Ghana Pharmaceutical Council who also operates as one of the major wholesales in Ghana stated:

> *We are not conscious of the environment. Most of us use plastics instead of paper bags. I don't think I will gain a competitive advantage when I'm conscious of the environment and use more friendly materials (REF-1).*

To support REF-1 statement, the operations manager for arguably the biggest wholesaler in Ghana stated:

> *The concept of sustainability hasn't gotten hear yet. Moreover, as a company, we don't hold it as a requirement to work with another company. We look at the product going through the various registration processes, if a company is a*

sustainable company then it's a plus for them but we can't sell that idea to the retailers that this company is a sustainable company so stock their production. The market will determine where and from whom who should source from so probably based on quality or cost (REF-4).

Additionally, a lot of waste is generated in the chain especially with the manufacturing activities. This was noted for both sampled UK and Ghana companies. The generated waste is refined using treatment plants and tanks before disposed of, indicated by all sampled manufacturing companies. C3, for example, uses the effluent plant and further uses the recycled water for irrigating gardens and washrooms on site. However, only a few of the sampled companies in Ghana treat their solid waste.

Fortunately, our operations do not generate a lot of CO2 emissions but rather it is our liquid waste is the key effluent. So we have our own effluent machine that we use to treat the liquid to make it less harmful before disposing of them (RES-3).

The manufacturing companies in both the UK and Ghana make use of an extended chimney for their boilers which helps to reduce the number of toxic gases or smoke emitted into the environment. The majority of the companies are also given an EPA certificate which indicates that their companies are operating within the environmental limits set by the recognised environmental agency.

The majority of patients and few of the pharmaceutical companies were known to wrongly dispose of unwanted pharmaceutical products. Although this was noted among both the UK and Ghana sampled companies, the issue was more profound in the Ghanaian setting as companies perceive the entire disposal process as lengthy, and costly.

Waste disposal has been a great challenge. With waste disposal, I just tie them in rubber and put them in the normal bin. For the liquids, we pour them away using general drainage systems and dispose of them in the normal bin (RES-1).

Moreover for the pharmaceutical companies, laid down procedures are to be followed for disposing of pharmaceutical waste. For example in Ghana, the pharmaceutical companies

follow the disposal procedure outlined by the Food and Drugs Authority (FDA). This process is detailed below:

> *A list of the drugs and the quantity to be disposed of is generated by the pharmaceutical company: the pharmaceutical company contacts the FDA: the FDA sends it designated team to inspect the products listed by the pharmaceutical company for a bill to be generated: the FDA makes an arrangement with the EPA: then a date is fixed for the transportation and disposal of the items from the pharmaceutical company's premises: an EPA certificate is issued to the pharmaceutical company after the disposal.*

Interestingly, the Ghana companies indicated that the authorities dispose of most of the collected waste products on landfills, although about 80% of all the manufacturers indicated the use of recyclable materials and products. It was also noticed that some of the pharmaceutical companies use the issued disposal EPA certificate to challenge their suppliers' minimum order quantity or to seek discounts. Importers dealing with controlled products also use the disposal EPA certificate for FDA verification purposely to avoid charges.

> *Ok for the materials we use, they are not recyclable, to be honest. They go and we don't know how and where they end up (REF-3).*

The pharmaceutical companies were known to dispose of unwanted drugs wrongly as they perceive the entire disposal process as costly and lengthy. This was more profound among the Ghana companies. Some of the specific wrongful acts identified were disposing of tablets using normal bins and disposing of liquids using general drainage systems. Also peculiar to the Ghana setting, most people use the option of digging the ground and burying products or crush dispose of using normal disposal systems. Interestingly, the high rise in drug disposal was attributed (by the majority of all the companies) to higher levels of expired drugs mainly due to inaccurate forecasting and demand uncertainty.

> *I do this because if you want to properly dispose of the expired products, you need to first contact the FDA (Food and Drugs Authority) who will charge you for the disposal. Due to this most people dig the ground and bury them or crush them and*

dispose of using normal disposal systems. Sometime to even get FDA to come to your premises for disposal is a challenge and time consuming (REF-3).

From the results, it is evident that the manufacturers produce most liquid waste, whilst the wholesalers and distributors emit most CO2 from their transportation activities, whilst the retailers and patients/consumers are known to mostly dispose of unwanted/expired drugs wrongfully. These aforementioned issues are evident in both the UK and Ghana setting. However, in the context of Ghana, most of the identified environmental issues are associated with the fact that there are less strict regulations and perceived long processes that deter players and consumers from being environmentally friendly with their activities and actions. In the context of the UK, the environmental issues can be mainly associated with the evolving complexities of pharmaceutical activities whiles consumers have less information on how to properly dispose of pharmaceutical products.

6.2.3 External uncertainty

All the key EU factors for each company and their corresponding impact on the three dimensions of sustainability (RQ2) were established from the analysed sampled data (Table 6.5). The results also show which main SCI dimension(s) the key EU factors influence. For the impact level rating (Table 6.5), high denotes: key EU factor not only been an inhibitor but also identified by the majority of the companies as contributing strongly to the ineffective/inefficient (due to unpredictability) operationalisation of SCI to impact supply chain sustainability. Generally, the rapid increase in unpredictable drug shortages and unavailability was identified as more profound in the UK than Ghana.

The pharmaceutical industry in both the UK and Ghana were known to be characterized by different unpredictability and uncertainty as detailed in Table 6.5. These uncertainties pose as obstacles for pharmaceutical players in operationalizing SCI and forecasting demand and supply accurately. The most common software known to be used for the forecasting was med biz (for most retailers) and Tally (for most manufacturers). It was noticed that the majority of the companies especially those in Ghana do not have the appropriate data to make accurate forecasts in spite of the *high unpredictable/erratic nature of the pharmaceutical industry*. The production manager for one of the leading manufacturing companies in Ghana stated:

***Table 6.5*: Key EU factors and their impact on supply chain sustainability**

Level in Supply Chain	Key EU factors	Impact level ratings	Supply Chain Sustainability			Key EU factors mainly influence the level of
			Economic	Social	Environmental	
Upstream	Currency fluctuations* (-)	High	C5,C7,C9,C10,C12	NIDI	NIDI	II,SI,CI
	High technology changes (-)	High	C3, C4	NIDI	C4	II
	Dynamic and unpredictable change of manufacturing regulations (-)	High	C3,C4,C9	NIDI	NIDI	II
	Uncertain and long manufacturing lead time (-)	High	C8, C10	NIDI	NIDI	II
Downstream	Demand uncertainty (-)	High	C1,C3,C10,C11,C13	NIDI	NIDI	II,CI
	Forecast difficulty and inaccuracy (-)	High	C1,C3,C11	NIDI	NIDI	II,SI,CI
	Unpredictable market (-)	High	C1,C4,C8	NIDI	NIDI	CI
	Free zone regulation* (-)	High	C2,C3,C4	C2,C3,C4	NIDI	II,SI,CI
Entire supply chain	Fund and payment uncertainty (-)	High	C6,C7,C9,C12	NIDI	C1	CI
	Unpredictable drug shortages (-)	High	All companies	C3,C4,C8,C10	NIDI	II,SI,CI
	High price differences and fluctuations (-)	High	C7,C8,C10.C14	C1,C4,C5,C16	C17	II,SI,CI
	Dynamic regulations (-)	High	C3,C11,C18	NIDI	NIDI	II,SI

Note: C: Company. E.g. C1 = Company 1. (-): Inhibitor NIDI: No identified direct impact *: Peculiar issues to Ghana

This year I was supposed to do 2million capsules of piroxicam based on a forecast. However, the demand changed so high that just from January to February I have already produced and sold the 2 million already. Even though historically we don't do more than 2million (RES-3).

In regard to demand unpredictability, especially in the UK and Europe, it was noticed that a great effort is been made to improve upon predicting demands by increasing transparency within/across the supply chain. Besides, the majority of the companies, especially in the UK, are collecting more data to help improve upon their demand predictions. However, as predicting demand is getting better, the lead time for producing certain products is increasing marginally and becoming quite uncertain. For example, it was noticed that vaccines now take 1 to 2 years to manufacture. Based on such long lead time, manufacturers find it difficult to predict demand accurately especially for epidemic situations.

When you have an epidemic or something that you cannot predict in say two years in advance and that happens today or tomorrow, then that becomes a problem (REF-7).

Interestingly, for government contracts, all the manufacturing companies indicated that they mostly have a clear indication of the type of product(s) and brand to produce for an entire year. However, the manufacturers are unable to predict the exact volume that will be needed for the exact entire year due to demand unpredictability.

On the other hand, with short shelf-life (e.g. "Galvus met" which has a 1-year shelve-life) products, all the companies find it difficult to forecast in terms of demand. Due to this, most of the retailers overstock with the fear that such products might go out of stock. However, most of these products end up been flooded on the market which results in expired products.

Quality uncertainty was identified as one of the uncertainty issues which is beyond the control of the importers and suppliers. Thus, in most cases, the importers (both in the UK and Ghana) are unable to predict the damages/contaminations that shipped products incur during their transportation or assure the quality of the imported raw materials (e.g. AI) until the products are received at the last point of the chain. The head of Research and Product Development for arguably one of the leading pharmaceutical manufacturers in Ghana stated

Excipients are not to contain certain bacteria according to regulations. However, during their mode of transport, they get contaminated (REF-2).

Also, market unpredictability, in general, was identified as an issue for both the sampled UK and Ghana companies. For the sampled Ghana companies, in particular, the majority indicated that they can predict up to about 80% of the market demands. Interestingly, more than 50% of the respondents from both the UK and Ghana indicated that raw material shortages are mostly associated with plant-based products and the seasonality of AI ingredients. Due to the high rise in climate change and weather unpredictability, seasonally grown pharmaceutical products (e.g. hyosen) are highly subjected to plant unavailability issues which affect manufacturing levels and the entire supply chain as a whole.

6.2.3.1 Drug shortages/unavailability

Drug shortages/unavailability, characterized by no specific trend, was identified as one of the key issues affecting the pharmaceutical industry in both the UK and Ghana. Especially in the UK and Europe, the issue of drug shortages/unavailability was identified to be on a high rise. REF-7 indicated that it is hard to put the level of shortages and unavailability of drugs in the UK and Europe on a scale of 1-10, however, the member states (like from France, Belgium) are continuously mentioning that the problem of drug shortages and unavailability is getting worse and worse.

Although "shortages" and "unavailability" are used interchangeably by most players in the UK and Ghana, the European Federation of Pharmaceutical Industry and Association (EFPIA) draws a distinction between the two. Thus, drug shortage is considered as a regional or specific geographical problem whilst drug unavailability is a countrywide problem. However, in this thesis, the two terms are used interchangeably because in both cases the bottom line remains that the patient does not have access to the needed product at a specific point/period.

One of the causes of drug shortages is unpredictable supply chain inefficiencies which were linked to the complex nature of supply chains due to globalization. Companies now operate in unpredictable and different national geographies which have placed pressures on creating a seamless chain for lean and agile operations. These complexities were known to affect drug shortage. A typical example is having more of a pharmaceutical product in one

area/state/country whilst patients in a different area/state/country cannot access this product even though they are of higher need in the latter area/state/country. Such shortages were known to be caused by supply chain inefficiencies such as transportation issues, affecting on-time delivery. Most of these issues are unpredictable which also affects forecasting.

> *There are various reasons and you know the pharmaceutical supply chain is very global and complicated, there are changes in global demand, fluctuations in prices, and exchange rate, shortage of ingredients. So for example having a global shortage of a specific active ingredient (AI) or for example licensing regulatory issues, this leads to drug shortages (REF-9).*

Another cause of drug shortage is associated with the continuous consolidation of manufacturing for specific products to be manufactured in a single plant for the entire world market. In such cases, when manufacturing is halted due to any unforeseen circumstance (e.g. suspension of license), automatically shortages are then experienced on a global basis. A similar trend of consolidation is also noted for AI manufacturers which further causes unavailability of raw materials for secondary manufacturers. Additionally, it was noticed that the dynamic and increasing nature of regulatory requirements also causes interruptions or stoppages in the manufacturing activities of companies which also affects the availability of drugs. All these issues are faced in both the UK and Ghana pharmaceutical industry.

Furthermore, parallel trade was identified as a key factor contributing to the unpredictable drug shortages. However, this issue is more profound in the UK and Europe context. Parallel trade is highly influenced when there are significant variations in price for products among different countries (e.g. the UK and other European countries). For example, as prices for most prescription drugs are known to be cheaper in the UK than in other European countries, this forces most wholesalers and distributors to further transport and sell products meant to meet the demands in the UK to other European countries purposely to make more profit. Nonetheless, the sampled companies were faced with the challenge of not knowing when products might be in shortage due to the high rise in parallel trade.

> *So there is a lot of opportunity for parallel trade of which no one is contesting that, but it does create a little of asymmetry between the supplier, manufacturer and their*

clients in the fact that there is a strong incentive for parallel trade which sometimes causes the issue of shortages (REF-9).

Also, it was noticed that most of the regulations in the pharmaceutical are very uncertain. Thus they change frequently from time to time. The regulations mainly tackle the issue of facility standards. This broadly includes the type of technology or equipment, expected to be used by the different players across the supply chain. Regulations for the manufacturers were known to be very dynamic mainly to help the manufacturers' matchup with the complex diseases that the pharmaceutical industry tackles. Precisely with technology uncertainty, the regulations on technology usage was known to be very dynamic. The majority of the manufacturers and wholesalers indicated that what (technology) is relevant today might not be relevant tomorrow. This notwithstanding, the companies in the UK and most developed countries are keeping up with the usage of cutting edge technology as compared to those in Ghana and other developed countries. It was noticed that the companies in Ghana are reluctant as complying with the Good Manufacturing Practices (GMP) and Good Distribution Practices (GMP) requires high cost of technology/equipment investment. Thus, compliance requires a huge amount of monetary investment which is currently beyond the financial capacity of the majority of the Ghana companies. The majority of the companies in Ghana will have to pull down their current facilities to reconstruct new ones purposely to match up with that of the UK companies.

Yes, we face a lot of regulatory issues. It is a very dynamic industry, what is good today might not be good tomorrow. Because of how dynamic the industry is, regulators come and most times find issues. Ranging from air handling units, waste treatment systems etc. There will always be issues when it comes to regulators however we focus on the patient and make sure what we give them is safe, effective and efficient (REF-3).

For predicting the activities of competitors, the majority of the companies use their general national associations (e.g. ABPI in the UK, EFPIA in Europe, and PMAG in Ghana) to track the up to date activities of their competitors. This information is used to make predictions about the future activities of competitors. Specifically, REF-3 indicated that with their company, they also make use of customer surveys which helps to examine why customers buy their products or that of their competitors. Based on this, the company is able to make predictions about the activities of competitors. The majority of the sampled companies (both

in the UK and Ghana) also relied on survey results from third party institutions to make predictions about their competitors. For example in Ghana, The FDA engages in a "post-market surveillance" which compares locally manufactured products with imported drugs on the market, using different measures. REF-3 stated that interestingly, "*sometimes we even find our products doing better than the ones from foreign multinational companies in terms of laboratory analysis which gives you some form of motivation*". In general, the results from such surveys/activities are used to consistently monitor the activities of competitors and to predict future competitors' activities.

The players in Ghana also face unpredictable price fluctuations due to currency fluctuations. However, this issue is less faced in the UK setting. REF-4 indicated that the changes in price due to price fluctuations mostly have a duration of 3 months, 7 months, or a year depending on the fluctuations. The price fluctuation affects the credit periods that the companies give to their customers. Thus, companies are at a high risk of making losses with long credit periods due to price fluctuations, and especially as the companies have short credit periods with their multinational suppliers. In addition, as retailers, hospitals, and clinics are demanding for long credit periods, the pharmaceutical companies are faced with the challenge of using their forward rates to set their prices. However, this makes the price of the products very expensive. Due to this, prices are mostly altered as and when the prices fluctuate before sold to customers.

> *The primary challenge is how the credit periods are handled in the country and how forex rates are unstable. Because the forex rates are unstable we have to work frequently to update our prices or we change our prices to reflect the on-going rate. That affects what sort of credit periods you can give to your clients It's a reputational issue so you facing a challenge of having to meet up with the pressure that comes from the people you import from and yet you get unto the grounds and some are asking for over 8 months credit period, you have institutions that owe you for over a month (REF-4).*

Aside from the demand for long credit periods, the majority of the manufacturers and wholesalers in both the UK and Ghana indicated that the payment of funds by their customers (retailers and government) is quite uncertain. This type of delay was known to affect the manufacturers' and wholesalers' ability to consistently carry out planned activities.

> *The uncertainty comes from the funds. Because sometimes when I take it (orders) to the accounting department, within a day or two they will pay. At times 3, 4 months they haven't paid yet because there is no money due to payment delays from customers (REF-6).*

In addition to the causes of price fluctuation, the pharmaceutical companies in Ghana have the legal mandate to set their own product prices whilst in the UK prices are mostly standardized and regulated by the government. The unregulated nature of products in the Ghana setting results in issues such as (1) having numerous prices for the same products at one point in time (2) frequent changes in product prices creating high price uncertainty. However, in the UK and Europe context, the difference in prices for the same/similar products was identified on a national basis among different countries in Europe. This is mainly caused by parallel trade due to marginal price differences among the European countries.

> *In the context of our business in Ghana, prices are not controlled in the country by the government. So you come against your competitors who set what price, who is doing what margin, so at every time you need to be very certain to be affordable (RES-2).*

To support the argument of regulated prices and some of its associated effects, the market access manager for the largest pharmaceutical association in the UK and Europe stated:

> *Prices are set at national levels however they vary quite a lot between countries. A lot of the medicines that member companies sell they don't sell on the open market but they sell on the reimbursement by the authorities so sometimes the authority drives down the price below a certain threshold and the manufacturer decides to completely redraw from the market then it is something we consider lack of availability (RES-7).*

Road congestion was another external issue identified. In both the UK and Ghana, the issue of road congestion is mostly experienced in the central or urban areas. For example in Ghana, the central part of Accra Ghana is known to be highly congested with long traffic congestions. This issue is known to affect delivery times and the number of delivery points

served in a day. The same issue was identified with pharmaceutical transportation activities in central London- UK. With road constraint, the Ghana companies indicated that the majority of the roads outside the central business areas in Accra, are not in their best shape whilst some are in a deployable state which affects deliveries and transportation activities in general.

Generally, the results show that pharmaceutical companies in both the UK and Ghana face high uncertainties from their external environments which impact on drug shortages and unavailability. However, the few differences in the type of external uncertainty faced by companies in the UK and Ghana are mainly influenced by the kind of regulations exposed to the companies. For example, the companies in Ghana were known to face price fluctuations due to the no price regulation for pharmaceutical companies. But, in the UK, price fluctuation is less experienced as prices for pharmaceutical products are highly controlled and regulated by the government. In summary, the UK companies are known to face higher drug shortages and unavailability compared the Ghana companies.

> *Member states like France and Belgium indicate that the problem of shortages and unavailability is getting worse and worse (RES-7).*

The issue of shortages was also lamented by C10, which serves as a trading body for all key community pharmacies in the UK:

> *Yes, drug shortages are getting worse especially looking at the feedback we get from our members (RES-9).*

6.2.4 Internal and external contextual factors

Beyond the themes (SCI, supply chain sustainability, and EU) used for the interview, additional IECF's (Table 6.6) were identified as lamented by the sampled companies (RQ2). These factors were identified to influence the company's ability to optimally integrate its supply chain activities to achieve supply chain sustainability. Hence the IECF's key factors are rated as high for impact level rating. Although the EU is an IECF, the new IECF's are differentiated from that of EU as they are not characterized by highly unpredictable and unexpected changes. The results for the new IECF's are presented.

Table 6.6: **Relationship between the internal and external contextual factors, supply chain sustainability and supply chain integration**

IECF's	IECF's Key factors and their impact sign	Impact level rating	Supply Chain Sustainability			IECF's Key factors mainly influence the level of
			Economic	Social	Environmental	
Resource constraint	Financial (-)	High	All companies	All companies	All companies	II,SI,CI
	Human (-)	High	All companies	C2,C3,C4,C8,C7	NIDI	II,SI,CI
Leadership style	Autocratic (-)	High	C3,C4,C6,C7	C4,C5,C7	NIDI	II
Product innovation	More specialized new drugs (+)	High	C2,C3,C7,C8,C9	C1,C3,C8	NIDI	II,SI,CI
	Complex diseases (+)	High	C2,C3,C7,C8,C9	C8	NIDI	II,SI,CI
	Research and Development (+)	High	C2,C3,C4,C5, C8,C14,C15	C2,C3,C4,C8	NIDI	II,SI,CI
						IECF Key factors facilitated/impacted by
Patient satisfaction	Reputable brand names (+)	High	All companies	All companies	C3,C4,C6, C9,C13,C15	II,SI,CI
	Quality (product efficacy and effectiveness) (+)	High	CI,C3,C4,C5,C6, C7,C9,C11,C13,C14 ,C15,C16,C17,C18	All companies	NIDI	II,SI,CI

Note: NIDI: No identified direct impact C: Company. E.g. C1 = Company 1. (-): Inhibitors (+): Enablers II: Internal integration SI: Supplier integration CI: Customer integration

6.2.4.1 Resource constraint and leadership style

For clarity and avoidance of repetition, this section presents the IECF's resource constraints and leadership style as a single sub-section. Thus leadership style was known to largely affect the amount of available resources accessible to the companies. Hence it is more appropriate to present both IECF's together.

Financial

In the UK and Ghana, the pharmaceutical industry faces critical *funding challenges*. However, this issue is more profound among the sampled Ghana companies. Currently, the companies in Ghana have no substantive government financial support. The managing director for one of the well-known pharmaceutical (manufacturing) companies in Ghana lamented on the funding issue, giving an example that:

> *When it comes to GMP it's about the facilities which are very costly. Some of the traditional companies that have huge capital like C4 currently have lands and they have started constructing new plants to meet the WHO standards as their present plants do not meet the requirement. They cannot pull down their present site that will be costly but rather they have to build a new plant just like what they have started. So the main thing is the funding (RES-8).*

In the context of the UK, the UK government reduced the funds for community pharmacies which has complicated the operations for players and led to some store (community pharmacies) closures. The respondent for C10 indicated:

> *Generally, financially it is a tough situation for community pharmacies. Recently, we have the government squeezing the funding for community pharmacies which has complicated the operations for contractors. Yes so at the moment it is tough for contractors. The reduction of funds is around £321,000, 000 (RES-9).*

The funding issue is known to affect all aspects of operations, indicated by all sampled companies from Ghana. For example, orders were placed in July 2018 with a lead time of 3 months. The orders arrived, sat at the port for months and the company was only capable of paying for the products in December 2018 (REF-3). Late payments for products negatively affect the relationship between the importer and supplier, and delays already planned

operations for the importer. The majority of the Ghanaian companies also attributed this issue to *leadership style*. Thus, most of the companies are structured in a way that allows only a few company leaders to have full control over the company's wealth. They decide where, when and how to invest the company monies without a collective effort with other key stakeholders. The leadership style adopted was known to affect the collective ability of internal and external stakeholders in finding well targeted and appropriate mediums for securing needed funds. On the issue of adopted leadership style, the operations manager for the largest and oldest pharmaceutical manufacturer in Ghana indicated:

> *Yes, we should make profits. Yes, companies do publish these things in their reports but unfortunately, we don't do that into detail. This is mainly controlled by the owner of the company, yes one-man Company. Even to the extent that the chief accountant does not know the full size of the elephant (RES-3).*

To support the raised issue of how adopted leadership style impact firm performance, the supply chain manager for arguably one of the leading pharmaceutical manufacturers in Ghana indicated:

> *Autocratic leadership and structure are also affecting our lack of funding. Decisions are mostly solely taking by the owner which sometimes leads to financial mismanagement (RES-6).*

In Ghana, manufacturers operate in a *free-zone enclave*. Meaning manufacturers are to export 70% of what they produce, and 30% for local consumption. The sampled Ghana companies export 70% to other (mostly West) African countries (like Gambia, Cameroon, Mali: RES-6*)* and have the government of these countries as their major customers. Most of these major customers (government) delay payments for received products. This affects the manufacturers' ability to reinvest spent money into their production and supply chain activities. Hence causing delays and drug shortages.

The manufacturers from Ghana face *high pressure from the* government and other stakeholders. Pressures to match-up with the standards of the developed countries. Yet, there is no funding support from most of the stakeholders, especially the government. For example, the UN and the Food and Drugs Authority (FDA) – Ghana initiated a program for

manufacturers in Ghana to achieve WHO standards in a 5 years period. The program started with 37 companies. However, due to the high financial demand to meet the program's objective, 21 companies have opted out as there is no funding support from the government. To support the issue of funding and high pressure respectively, one of the owners/pharmacist/directors of the sampled Ghana pharmaceutical companies stated:

> *Yes, it is a big task because the demands and things to be put in place are way beyond us and there is no fund. The problem is that we know what to do, we know how a GMP facility is supposed to look like not that we don't know but it is the money. Standards that the manufacturers in the UK and Europe currently have, took them centuries to achieve. The oldest and richest pharmaceutical manufacturer in Ghana has existed for not more than 40 years, which makes it unrealistic for such a company and the newer ones to meet the manufacturing standards of those in developed countries especially as there is no financial support (REF-8).*

Human

The *scarcity of qualified pharmacists* was a critical issue identified in the Ghanaian setting compared to the UK. According to the Ghana Pharmacy Council (GPC), which regulates pharmacy practices and health professionals, it is a requirement for every retail pharmacy to have a pharmacist superintendent present each time. Retailers lamented the difficulty in meeting this requirement as notwithstanding the scarcity of pharmacists, pharmacists are also quite *expensive to hire*. One of the registration and license officers for C2 - an institution responsible for regulating all pharmacies and in Ghana said:

> *Human resource is a key challenge. Per the GPC regulations, there supposed to be a pharmacist superintendent present at the pharmacy each time. Pharmacists are scarce to get as there are only a few, and pharmacies that are fortunate to get a Pharmacist are expensive to hire as they charge a high amount per hour, which are not cost-competitive compared to the sales been made at the pharmacy (REF-1).*

One of the assistant store managers for arguably the largest pharmaceutical retailer in the UK supported this claim by indicating:

There is a scarcity of qualified pharmacists in the UK. When you juxtapose the workload and demand for the pharmaceutical industry with the current number of qualified pharmacists in the sector, there is a great shortage of pharmacists (RES-12).

For the renewal of licenses, pharmacies are to have pharmacists superintend the admission of drugs (most prescribed) to patients at all times. However, due to the scarcity and high cost of employing qualified pharmacists, retailers fail to meet the aforementioned objective. This issue is peculiar to the sampled Ghana retailers. Retailers that meet the standards mostly fail to adhere to the objective after the renewal. Most of the retail pharmacies in Ghana use Medicine Counter Assistant (MCA) and sometimes only do use pharmacists during busy hours. MCA's pose a risk of issuing drugs which may interact. They also sometimes are unable to detect errors in prescription notes before issuing drugs.

The number for pharmaceutical raw material (especially AI) and product manufacturers, especially for specific key materials and products have decreased marginally over the years. This reduction in the number was associated with having numerous input and product manufacturers consolidating their activities over the years. When unexpected issues (example, GMP violations, unpredictability, and seasonality of raw materials) force these few manufacturers to halt their production over some time, this greatly affects the issue of drug shortage. In Ghana, there are no international standard input manufacturers. This hugely affects the capability of the manufacturers in meeting the current high demand in Ghana and West Africa. The respondent for EFPIA also lamented on the issue of shortages by stating:

So you have more and more manufacturers consolidating manufacturing for a specific product in only one factory for the whole world. So now you can imagine if you have an unexpected problem like fire then you have the whole world having a problem with that. Another challenge is the consolidation of resources of active pharmaceutical ingredients (called AI). So if a manufacturer of an active pharmaceutical ingredient in say China or India has a problem like I mentioned, fire, then no manufacturer can get the right amount of active pharmaceutical ingredient for them to continue their manufacturing (RES-7).

Pharmacovigilance is very high in the UK pharmaceutical industry but weak in the Ghanaian setting. The issue of weak pharmacovigilance was attributed to human resource constraints. In Greater Accra-Ghana, there exist only two inspectors from the GPC responsible for overseeing the daily operations of over 500 pharmacies (this is subject to the time data was collected) which is a great challenge for maintaining proper pharmacovigilance. The companies indicated that the GPC cannot recruit more inspectors as the government has placed a ban on recruitment over a period of time. This poses a huge challenge for the regulators. A registration and license Officer for GPC stated:

> *There are over 1900 pharmacies and over 3000 over the counter medicines seller facilities currently in Ghana. For example, in the Greater Accra region, we have only just two inspectors, thus the regional manager and the assistant which makes it difficult for regular monitoring and checks. They don't only do monitoring and checks, they receive applications, they do site inspections, final inspections, and general office management. The work is crazily overwhelming for just two people. The same issue is faced in the other 9 regions in the country. Hence proper or effective supervision is a serious challenge (REF-1).*

From the results, although both the UK and Ghana players experience human resource constraints, this issue was more profound among the sampled Ghana companies. Human resource constraint was noted to inhibit the capacity needed by the companies to produce the right amount of products to meet expected demands. In the context of Ghana, the issue of human resource constraint was known to mainly impact the efficiency and effectiveness of pharmacovigilance in the pharmaceutical industry. Hence putting the safety of consumers at risk. In the UK, issues of shortages are experienced mainly because of fewer input manufacturers, high levels of consolidated manufacturers, and seasonality of raw materials. These issues are also experienced in the Ghana setting.

6.2.4.2 Product innovation

Product innovation is one of the main factors used by all the UK and Ghana sampled companies to achieve the main objective of "*patient satisfaction*". Companies are now dealing with *complex diseases* that necessitate targeted and *innovative new drugs*. An example of such complexity is the disease Alzheimer's of which no drug has been invented yet to cure. Another example is cancer. 30 years ago the research community had an idea of

a few types of cancer. Now with a better understanding of diseases through innovation, a clear distinction is made among different sub-categories of cancer. There are currently about 19 different medicines for lung cancer compared to initially when only 3 existed. Hence to a large extent, there is product innovation as treatment is more targeted purposely to *satisfy the patient.* This was the overall goal for all the players across the pharmaceutical supply chain. The respondent for EFPIA summarised in a statement on how product innovation is been more focused due to the complexity of diseases:

> *Pharma is been more innovative, Diseases are more difficult to solve now. Products are more specialised now due to complicated diseases (RES-7).*

6.2.4.3 Patient satisfaction

The majority of the companies from the UK and Ghana used *quality* as the main operation's objective to satisfy patients for competitive advantage. The quality of products and services rendered to patients create *reputable brand names* that are used for *competitive advantage*. Especially in Ghana, there is less access to information by patients. Hence patients thrive on brand names as an indicator for quality when purchasing drugs.

> *There will always be issues when it comes to regulators however we focus on the patient and make sure what we give them is safe, effective and efficient. You know the regulators are just like policemen, whatever you do, they will always find an issue. We even have a section where we do packaging for the largest manufacturer in the UK, and before they agree to such collaboration they make sure all requirements are met. Our main competitive advantage is quality and our reputable brand name "C4", it has become so conspicuous. The name has become a household name and people are ready to buy. We have gotten to the point where anything we produce here and we say it is from C4 people are ready to buy (RES-3).*

To support REF-3 statement:

> *I think I won the government contract because of my consistency in producing premium products for our patients from a facility that is not top-notch. So with our*

manufacturing, quality, packaging, and delivery are in our hallmark to satisfy our patients. It is my philosophy (REF-8).

The results show that quality is mainly targeted by the companies to gain a competitive advantage. However, it was clearly evident that the main way to gain competitive advantage is through "patient satisfaction" which is mostly achieved by providing the patients with quality products and services to meet their specific needs.

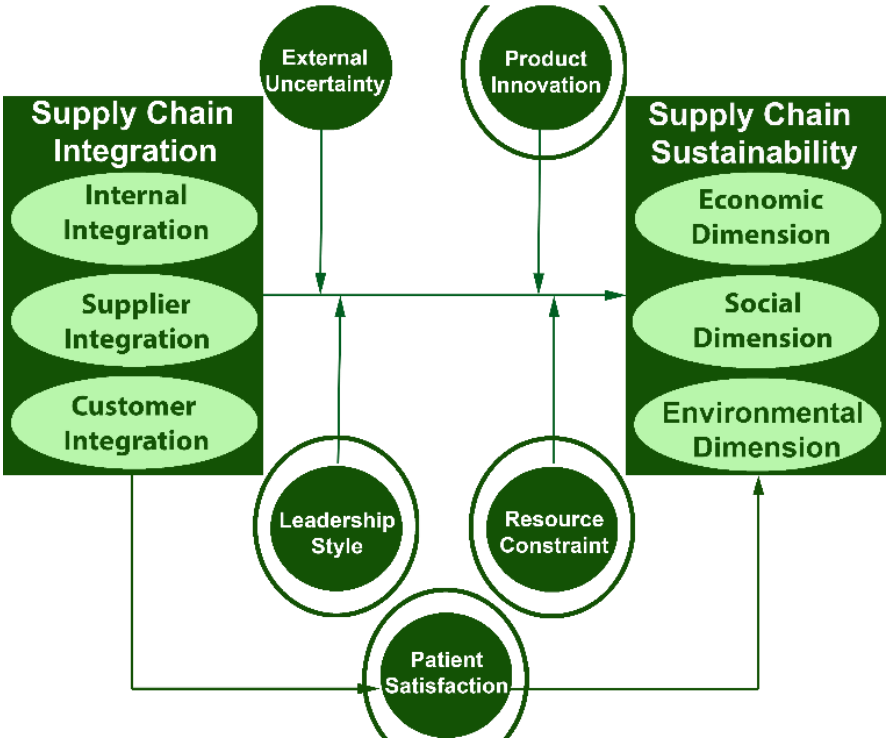
6.3 Updated conceptual framework

The newly identified IECF's (Table 6.6) from the interview engagement were integrated into the initially developed conceptual framework (Figure 2.2). The updated conceptual framework is shown in Figure 6.1. The newly identified IECF's resource constraint, leadership style, and product innovation were integrated into the conceptual model as moderators whilst patient satisfaction was integrated as a mediator. *The justification for using the additional IECF's as moderators and a mediator is presented in the next chapter (chapter 7). The formulation of hypotheses for the newly identified IECF's is also presented in chapter 7.*

6.4 Conclusion

The study aimed to identify and propose a framework that provides insight into the internal and external factors which enhance or hinder supply chain sustainability through SCI. A qualitative study, adopting semi-structured interviews, observation, and secondary data were used. Specifically, the empirical data were obtained from 18 leading pharmaceutical companies, national pharmaceutical institutions, and regulators in Ghana and the UK. The findings revealed that supply chain sustainability can be achieved through effective and efficient SCI, although none of the sampled companies have truly sustainable supply chains'. The study further revealed that EU and the new IECF's: patient satisfaction, leadership style, product innovation, and resource constraint, must be collectively considered to achieve supply chain sustainability as these key factors enhance or hinder supply chain sustainability through SCI. Based on these new findings, the conceptual framework was updated (Figure 6.1) integrating the newly identified IECF's: patient satisfaction, leadership style, product innovation, and resource constraint. The updated conceptual framework was used to inform the designing of the survey questionnaire (Appendix C**)** for the quantitative study. The

formulation of hypotheses for the newly identified IECF's, and preliminary analysis of the survey data are detailed in the next chapter.



Note: Circled factors are the additionally identified internal and external contextual factors

***Figure 6.1*: Proposed framework for supply chain sustainability through supply chain integration**

CHAPTER 7

MODEL REFORMULATION AND PRELIMINARY DATA ANALYSIS

7.0 Chapter overview

This chapter details the justification for the updated conceptual framework developed after the qualitative study (chapter 6, page 92), the hypotheses formulation for the additionally identified internal and external contextual factors (IECF's) from the qualitative study (chapter 6), and all the preliminary analysis for the collected survey data from pharmaceutical companies in Ghana and the UK.

This chapter first details the gap/need and the hypotheses for each of the newly identified IECF's added to the updated conceptual framework, and presents the revised research questions. The chapter further gives a brief description of how the collected survey data were screened, and checked for outliers and normality, non-response bias, common method bias, reliability and validity, multicollinearity, and invariance measurement.

7.1 Newly identified constructs from the qualitative study

7.1.1 Leadership style and the SCI-supply chain sustainability relationship

Based on the qualitative findings, it was noted that the leadership style (mainly autocratic) adopted by the pharmaceutical companies in both the UK and Ghana context affect company performance (6.2.4.1, page 134). Based on this, it is important to inculcate the leadership style construct in this study. The addition of the leadership style construct is justified using literature.

The majority of leadership style - firm performance relationship studies have shown inconsistent results (Farh et al. 2008; Farh and Cheng 2000; McGrath and MacMill 2000). For example, in a study conducted by Cheng et al. (2004) in Taiwan, the study showed that authoritarian leadership has a positive relationship with employee performance. However, that of Farh and Cheng (2000) showed a negative relationship. Cheng et al. (2004) detailed that the result inconsistencies can be explained by the plausible reason that the relationship between leadership style and performance depends on certain conditions, which has not been

fully exploited. This argument clearly indicates that there are key missing variables/conditions/factors that need to be exploited together with leadership style and performance, of which this study considers. Moreover, although some established empirical results show a significant result between leadership style and firm performance (*mostly economic dimension*), less has been done to empirically identify and understand how contextually, leadership style influences the level to which firms integrate internally, and with suppliers and customers to impact supply chain sustainability. Hence the study aims to measure the moderating role of leadership style on the SCI-supply chain sustainability relationship.

7.1.1.1 Hypotheses

In relevance to the researcher's interview findings from the pharmaceutical companies in both the UK and Ghana, the autocratic and non-autocratic (flexible/participative) leadership style scale will be used. Thus, from the interview findings, the key types of leadership styles identified as been used by the pharmaceutical companies were autocratic and non-autocratic leadership styles, which were known to have an impact on the company's' sustainability performance. The autocratic leadership style refers to a leader's behavior that asserts absolute authority and control over subordinates and demands unquestionable obedience from subordinates (Cheng et al. 2004). Whilst the non-autocratic leadership style is exhibited when a leader invites other members of the team to participate in the decision-making process (Bhatti et al. 2012).

The type of leadership style adopted by a firm is empirically known to directly/indirectly impact on how successful that particular firm turns out (Ojokuku 2012). Leadership influences the commitment of others with the aim of people realizing their optimum potential to achieve a value-added shared vision with passion and integrity (Jeremy et al. 2011). Also, leadership is reciprocal where leaders and subordinates influence each other to achieve firm goals (Ngogo 2008). In literature, several studies have shown a significant relationship between leadership style and firm performance (Farh et al. 2008; Farh and Cheng 2000; McGrath and MacMill 2000). For example, Sun (2002) carried out empirical research on schools and enterprises in China and found out that in both institutions, leadership style positively correlates with organizational performance. This notwithstanding, some researchers have also found a negative relationship between leadership style and performance (Farh and Cheng 2000). Hence placing critical importance on leaders or firms

to know the right type of leadership style to adopt to achieve a particular outcome. However, in relating our study to the aforementioned leadership style-performance relationship findings, it can be said that a strict leadership approach (autocratic) will be more effective and efficient in improving economic and environmental activities through the supply chain. Thus a strict/autocratic approach will ensure that players (suppliers, focal firms, customers) adhere to laid down environmental rules/regulations as well as organisational strategies to improve environmental and economic performance (Cheng et al. 2004) but not for social performance. Thus, in dealing with social issues throughout the supply chain (suppliers, focal firms, customers), a more flexible approach will be more effective and efficient as this will give the needed platform for employees, societies, suppliers, and customers to communicate their specific social needs to firms or stakeholders for them to be met. Moreover, a more flexible approach with customers will enable a more friendly approach for customers to communicate and associate with the companies, which will help identify and meet the social demands of the customers. Based on these arguments, the following hypotheses are suggested:

H3a: The relationship between supplier integration and (1) economic (3) environmental performance will be significant and stronger for autocratic leadership style, but not for (2) social performance

H3b: The relationship between internal integration and (1) economic (3) environmental performance will be significant and stronger for autocratic leadership style, but not for (2) social performance

H3c: The relationship between customer integration and (1) economic (2) social (3) environmental performance will be significant and stronger for non-autocratic leadership style

7.1.2 Resource constraints and the SCI-supply chain sustainability relationship

From the interview findings, it was noted that the accessibility to needed resources by the pharmaceutical companies was a great challenge (6.2.4.1, page 134). Thus, the issue of resource constraints was known to affect the level/extend to which the companies operationalised SCI to achieve supply chain sustainability. The addition of the resource construct is justified using literature.

The majority of previous studies have shown inconsistent results for the relationship between resource constraints and firm performance (Daniel et al. 2004). Generally, most of the studies on the resource-performance relationship: (1) Focus on developed economies and less on developing economies (Tan and Peng 2003) (2) Focus on financial constraints with less inclusion of other key constraints, e.g. human resource constraints (George et al. 2005). Hence based on the gaps (1) inconsistent results on the resource constraints-performance relationship, (2) less use of developing economies in studying the resource-performance relationship, and (3) less inclusion of other key constraint measures in studying the resource-performance relationship, there is a need for further research on the resource constraints-firm performance relationship taking into consideration all the aforementioned gaps. Hence, in this study, apart from addressing all the aforementioned gaps outlined in (1), (2), and (3), a further step is taking to give more insightful results. Thus, the study further analyses how resource constraint moderates the impact of SCI on the three dimensions of sustainability. The study also considers both financial and human resource constraints, as well as developed and developing economies.

7.1.2.1 Hypotheses

Resource constraint is known to create liabilities that leave firms with limited strategic choices and high uncertainty (Baucus and Near 1991). Moreover, the failure of firms to obtain adequate resources can have negative effects on firm performance and their capabilities to obtain future resources (Paeleman and Vanacker 2015; Wu et al. 2016). These inabilities sometimes serve as enablers for firms to indulge in fraudulent or unlawful activities purposely to mitigate the impact of constraints. However, the aforementioned argument has been inconsistent (Baucus and Near 1991; Mishina et al. 2010) in literature. Based on the raised findings, it can be said that resource constraints do not only affect financial and operational (economic) performance but also social (people) and environmental performance due to the risk of firms engaging in fraudulent or illegal activities.

Moreover, many empirical studies (although the majority is limited to developed countries) have shown a significant relationship between financial slack and organizational performance (Bradley et al. 2011; Mishina et al. 2010; Tran et al. 2018). In context to human resource constraints, some studies have also shown that human resources, mostly in the form of highly educated and qualified decision-makers/managers, have a positive impact on firm

growth (Sapienza and Grimm 1997). Based on the raised arguments, it can be said that companies with available financial and human resources will have more capacity and strategies to optimally integrate their activities with supply chain players to impact their supply chain sustainability. The following hypotheses are suggested:

H4a: The relationship between supplier integration and (1) economic (2) social (3) environmental performance will be significant and stronger for resource availability
H4b: The relationship between internal integration and (1) economic (2) social (3) environmental performance will be significant and stronger for resource availability
H4c: The relationship between customer integration and (1) economic (2) social (3) environmental performance will be significant and stronger for resource availability

7.1.3 Product innovation and the SCI-supply chain sustainability relationship

Product innovation was known from the interview findings to impact the extent to which the firms integrate with supply chain partners to achieve supply chain sustainability (6.2.4.2, page 138). Hence, it is important to add the product innovation construct to this study and examine how the construct influences pharmaceutical companies to achieve sustainability through SCI. This argument is justified using the literature.

Although the impact of SCI on firm performance has been empirically studied and supported (Fynn et al. 2010; Wong et al. 2011), there is less empirical research on how SCI (both internal and external) impact on product innovation (Wong et al. 2013). Some (Wong et al. 2013) have also argued that the relationship between SCI and product innovation is generally less understood as the aforementioned relationship is confronted with a lack of theoretical explanation and less empirical research. Some have further argued that the majority of research (Cozza et al. 2012; DeFaria and Mendonca 2011) that studied the product innovation-performance relationship also focused on the economic dimension only. Hence also accounting for the lack of theoretical explanation for the SCI-product innovation relationship.

In addition, although the few existing literature has established a significant relationship between SCI and product innovation (Gomes et al. 2003), some have also established a positive significant relationship between product innovation and firm performance (Artz et al. 2010; Baines at al. 2009; Hult et al. 2004; Zhou 2006). The raised argument shows that

one of the *main omitted contextual factors needed to provide further insight into the inconsistent SCI-performance results* (Flynn et al. 2010; Wong et al. 2013) is product innovation. Hence, this study will measure the moderating role of product innovation on the SCI-supply chain sustainability relationship. Thus, the study does not consider only the economic dimension, but also the environmental and social dimensions (Ahi and Searcy 2013; Wu and Pagell 2011). Hence giving more insightful results.

7.1.3.1 Hypotheses

According to Petersen et al. (2005) *external integration* facilitates the gaining of adequate and accurate customer information (Griffin and Hauser 1996) and sharing knowledge on product design with suppliers (Clark and Fujimoto 1991) which collectively impacts product innovation. A study by Wong et al. (2013) on the relationship between internal integration, external integration, and product innovation showed that there is a positive relationship between external integration and product innovation. Although in Wong et al. (2013) study internal integration had no direct relationship with product innovation, the total effect of internal and external integration was identified to have a positive relationship with product innovation.

Moreover, most SCI studies argue that *internal integration* enables exploiting and coordinating internal resources through the reduction or removal of functional barriers (Flynn et al. 2010; Wong et al. 2013). Hence enabling optimizing product development time and responsiveness (Droge et al. 2004), and improving upon product and process design (Rosenzweig et al. 2003). Moreover, internal integration facilitates optimum knowledge sharing among various departments within a firm (Narasimhan and Kim 2002) which helps to improve upon product innovation (Gomes et al. 2003). Based on the raised literature findings on SCI-product innovation, it can be said that companies that engage in high levels of innovative products will engage more in SCI as compared to companies engaging in low innovative products. Hence the following hypotheses are suggested:

H5a: The relationship between supplier integration and (1) economic (2) social (3) environmental performance will be significant and stronger for high product innovation
H5b: The relationship between internal integration and (1) economic (2) social (3) environmental performance will be significant and stronger for high product innovation

H5c: The relationship between customer integration and (1) economic (2) social (3) environmental performance will be significant and stronger for high product innovation

7.1.4 Patient satisfaction and the SCI-supply chain sustainability relationship

From the interview engagement, it was noted that although the pharmaceutical companies in both the UK and Ghana face diverse issues, they mainly focus on satisfying the customer to gain economic and competitive advantage (6.2.4.3**,** page 139). This raises the need for this study to add the patient satisfaction construct in studying the relationship between SCI and supply chain sustainability. This argument is justified.

Many SCI studies have shown both positive (Wiengarten et al. 2019) and negative (Vereecke and Muylle 2006) SCI-performance relationship. This has been attributed to the fact that the impact of SCI on performance has not been completely studied (Childerhouse and Towill 2000). Whilst some argue that the direct relationship between SCI and performance provides limited insight (Zhao et al. 2011). Thus most SCI studies mainly exploited only the direct impact of SCI on performance while excluding other vital factors that may be mediating the aforementioned relationship (Yu et al. 2013). However, customer satisfaction which is argued to be one of the key missing factors mediating the SCI-performance relationship is less explored (Wiengarten et al. 2019; Yu et al. 2013). Hence, this study explores this gap.

7.1.4.1 Hypotheses

SCI is empirically known to have a significant impact on customer satisfaction (Homburg and Stock 2004; Yu et al. 2013). Cramton (2001) indicated that SCI facilitates the sharing of adequate and accurate customer information across/within the supply chain which enables understanding the needs and services demanded by customers (Yu et al. 2013). Heikkila (2002) also indicated that understanding customers' needs informs the company's' about the right type of products/services to offer to achieve customer satisfaction (Reichheld 2003). Besides, extant literature has shown that customer satisfaction influences firm performance in different ways (Dotson and Allenby 2010; Narayanan et al. 2011). Thus, firms known to satisfy their customers turn out having loyal customers (Bolton and Drew 1991) who are also willing to pay premium prices for offered products and/or services (Homburg et al. 2005). Other studies also showed that firms with higher levels of customer satisfaction have higher levels of cash flows (Mittal et al. 2005).

Several researchers have shown a positive impact of (1) SCI on customer service (Zhu et al. 2017), and (2) patient satisfaction on performance (Yu et al. 2013). Based on the latter argument, one can say that offering customers with ethical and environmentally friendly products, which is highly demanded by the majority of customers (Gimenez et al. 2012; Wolf 2011) will also increase performance. Hence we posit the following hypotheses:

"Please note that in the context of this study, the term "*customer*" is replaced with the term "*patient*" as the study focuses on the pharmaceutical industry.

H6a: Patient satisfaction will mediate the relationship between customer integration and (1) environmental (2) social (3) economic performance
H6b: Patient satisfaction will mediate the relationship between internal integration and (1) environmental (2) social (3) economic performance
H6c: Patient satisfaction will mediate the relationship between supplier integration and (1) environmental (2) social (3) economic performance

7.2 Revised research questions and newly developed conceptual framework

Based on the interview findings and justification of the additional IECF's to the conceptual framework (Figure 7.1), the revised research questions are;

(1) What is the impact of supply chain integration on supply chain sustainability?
(2) What is the moderating effect of external uncertainty, leadership style, resource constraint, and product innovation on the impact of supply chain integration on supply chain sustainability?
(3) What is the mediating effect of patient satisfaction on the impact of supply chain integration on supply chain sustainability?

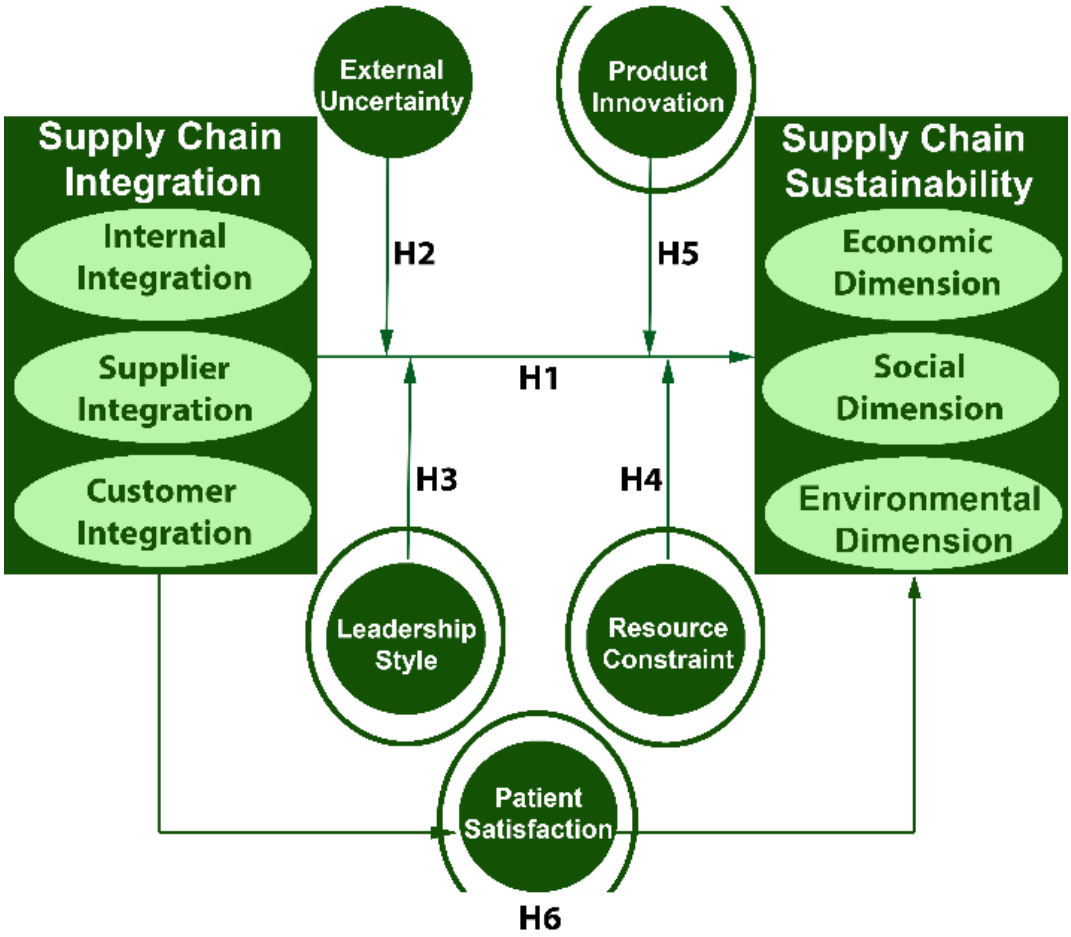


Figure 7.1: **Newly generated conceptual framework**

All the drafted hypotheses, thus the initially developed (chapter 4, section 4.4) and the newly developed (chapter 7, section 7.2), to be statistically tested are presented in Table 7.1.

Table 7.1: **Summary of all hypotheses**

Hypotheses
RQ1: What is the impact of supply chain integration on supply chain sustainability?
H1a1: Internal integration will positively impact the economic performance of members within the supply chain.
H1a2: Customer integration will positively impact the economic performance of members within the supply chain.
H1a3: Supplier integration will positively impact the economic performance of members within the supply chain.
H1b1: Internal integration will positively impact the social performance of members within the supply chain.
H1b2: Customer integration will positively impact the social performance of members within the supply chain.
H1b3: Supplier integration will positively impact the social performance of members within the supply chain.

H1c1: Internal integration will positively impact the environmental performance of members within the supply chain.
H1c2: Customer integration will positively impact the environmental performance of members within the supply chain.
H1c3: Supplier integration will positively impact the environmental performance of members within the supply chain.
RQ2: What is the moderating effect of external uncertainty, leadership style, resource constraint, and product innovation on the impact of supply chain integration on supply chain sustainability?
H2a: The relationship between customer integration and (1) economic (2) social (3) environmental performance will be significant and stronger for high EU.
H2b: The relationship between supplier integration and (1) economic (2) social (3) environmental performance will be significant and stronger for low uncertainty.
H2c: The relationship between internal integration and (1) economic will be significant and stronger for high EU, but not for (2) social (3) environmental performance.
H3a: The relationship between supplier integration and (1) economic (3) environmental performance will be significant and stronger for autocratic leadership style, but not for (2) social performance.
H3b: The relationship between internal integration and (1) economic (3) environmental performance will be significant and stronger for autocratic leadership style, but not for (2) social performance.
H3c: The relationship between customer integration and (1) economic (2) social (3) environmental performance will be significant and stronger for non-autocratic leadership style.
H4a: The relationship between supplier integration and (1) economic (2) social (3) environmental performance will be significant and stronger for resource availability.
H4b: The relationship between internal integration and (1) economic (2) social (3) environmental performance will be significant and stronger for resource availability.
H4c: The relationship between customer integration and (1) economic (2) social (3) environmental performance will be significant and stronger for resource availability.
H5a: The relationship between supplier integration and (1) economic (2) social (3) environmental performance will be significant and stronger for high product innovation.
H5b: The relationship between internal integration and (1) economic (2) social (3) environmental performance will be significant and stronger for high product innovation.
H5c: The relationship between customer integration and (1) economic (2) social (3) environmental performance will be significant and stronger for high product innovation.
RQ3: What is the mediating effect of patient satisfaction on the impact of supply chain integration on supply chain sustainability?
H6a: Patient satisfaction will mediate the relationship between customer integration and (1) environmental (2) social (3) economic performance.
H6b: Patient satisfaction will mediate the relationship between internal integration and (1) environmental (2) social (3) economic performance.
H6c: Patient satisfaction will mediate the relationship between supplier integration and (1)environmental (2) social (3) economic performance.

7.3 Data screening (Incomplete cases)

Survey data, a total of 280 was collected and assessed to identify complete and incomplete cases. 41 cases were identified to have a completion rate of 0%. This is attributed to the company heads previewing the questions before agreeing and passing it on to the right person in the organisation to complete the survey. Some of the UK respondents confirmed

taking this procedure/approach. In addition, 3 cases were 90-99% incomplete whilst 5 cases were 80-90% incomplete. These were also presumed to be reviews as only a few questions, all in the demographic section were answered. This may be as a result of oversight while reviewing the questionnaire. All these were UK cases justifying it to be reviews. In summary, a total of 231 usable responses were used representing a 31.3% response rate. The response rate is comparable to other SCI studies (Flynn et al. 2010; Swink et al. 2007) and deemed acceptable in the field of management studies (Anseel et al. 2010). Table 7.2 provides a summary of the respondent's demographics.

Table 7.2: **Demographics**

		Frequency	%	Mean	Std. Deviation
Gender	Male	144	62.3	1.40	.550
	Female	82	35.5		
	Prefer not to say	4	1.7		
	Others	1	.4		
	Total	231	100.0		
Highest level of education achieved	Bachelor's degree	79	34.2	2.47	1.285
	Master's degree	46	19.9		
	PhD	24	10.4		
	Other	82	35.5		
	Total	231	100.0		
Level of job title / position	Top-level management	49	21.2	2.15	.867
	Middle-level management	122	52.8		
	Low-level management	37	16.0		
	Other	23	10.0		
	Total	231	100.0		
How long you have worked at present organisation	Under 1 year	11	4.8	2.76	.983
	1-5 years	99	42.9		
	6 - 10 years	70	30.3		
	11 - 15 years	37	16.0		
	16 years and above	14	6.1		
	Total	231	100.0		
Annual turnover	Less than £25m	168	72.7	1.27	.446
	More than £25m	63	27.3		
	Total	231	100.0		
Firm Ownership	Public owned	14	6.1	1.94	.249
	Private owned	216	93.5		
	State owned	1	.4		
	Total	231	100.0		
Company classification	UK	89	38.5	1.61	.488
	Ghana	142	61.5		
	Total	231	100.0		
Which of the	Raw material supplier only	2	.9	7.18	2.220
	Manufacturing only	2	.9		
	Manufacturing and Distribution	26	11.3		

following best classifies your company	Manufacturing, Distribution, and Retail	14	6.1
	Wholesale only	6	2.6
	Wholesale and Distribution	6	2.6
	Wholesale, Distribution, and Retail	58	25.1
	Distribution only	7	3.0
	Retail only	110	47.6
	Total	231	100.0

7.4 Checking for outliers and normality

The study adopts a more generous approach, due to the use of a Likert scale, in detecting outliers and assessing normality in the collected data. The study adopted a threshold of +/-2.2 for skewness and +/-2.2 for kurtosis (Sposito et al. 1983; West et al. 1995) to assess the presence of outliers in the data. All the questionnaire items, as shown in Table 7.3, were within both thresholds. Hence, indicating the presence of no outliers in the collected data.

Moreover, the same approach of skewness and kurtosis was used to assess the normality of the data. Thus, the kurtosis of normally distributed data is argued to fall within the threshold of +/-1.96. 1.96 (Field 2013). This condition was met in this study (Table 7.3). To further check normality, the researcher analysed the histogram graph of the constructs. For example, Figure 7.2 shows the histogram graph for the construct operational performance. Similar results were obtained for the other constructs. Most importantly, some researchers argue that with a large data set (>200, which is the case for this study) normality is assumed or the sampling distribution tends to be normal (Field 2013; Ghasemi and Zahediasl 2012). Indicating no need for normality check. To support this assertion, some researchers also argue that based on the central limit theorem the sampling distribution is normal if the sample data is also approximately normal (Field 2013; Ghasemi and Zahediasl 2012). All these arguments give justification for our study to carry out parametric tests on the collected survey data.

Table 7.3: **Skewness and kurtosis**

		N	Skewness		Kurtosis	
Questionnaire items	Given codes	Statistic	Statistic	Std. Error	Statistic	Std. Error
Supplier integration						
Share information to our major suppliers through information technologies	si1	231	-.020	.160	-1.227	.319

Have a high degree of strategic partnership with suppliers	si2	231	-.425	.160	-.984	.319
Have a high degree of joint planning to obtain rapid response ordering process (inbound) with suppliers	si3	231	-.385	.160	-.998	.319
Our suppliers provide information to us in the production and procurement processes	si4	231	-.188	.160	-1.178	.319
Our suppliers are involved in our product development processes	si5	231	.040	.160	-1.308	.319
Internal integration						
Have a high level of responsiveness within our plant to meet other department's needs	ii1	231	-.512	.160	-.764	.319
Have an integrated system across functional areas under plant control	ii2	231	-.464	.160	-.976	.319
Within our plant, we emphasize on information flows among purchasing, inventory management, sales, and distribution departments	ii3	231	-.455	.160	-1.063	.319
Within our plant, we emphasize on physical flows among production, packing, warehousing, and transportation departments	ii4	231	-.489	.160	-1.060	.319
The utilization of periodic interdepartmental meetings among internal functions	ii5	231	-.323	.160	-1.128	.319
Customer integration						
Have a high level of information sharing with major customers about market information	ci1	231	-.401	.160	-.961	.319
Share information to major customers through information technologies	ci2	231	-.148	.160	-1.196	.319
Have a high degree of joint planning and forecasting with major customers to anticipate demand visibility	ci3	231	-.139	.160	-1.305	.319
Our customers provide information to us in the procurement and production processes	ci4	231	-.011	.160	-1.254	.319
Our customers are involved in our product development processes	ci5	231	.156	.160	-1.213	.319
Operational performance						
Our company can quickly modify products to meet our major customer's requirements.	op1	231	-.696	.160	-.737	.319
Our company can quickly introduce new products into the market.	op2	231	-.670	.160	-.657	.319
Our company can quickly respond to changes in market demand.	op3	231	-1.158	.160	1.136	.319
Our company has an outstanding on-time delivery record to our major customer.	op4	231	-1.233	.160	.853	.319
The lead time for fulfilling customers' orders (the time which elapses between the receipt of customer's order and the delivery of the goods) is short.	op5	231	-1.156	.160	1.122	.319
Our company provides a high level of customer service to our major customer.	op6	231	-1.079	.160	.396	.319
Financial performance						
Growth in sales	fin1	231	-.434	.160	-.522	.319
Return on sales	fin2	231	-.488	.160	-.557	.319
Growth in profit	fin3	231	-.413	.160	-.665	.319
Growth in market share	fin4	231	-.670	.160	.326	.319
Return on investment (ROI)	fin5	231	-.934	.160	.525	.319

Social performance						
Improvement in overall stakeholder welfare or betterment	so1	231	-.912	.160	1.372	.319
Improvement in community health and safety	so2	231	-.962	.160	1.029	.319
Reduction in environmental impacts and risks to general public	so3	231	-.928	.160	.635	.319
Improvement in occupational health and safety of employees	so4	231	-1.018	.160	1.277	.319
Improved awareness and protection of the claims and rights of people in community served	so5	231	-.742	.160	.549	.319
Employees receive periodic training	so6	231	-1.001	.160	.746	.319
Environmental performance						
Reduction of waste water	env1	231	-.837	.160	.362	.319
Reduction of solid wastes	env2	231	-.820	.160	.196	.319
Reduction in air emission	env3	231	-.434	.160	-.417	.319
Decrease in consumption for hazardous/harmful/toxic materials	env4	231	-.917	.160	.563	.319
Decrease in frequency for environmental accidents	env5	231	-.687	.160	-.085	.319
Improve a company's environmental situation	env6	231	-.781	.160	.277	.319
Increase in energy saved due to conservation and efficiency improvements	env7	231	-.725	.160	.530	.319
Decrease in improper drug disposal	env8	231	-.603	.160	-.202	.319
Decrease in improper solid/liquid wastes disposal	env9	231	-.646	.160	-.281	.319
External uncertainty						
Our customers often change their order over the month	eu1	231	-.222	.160	-.558	.319
Our supplier's performance is unpredictable	eu2	231	-.279	.160	-.358	.319
Competitors' actions regarding marketing promotions are unpredictable	eu3	231	-.336	.160	-.092	.319
Our plant uses core production technologies that often change	eu4	231	-.357	.160	-.100	.319
Process technologies employed in plants are complex	eu5	231	-.361	.160	-.416	.319
Core product technologies often change	eu6	231	-.197	.160	-.412	.319
Regulations often change	eu7	231	-.479	.160	-.135	.319
Product prices often change	eu8	231	-.254	.160	-.501	.319
Product innovation						
Respond well to customer need for "new" product features	pro1	231	-1.267	.160	1.535	.319
Develop unique product features to our customer needs	pro2	231	-.886	.160	-.183	.319
Develop new product features into the market quickly	pro3	231	-.679	.160	-.559	.319
Develop new product features to our customers	pro4	231	-.945	.160	.142	.319
Change product offered to meet customers' needs	pro5	231	-.868	.160	-.188	.319
Leadership style						
My supervisor asks me to obey his/her instructions completely	lea1	231	-.300	.160	-1.107	.319
My supervisor determined all decisions in the organization whether they are important or not	lea2	231	.127	.160	-1.215	.319
My supervisor always has the last say in the meeting	lea3	231	.082	.160	-1.079	.319
My supervisor always behaves in a commanding fashion in front of employees	lea4	231	-.144	.160	-1.050	.319

My supervisor exercises strict discipline over subordinates	lea5	231	.160	.160	-1.090	.319
Resource						
Lack of qualified personnel	res1	231	-.852	.160	.354	.319
The firm has a satisfactory financial position currently	res2	231	-.541	.160	-.595	.319
The firm is easy to access financial capital to support our market operations	res3	231	-.722	.160	.359	.319
The firm can secure the necessary funds if needed	res4	231	-.607	.160	-.261	.319
The firm can secure the necessary funds if needed	res5	231	-.554	.160	-.223	.319
Patient satisfaction						
Our customers are pleased with the products and services we provide for them	sat1	231	-1.257	.160	1.882	.319
Our overall customer satisfaction levels increased	sat2	231	-.898	.160	.224	.319
Our after-sales service satisfaction levels increased	sat3	231	-.544	.160	-.832	.319
Our customers stated expectations are exceeded	sat4	231	-.553	.160	-.721	.319
Customer standards are always met by our plant	sat5	231	-.911	.160	.376	.319
Valid N (listwise)		231				

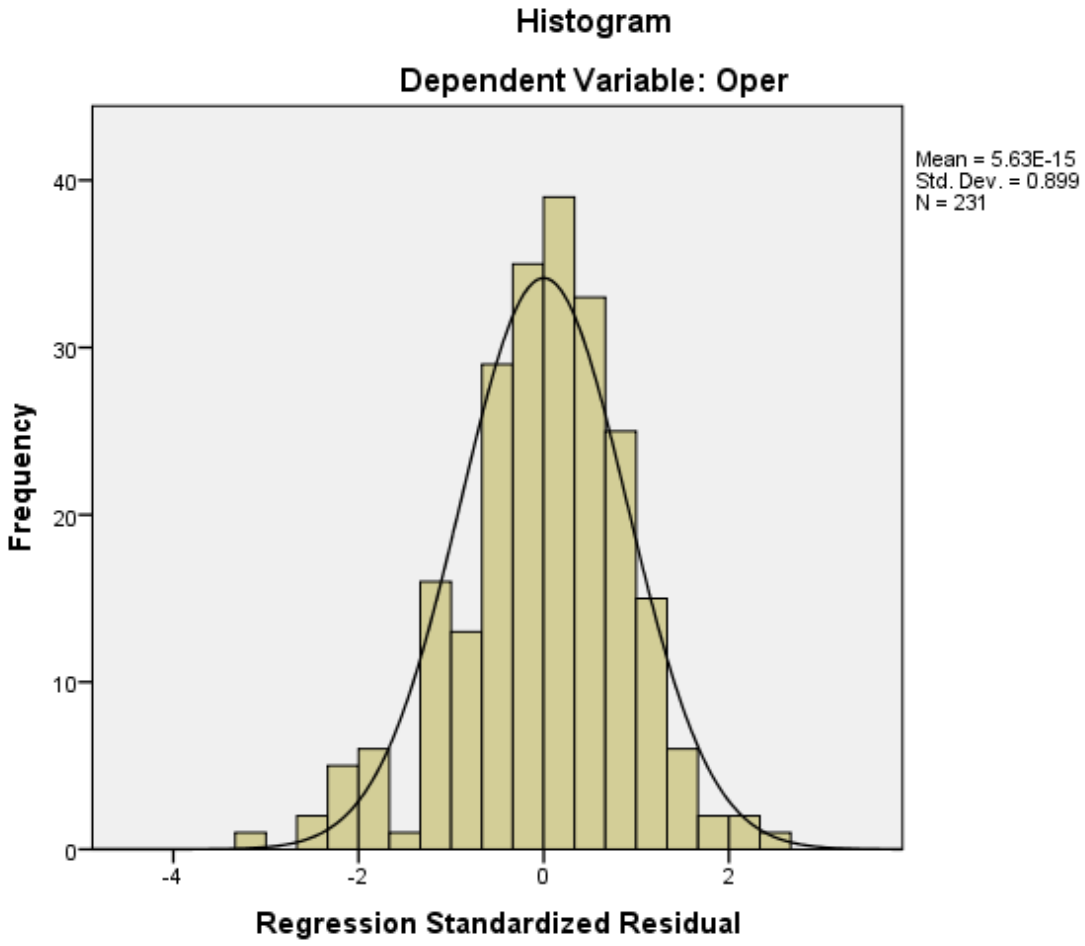


***Figure 7.2*: Additional normality check using histogram: Operational performance**

7.5 Non-response bias

The study compared early and late responses (Table 7.4) as recommended by Armstrong and Overton (1977) using annual turnover, company type, and company classification. The results showed no significant difference ($p<0.05$) (Table 7.5). Hence, non-response bias is unlikely to be present in this study.

Table 7.4: **Group statistics**

Parameters	Early and Late Responses	N	Mean	Std. Deviation
Annual turnover	Early	20	1.40	.503
	Late	20	1.05	.224
Company type	Early	20	6.05	2.585
	Late	20	8.15	1.954
Company classification	Early	20	1.30	.470
	Late	20	2.00	.000

Table 7.5: **Independent samples test**

		F	P-value	t	df	P-value (2 tailed)
Annual turnover	Equal variances assumed	58.581	.000	2.845	38	.007
	Equal variances not assumed			2.845	26.237	.008
Company type	Equal variances assumed	6.886	.012	-2.898	38	.006
	Equal variances not assumed			-2.898	35.370	.006
Company classification	Equal variances assumed	99.750	.000	-6.658	38	.000
	Equal variances not assumed			-6.658	19.000	.000

7.6 Common method bias

Common Method Bias (CMB) is generally used to assess the extent of bias in the collected data influenced by an external factor (s) (Podsakoff et al. 2003). Specifically, as a single respondent was used for each company, there might be a systematic response bias which may inflate or deflate the responses. The possibility of having this issue in the collected data was assessed in this study using CMB (Podsakoff et al. 2003).

Firstly, the researcher used Harman's single factor as it is mostly used for single-method research (Podsakoff et al. 2003). Thus an EFA was performed subjecting all the items to load on a single factor. The extracted single factor explains less than 40% of the total variance (Table 7.6) whilst the extraction generated more than 1 factor. Secondly, the researcher

subjected the Harman's single factor to CFA which generated an unacceptable model: X^2/df= 6.582, IFI=.636 TLI=.623, CFI=.635, RMSEA=.106, SRMR=.362 (Table 7.7). Thirdly, the researcher further utilised the "unmeasured latent factor" (Podsakoff et al. 2003) by testing two measurement models. The first model has traits (the latent variables and the various questionnaire items) only whilst the second model has a *common latent variable* (CLF) added to the initial traits (Yu et al. 2019). No significant difference (regression weights) among the two models, indicating unlikeliness of CMB issue in this study (Paulraj et al. 2008) (Table 7.8).

Table 7.6: **Harman's single factor**

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	27.267	39.517	39.517	27.267	**39.517**	39.517

Extraction Method: Principal Component Analysis.

Table 7.7: **Fit indices: Subjected Harman's single factor to CFA**

Model		CMIN	DF	P	CMIN/DF
Default model		14987.412	2277	.000	6.582
Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.558	.544	.636	.623	.635
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000
Model	RMSEA	LO 90	HI 90		PCLOSE
Default model	.106	.104	.109		.000
Independence model	.173	.171	.175		.000

Table 7.8: **Common method bias: Unmeasured latent factor**

			Trait only	**With CLF**	
Path	**Relationship**		Estimate	Estimate	Difference
fin4	←	Financial performance	0.802	0.802	0
fin2	←	Financial performance	0.897	0.897	0
fin1	←	Financial performance	0.851	0.851	0
so3	←	Social performance	0.855	0.855	0
so2	←	Social performance	0.868	0.868	0
env5	←	Environmental performance	0.893	0.893	0
fin3	←	Financial performance	0.816	0.816	0
op4	←	Operational performance	0.839	0.839	0
so5	←	Social performance	0.911	0.911	0

env1	←	Environmental performance	0.839	0.839	0
env9	←	Environmental performance	0.852	0.852	0
si1	←	Supplier integration	0.754	0.754	0
si2	←	Supplier integration	0.853	0.853	0
si3	←	Supplier integration	0.881	0.881	0
ii1	←	Internal integration	0.820	0.820	0
ii2	←	Internal integration	0.899	0.899	0
ii3	←	Internal integration	0.882	0.882	0
ii4	←	Internal integration	0.859	0.859	0
ci3	←	Customer integration	0.870	0.870	0
ci4	←	Customer integration	0.787	0.787	0
ci5	←	Customer integration	0.703	0.703	0
eu7	←	External uncertainty	0.662	0.662	0
eu6	←	External uncertainty	0.754	0.754	0
eu5	←	External uncertainty	0.660	0.660	0
eu4	←	External uncertainty	0.736	0.736	0
eu2	←	External uncertainty	0.745	0.745	0
sat5	←	Patient satisfaction	0.883	0.883	0
sat4	←	Patient satisfaction	0.903	0.903	0
sat3	←	Patient satisfaction	0.860	0.860	0
op1	←	Operational performance	0.715	0.715	0
op3	←	Operational performance	0.834	0.834	0
si4	←	Supplier integration	0.767	0.767	0
si5	←	Supplier integration	0.709	0.709	0
ii5	←	Internal integration	0.827	0.827	0
ci1	←	Customer integration	0.792	0.792	0
ci2	←	Customer integration	0.841	0.841	0
op2	←	Operational performance	0.695	0.695	0
op5	←	Operational performance	0.691	0.691	0
op6	←	Operational performance	0.667	0.667	0
fin5	←	Financial performance	0.714	0.714	0
so1	←	Social performance	0.833	0.833	0
so4	←	Social performance	0.879	0.879	0
so6	←	Social performance	0.787	0.787	0
env2	←	Environmental performance	0.827	0.827	0
env3	←	Environmental performance	0.801	0.801	0
env4	←	Environmental performance	0.898	0.898	0
env6	←	Environmental performance	0.882	0.882	0
env7	←	Environmental performance	0.733	0.733	0
eu1	←	External uncertainty	0.613	0.613	0
eu3	←	External uncertainty	0.524	0.524	0
eu8	←	External uncertainty	0.603	0.603	0
sat1	←	Patient satisfaction	0.851	0.851	0
sat2	←	Patient satisfaction	0.864	0.864	0
env8	←	Environmental performance	0.802	0.802	0
pro1	←	Product Innovation	0.567	0.567	0
pro2	←	Product Innovation	0.807	0.807	0
pro3	←	Product Innovation	0.895	0.895	0
pro4	←	Product Innovation	0.948	0.948	0
pro5	←	Product Innovation	0.714	0.714	0
lea1	←	Leadership Style	0.626	0.626	0
lea2	←	Leadership Style	0.748	0.748	0
lea3	←	Leadership Style	0.730	0.730	0
lea4	←	Leadership Style	0.740	0.740	0
lea5	←	Leadership Style	0.693	0.693	0

res1	←	Resource Constraint	0.655	0.655	0
res2	←	Resource Constraint	0.875	0.875	0
res3	←	Resource Constraint	0.911	0.911	0
res4	←	Resource Constraint	0.870	0.870	0
res5	←	Resource Constraint	0.882	0.882	0

7.7 Reliability and validity

We tested for unidimensionality, reliability, and validity for all constructs (Table 7.9 to 7.18). Exploratory factor analysis (EFA) (detailed in Table 7.9 to 7.15) and confirmatory factor analysis (CFA) (Table 7.16) were used. Furthermore, reliability and validity analysis was checked by calculating for average variance extracted (AVE), square root of AVE, composite reliability, Cronbach's alpha (Table 7.17), and the heterotrait-monotrait ratio of correlations (HTMT) (Table 7.18).

7.7.1 Exploratory factor analysis (EFA)

Exploratory factor analysis (EFA) using *maximum likelihood with Promax* rotation (Chen and Paulraj 2004) was conducted with final items loading more than .50 (Hair et al. 2010) (Table 7.16). Extracted factors matched the number of factors known from the literature, supporting unidimensionality and convergent validity.

Moreover, all the constructs reported an acceptable Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy whilst Bartlett's test of sphericity results rejects the null hypothesis that the correlation matrix is proportional to an identity matrix (Table 7.9). Thus for (1) *Supply chain integration* (KMO measure of sampling adequacy of .929, Bartlett's Test of Sphericity X^2 (105) = 2952.327, P< .001) (2) *Supply chain sustainability* (KMO measure of sampling adequacy of .941, Bartlett's Test of Sphericity X^2 (325) = 6036.475, P<.001) (3) *Moderators and Mediator* (KMO measure of sampling adequacy of .871, Bartlett's Test of Sphericity X^2 (378) = 4758.911, P<.001). Hence the results give an indication that factor analysis can be carried out for all the constructs.

Table 7.9: **Kaiser-Meyer-Olkin and Bartlett's test for all constructs**

Supply chain integration		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.929
Bartlett's Test of Sphericity	Approx. Chi-Square	2952.327
	df	105
	Sig.	.000

Supply chain sustainability		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.941
Bartlett's Test of Sphericity	Approx. Chi-Square	6036.475
	df	325
	Sig.	.000
Moderators and Mediator		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.871
Bartlett's Test of Sphericity	Approx. Chi-Square	4758.911
	df	378
	Sig.	.000

7.7.1.1 Independent variable (Supply chain integration)

For the SCI construct, one item under the supplier integration (si5) dimension was identified to cross load on the customer integration factor. Hence, we omitted item si5. The total number of factors extracted (Table 7.10) for the SCI construct was 3 using the total proportion of variance explained (Table 7.10) eigenvalues (Figure 7.3), scree plot (Figure 7.3), and literature (Flynn et al. 2010). Table 7.11 also shows the total number of factors extracted and the corresponding factor loadings for each questionnaire item.

Table 7.10: **Total variance explained**

	Initial Eigenvalues			Rotation Sums of Squared Loadings[a]
Factor	Total	% of Variance	Cumulative %	Total
1	8.568	61.199	61.199	7.297
2	1.194	8.526	69.725	6.845
3	.933	6.668	76.393	6.290
4	.626	4.468	80.861	

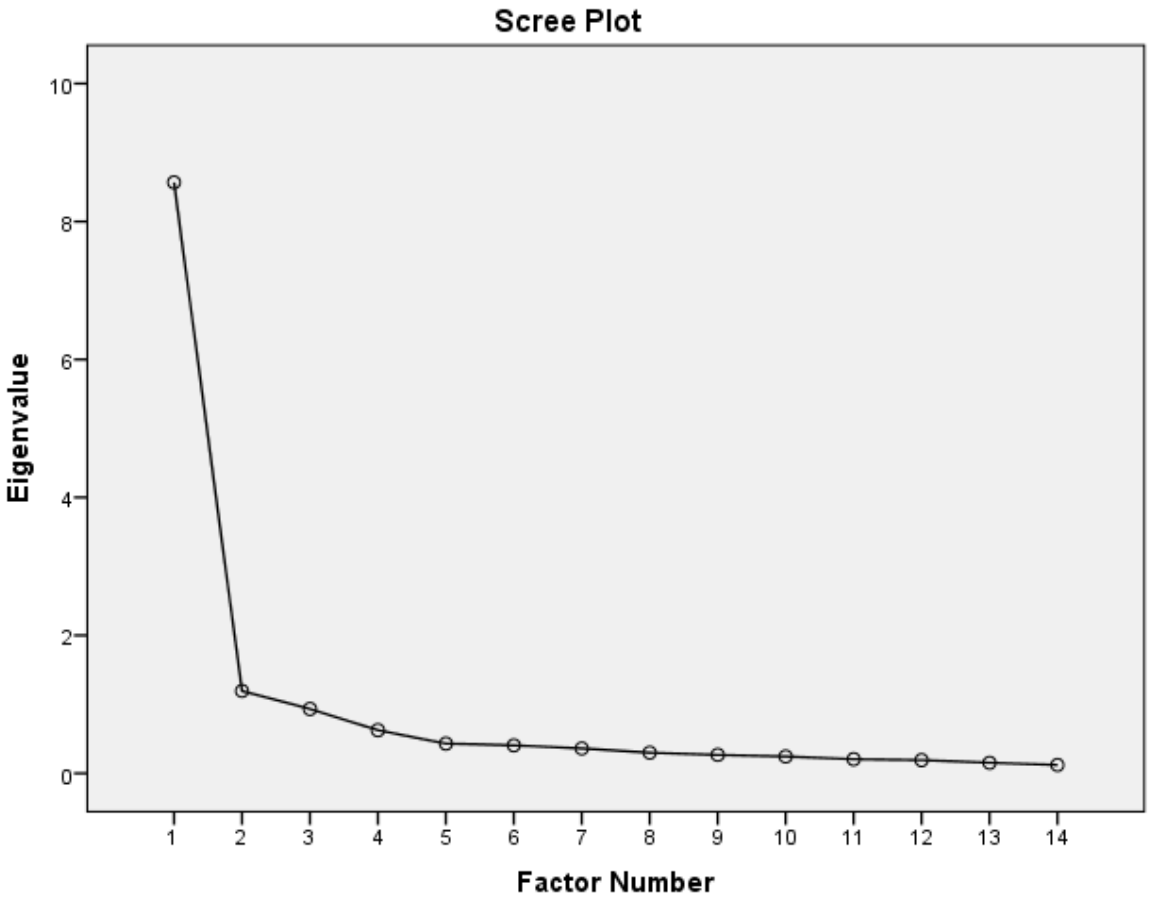


Figure 7.3: **Scree plot**

Table 7.11: **Pattern matrix**

	Factor		
	1	2	3
si1			.482
si2			.993
si3			.815
si4			.568
ii1	.606		
ii2	.807		
ii3	.975		
ii4	.894		
ii5	.559		
ci1		.530	
ci2		.782	
ci3		.830	
ci4		.864	
ci5		.783	

Extraction Method: Maximum Likelihood. Rotation Method: Promax with Kaiser Normalization. a. Rotation converged in 6 iterations.

7.7.1.2 Moderators and mediator

The items pro1 and res1 were deleted as they were loading more than .4 on a different factor but less than .4 on their own factors. The total number of factors extracted was 5 (Table 7.12) using the eigenvalues (Figure 7.4), scree plot (Figure 7.4), the total proportion of variance explained (Table 7.12), and literature (Chang et al. 2002; Wong et al. 2009; Zhang et al. 2003). Table 7.13 further shows the total number of factors extracted and the corresponding factor loadings for each questionnaire item.

Table 7.12: **Total variance explained**

	Initial Eigenvalues			Rotation Sums of Squared Loadings[a]
Factor	Total	% of Variance	Cumulative %	Total
1	8.573	32.973	32.973	6.311
2	3.162	12.161	45.133	5.097
3	3.021	11.619	56.752	5.929
4	1.851	7.118	63.871	5.330
5	1.554	5.976	69.846	2.664
6	.903	3.474	73.321	

Extraction Method: Maximum Likelihood.
a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

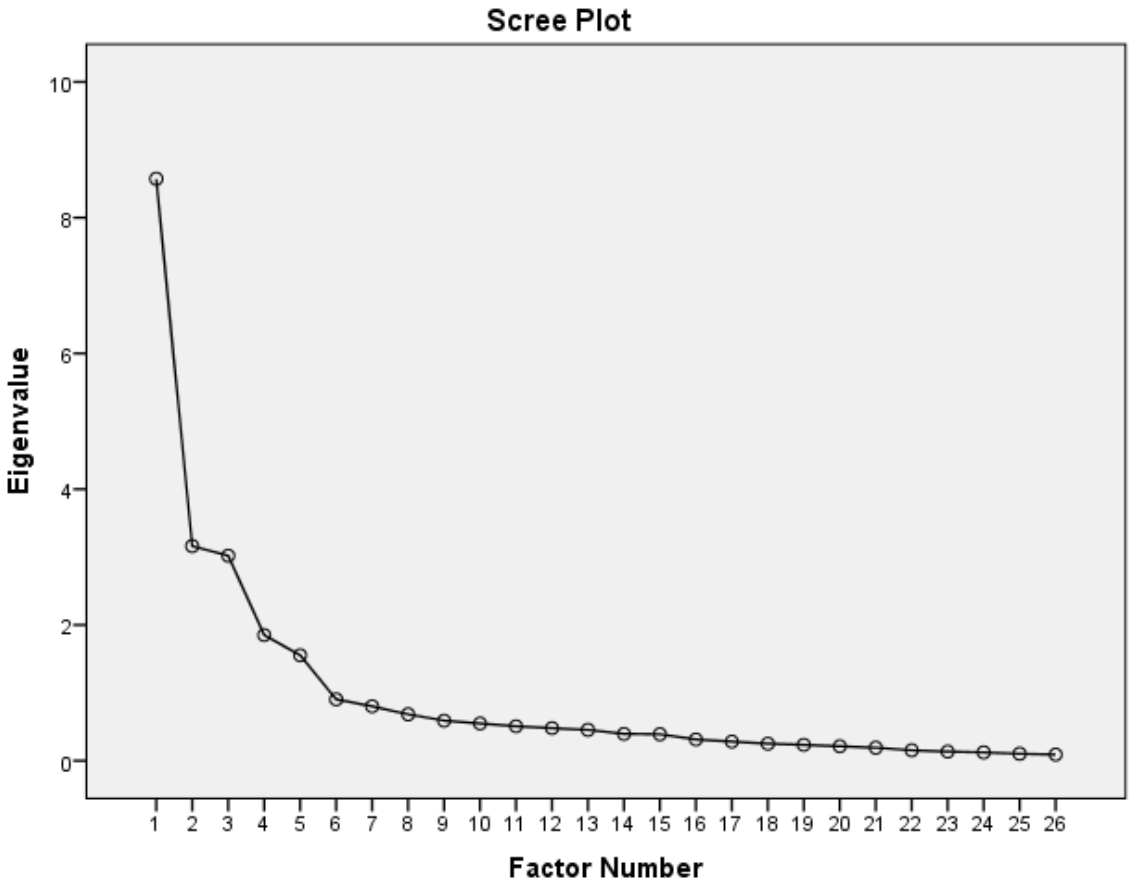


Figure 7.4: **Scree plot**

Table 7.13: **Pattern matrix**

	Factor				
	1	2	3	4	5
eu1		.641			
eu2		.740			
eu3		.460			
eu4		.713			
eu5		.682			
eu6		.807			
eu7		.646			
eu8		.556			
pro2				.747	
pro3				.829	
pro4				.962	
pro5				.795	
lea1					.640
lea2					.726

lea3			.764
lea4			.743
lea5			.685
res2		.814	
res3		.846	
res4		.841	
res5		.924	
sat1	.751		
sat2	.847		
sat3	.810		
sat4	.906		
sat5	.929		

Extraction Method: Maximum Likelihood.
Rotation Method: Promax with Kaiser Normalization.
a. Rotation converged in 6 iterations.

7.7.1.3 Dependent variable: Supply chain sustainability

For the supply chain sustainability construct, the items op2, env2, and env3 were initially deleted as they were cross-loading. Furthermore, op6, fin5, and env4 were deleted due to the same cross-loading issue. The total number of factors extracted was 4 (Table 7.14) using the eigenvalues (Figure 7.5), scree plot (Figure 7.5), the total proportion of variance explained (Table 7.14), and literature (Bansal 2005; Flynn et al. 2010; Paulraj 2011; Zhu et al. 2010). Table 7.15 also shows the total number of factors extracted and the corresponding factor loadings for each questionnaire item.

Table 7.14: **Total variance explained**

	Initial Eigenvalues			Rotation Sums of Squared Loadings[a]
Factor	Total	% of Variance	Cumulative %	Total
1	11.319	56.597	56.597	9.466
2	1.795	8.973	65.570	9.143
3	1.301	6.505	72.075	6.856
4	.913	4.566	76.641	7.287
5	.641	3.205	79.846	

Extraction Method: Maximum Likelihood.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

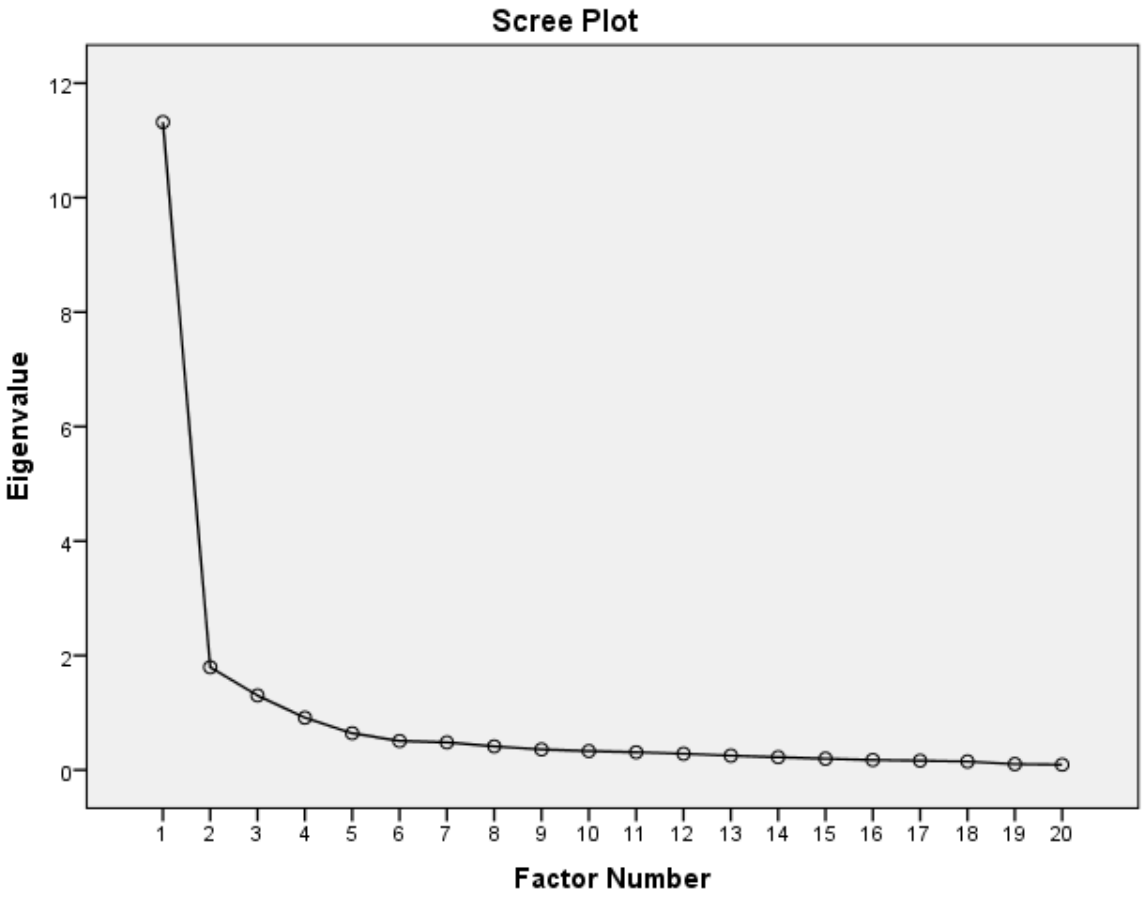


***Figure 7.5*: Scree plot**

***Table 7.15:* Pattern matrix**

	Factor			
	1	2	3	4
op1				.667
op3				.672
op4				.942
op5				.654
fin1			.783	
fin2			.975	
fin3			.708	
fin4			.772	
so1		.623		
so2		.928		
so3		.710		
so4		.704		
so5		.748		
so6		.417		

env1	.637
env5	.925
env6	.903
env7	.702
env8	.630
env9	.803

Extraction Method: Maximum Likelihood.
Rotation Method: Promax with Kaiser Normalization.
a. Rotation converged in 7 iterations.

7.7.2 Confirmatory factor analysis (CFA)

CFA was conducted to check for the convergent validity, discriminant validity, and unidimensionality of the measurement models (Table 7.16). The final output from the EFA was used for the CFA analysis. Although a wide range of fit indices are used by different researchers, the literature supports the general assertion that one fit indices' should not be over-relied upon but rather different fit indices should be used to collectively ascertain or assess fit. In this study, per the justification given in the literature review, the various fit indices used are X^2/df=1-5, IFI>.90, TLI>.90, CFI>.90, RMSEA<.08, SRMR<.10) (Hu and Bentler 1999).

Moreover for each measurement model, per the modification indices, the various items within the same latent variable were co-varied to improve fit. Each construct has one of its item loadings restrained to 1 purposely to identify the measurement models. This also assessed the adequacy of items (more than 2) for each construct in order to be identified (Hair et al. 2010). Generally, all the CFA loadings for all the measurement models are above .5 with t-values above 2 (Hair et al. 2010), showing convergent validity for all the models. For unidimensionality, the overall fits of the measurement models were acceptable (X^2/df=1-5, IFI>.90, TLI>.90, CFI>.90, RMSEA<.08, SRMR<.10) (Hu and Bentler 1999) (Table 7.16). Hence supporting the unidimensionality of the measurement models. The various process for each measurement model is detailed below.

Firstly, for the SCI measurement model, a few items (si4, ii5, ci1, and Ci 2) were identified to have high standardized residual covariance which was affecting the proper fit of the measurement model to the data. These were also affecting the discriminant validity of the model. For example, item si4 was correlating highly with internal integration whilst ii5 was

also correlating highly with customer integration. Hence, these items were omitted from the measurement model out of which a good fit and discriminant validity results were obtained (Table 7.16).

Secondly, for the dependent variable (supply chain sustainability) measurement model, items env7 and op5 were omitted due to their high standardized residual covariance which was affecting the fit. At this point, aside from the obtained RMSEA value still been an issue, item env6, so1, and so4 were also identified to be slightly high in terms of their standardized residual covariance. Hence, these items were also omitted. The obtained final measurement model had a good fit (Table 7.16).

Lastly, for the moderators (leadership style, EU, product innovation, and resource) and mediator (patient satisfaction) measurement model, the items EU1, EU3, EU8, and Pro3 were omitted due to their high standardized residual covariance. This was to also improve the overall fit of the model. Items sat1 and sat2 were further omitted for the same reason of high standardized residual covariance, hence affecting the overall fit. After these deletions, an acceptable measurement model was obtained (Table 7.16). The EFA and CFA loadings for the final items retained for the study are shown in Table 7.16.

Table 7.16: **EFA and CFA results: Reliability and validity**

Given Code	Construct (Reliability and Validity)	EFA Loading	CFA loading (t-values)
	Dependent Variable		
	Goodness of fit indices Chi-square= 94.991 df= 29 Chi-square/df= 3.276 IFI= 0.963 TLI= 0.942 CFI= 0.963 RMSEA= 0.080 SRMR= 0.041		
	Supply chain Integration		
	Supplier Integration *(Flynn et al. 2010; Narasimhan and Kim 2002)*		
si1	Share information to our major suppliers through information technologies	.549	.804(15.291)
si2	Have a high degree of strategic partnership with suppliers	.947	.826(15.964)
si3	Have a high degree of joint planning to obtain rapid response ordering process (inbound) with suppliers	.844	.901(-)
	Internal Integration *(Flynn et al. 2010; Narasimhan and Kim 2002; Stank et al. 2001)*		
ii1	Have a high level of responsiveness within our plant to meet other department's needs	.653	.823(-)
ii2	Have an integrated system across functional areas under plant control	.836	.912(18.560)
ii3	Within our plant, we emphasize on information flows among purchasing, inventory management, sales, and distribution departments	.965	.849(14.007)

ii4	Within our plant, we emphasize on physical flows among production, packing, warehousing, and transportation departments	.891	.822(13.418)
	Customer Integration *(Flynn et al. 2010; Narasimhan and Kim 2002)*		
ci3	Have a high degree of joint planning and forecasting with major customers to anticipate demand visibility	.551	.881(-)
ci4	Our customers provide information to us in the procurement and production processes	.965	.765(11.430)
ci5	Our customers are involved in our product development processes	.815	.653(9.523)
	Moderators and Mediator		
	Goodness of fit indices Chi-square= 346.947 df= 156 Chi-square/df= 2.224 IFI= 0.934 TLI= 0.919 CFI= 0.933 RMSEA= 0.073 SRMR= 0.066		
	Environmental Uncertainty *(Chang et al. 2002; Ragatz et al. 2002; Wong et al. 2009)*		
eu2	Our suppliers performance is unpredictable	.676	.737(8.431)
eu4	Our plant uses core production technologies that often change	.677	.763(8.657)
eu5	Process technologies employed in plants are complex	.703	.651(7.995)
eu6	Core product technologies often change	.903	.784(9.244)
eu7	Regulations often change	.594	.635(-)
	Product Innovation *(Koufteros et al. 2005; Rondeau et al. 2000)*		
pro2	Develop unique product features to our customer needs	.807	.873(12.462)
pro4	Develop new product features to our customers	.866	.887(12.551)
pro5	Change product offered to meet customers' needs	.809	.726(-)
	Leadership Style *(Cheng et al. 2000, 2004)*		
lea1	My supervisor asks me to obey his/her instructions completely	.656	.685(7.473)
lea2	My supervisor determined all decisions in the organization whether they are important or not	.740	.767(8.818)
lea3	My supervisor always has the last say in the meeting	.752	.730(8.614)
lea4	My supervisor exercises strict discipline over subordinates	.732	.681(10.010)
lea5	My supervisor always behaves in a commanding fashion in front of employees	.681	.678(-)
	Resource *(An et al. 2018; Boso et al. 2017)*		
res2	The firm has a satisfactory financial position currently	.836	.869(18.221)
res3	The firm is easy to access financial capital to support our market operations	.873	.914(20.178)
res4	The firm can secure the necessary funds if needed	.868	.876(18.536)
res5	The firm has sufficient slack capital	.931	.877(-)
	Patient Satisfaction *(Heskett et al. 1994; Kassinis and Soteriou 2003; Zhang et al. 2003)*		
sat3	Our after-sales service satisfaction levels increased	.762	.849(17.223)
sat4	Our customers stated expectations are exceeded	.995	.957(20.599)
sat5	Customer standards are always met by our plant	.864	.868(-)
	Dependent Variable		
	Goodness of fit indices: Chi-square= 153.721 df= 57 Chi-square/df= 2.697 IFI= 0.957 TLI= 0.941 CFI= 0.957 RMSEA= 0.086 SRMR= 0.045		
	Supply chain sustainability		
	Operational Dimension *(Flynn et al. 2010)*		
op1	Our company can quickly modify products to meet our major customer's requirements.	.529	.688(11.068)

op3	Our company can quickly respond to changes in market demand.	.694	.859(-)
op4	Our company has an outstanding on-time delivery record to our major customer.	.686	.818(13.568)
	Financial Dimension *(Flynn et al. 2010)*		
fin1	Growth in sales	.853	.880(18.305)
fin2	Return on sales	.979	.889(-)
fin3	Growth in profit	.671	.792(15.197)
fin4	Growth in market share	.844	.801(15.520)
	Social Dimension *(Bansal 2005; Paulraj 2011)*		
so2	Improvement in community health and safety	.587	.835(16.172)
so3	Reduction in environmental impacts and risks to general public	.631	.863(17.271)
so5	Improved awareness and protection of the claims and rights of people in community served	.722	.903(-)
	Environmental Dimension *(Bansal 2005; Paulraj 2011; Zhu et al. 2010)*		
env1	Reduction of waste water	.833	.797(13.599)
env5	Decrease in frequency for environmental accidents	.912	.866(-)
env9	Decrease in improper solid/liquid wastes disposal	.863	.843(14.835)

7.7.3 Further reliability and validity analysis

Convergent validity was tested using the average variance extracted (AVE). Thus AVE was calculated for each construct and compared with the threshold of .5 (Hair et al. 2011). The lowest recorded AVE was 0.513, indicating that each of the variables explains more than half of the variance (Table 7.17). Hence convergent validity for all the constructs was met. Moreover, we confirmed convergent validity as all the final EFA loadings were above the threshold of 0.4 for all the 231 samples (Hair et al. 2011) (Table 7.16).

Moreover, discriminant validity was checked using the square root of the AVE. Discriminant validity assesses that the items in each construct are related to the other items in the same construct. Thus the square root of the AVE must be greater than the correlation among any pair of the constructs (Fornell and Larcker 1981). This condition was met for all the constructs as indicated in Table 7.17, indicating adequate discriminant validity. To further make sure adequate discriminant validity is attained, the heterotrait-monotrait ratio of correlations (HTMT) analysis was conducted. All the values are below the cut-off point of 0.850 (Henseler et al. 2015) indicating discriminant validity (Table 7.18).

Moreover, Cronbach's alpha, and composite reliability, were generated to test for construct reliability. All the generated values (Table 7.17) are above the threshold, Cronbach's alpha (>.7), and composite reliability (CR>.7), indicating adequate reliability (Hair et al. 2010).

Table 7.17: **Correlation of the constructs**

Construct	*a*	CR	AVE	OPER	FINA	SOCI	ENV	SI	II	CI	EU	PROD	LEAD	RES	SATS
OPER	0.819	0.835	0.629	**0.793**											
FINA	0.904	0.907	0.709	0.520***	**0.842**										
SOCI	0.912	0.901	0.751	0.695***	0.701***	**0.867**									
ENV	0.886	0.873	0.696	0.756***	0.543***	0.822***	**0.834**								
SI	0.876	0.881	0.713	0.707***	0.542***	0.556***	0.513***	**0.844**							
II	0.921	0.914	0.726	0.720***	0.589***	0.606***	0.518***	0.795***	**0.852**						
CI	0.852	0.827	0.616	0.724***	0.552***	0.592***	0.427***	0.692***	0.760***	**0.785**					
EU	0.839	0.839	0.513	0.434***	0.371***	0.306***	0.240**	0.257**	0.296***	0.468***	**0.716**				
PROD	0.867	0.870	0.692	0.766***	0.464***	0.630***	0.456***	0.440***	0.585***	0.631***	0.407***	**0.832**			
LEAD	0.832	0.835	0.504	0.061	-0.096	-0.064	-0.084	-0.124	-0.055	-0.030	-0.077	0.070	**0.710**		
RES	0.934	0.935	0.783	0.642***	0.688***	0.654***	0.685***	0.514***	0.489***	0.506***	0.391***	0.501***	-0.065	**0.885**	
SATS	0.919	0.922	0.797	0.559***	0.539***	0.514***	0.554***	0.296***	0.332***	0.380***	0.323***	0.487***	-0.001	0.603***	**0.893**

Note: Square root of the AVE is on the diagonal. The Square root of the AVE is larger than the correlations they have with the other constructs showing discriminant validity**.**

***Table 7.18*: HTMT analysis**

	OPER	FINA	SOCI	ENV	SI	II	CI	EU	PROD	LEAD	RES	SATS
OPER												
FINA	0.522											
SOCI	0.672	0.704										
ENV	0.728	0.553	0.791									
SI	0.708	0.563	0.543	0.506								
II	0.719	0.596	0.612	0.536	0.792							
CI	0.740	0.507	0.529	0.390	0.677	0.719						
EU	0.435	0.375	0.271	0.247	0.286	0.329	0.487					
PROD	0.773	0.415	0.588	0.419	0.407	0.567	0.611	0.392				
LEAD	0.109	0.115	0.044	0.039	0.124	0.033	0.005	0.082	0.098			
RES	0.641	0.706	0.639	0.677	0.524	0.513	0.470	0.408	0.466	0.050		
SATS	0.556	0.561	0.528	0.543	0.295	0.354	0.374	0.336	0.484	0.015	0.618	

Thresholds are 0.850 for strict and 0.900 for liberal discriminant validity.
Source: Henseler et al. (2015).

7.8 Multicollinearity

Multicollinearity was checked to assess if the variance in the dependent variable explained by the items/independent variables are unique. This helps to assess if there is high collinearity among the independent variables. In this study, the variance inflation factor (VIF) with a threshold of 10 (Bryne 2013; Hair et al. 1995) was adopted. Multicollinearity was identified not to be an issue in this study as all the reserved final items were below the threshold 10 (variance inflation factor) (Table 7.19) (Bryne 2013). To support this claim on multicollinearity, all the tolerance values generated for the items are also above the threshold of 0.10 (O'brien 2007).

Table 7.19: **Collinearity statistics**

Model	Items	Tolerance	VIF
1	si1	.270	3.698
	si2	.244	4.092
	si3	.209	4.777
	ii1	.215	4.647
	ii2	.155	6.431
	ii3	.191	5.249
	ii4	.189	5.282
	ci3	.314	3.185
	ci4	.258	3.883
	ci5	.285	3.505
	op1	.319	3.139
	op3	.267	3.750
	op4	.296	3.374
	fin1	.185	5.392
	fin2	.216	4.626
	fin3	.268	3.737
	fin4	.274	3.646
	so2	.230	4.345
	so3	.203	4.924
	so5	.178	5.624
	so6	.270	3.705
	env1	.230	4.355
	env5	.209	4.773
	env9	.198	5.058
	EU2	.420	2.381
	EU4	.392	2.551
	EU5	.406	2.462
	EU6	.320	3.124
	EU7	.450	2.221
	pro2	.206	4.861
	pro4	.214	4.662
	pro5	.356	2.808

	lea1	.414	2.414
	lea2	.351	2.848
	lea3	.351	2.848
	lea4	.288	3.467
	lea5	.354	2.822
	res2	.169	5.915
	res3	.147	6.797
	res4	.190	5.264
	res5	.182	5.507
	sat3	.190	5.255
	sat4	.157	6.374
	sat5	.207	4.824

a. Dependent Variable: Operational performance

7.9 Invariance measurement

To ensure comparison among the two main groups (UK and Ghana) in the data, configural, metric, and scalar invariance was tested. The dependent variable, supply chain sustainability was used for these tests.

Firstly, configural invariance was used to **c**ompare the model fit for the ungrouped (the UK and Ghana data combined) and grouped (separated data into that of UK and Ghana) models. These two models were estimated freely. Both models have a good fit, hence enabling a comparison of the UK and Ghana data. Thus supply chain sustainability *grouped using UK and Ghana* **(**X^2= 202.238 df= 114 X^2/df= 1.774 IFI= 0.961 TLI= 0.946 CFI= 0.960 SRMR= 0.074 RMSEA= 0.058**),** *ungrouped* **(**X^2= 153.721 df= 57 X^2/df= 2.697 IFI= 0.957 TLI= 0.941 CFI= 0.957 SRMR= 0.045 RMSEA= 0.086).

Secondly, metric invariance **c**ompares the chi-square difference between the fully constrained (regression weights were constrained) and unconstrained grouped models. Having a p-value of the chi-square difference test as insignificant; indicates that both groups are invariant. Hence, comparison can be made among the groups. This condition was also met. Thus unconstrained model X^2= 202.238 df= 114, fully constrained model X^2= 215.436 df= 127, difference X^2= 13.198 df= 13, p= 0.433.

Thirdly, scaler invariance which mainly deals with constraining intercepts to ascertain the invariance of the models was carried out. Having an insignificant p-value shows that scaler

invariance is good. This condition was also met in this study. Thus X^2= 12.157, df= 20, p= 0.911.

7.10 Conclusion

In this chapter, the thesis justifies the inclusion of the newly identified IECF's and posits hypotheses for all the presented IECF's. Based on these, the updated framework for the research is presented as well as the revised research questions for the thesis. All the preliminary analysis for the collected survey data from pharmaceutical companies in Ghana and the UK were also successfully conducted. In the next chapter, which is chapter 8 all the presented hypotheses in this chapter are tested using the cleaned survey data.

CHAPTER 8

MODEL TESTING

8.0 Chapter overview

This chapter details the survey results and analysis from a total of 231 leading pharmaceutical companies in Ghana and the UK. The survey data was used to statistically test the newly developed conceptual framework (chapter 7, Figure 7.1) which aims to provide insight into the impact of supply chain integration (SCI) on supply chain sustainability.

The stated hypotheses (chapter 7) were tested whilst comparing the data between the UK and Ghana pharmaceutical companies. STATA and the Statistical Package for Social Sciences (IBM SPSS statistics version 21) were used for the statistical analysis.

8.1 Combined UK and Ghana data

8.1.1 The direct effect of SCI on supply chain sustainability

We tested the direct effect of SCI on Supply chain sustainability using Structural Equation Modelling (SEM) (Table 8.1). Both Ghana and the UK samples were combined, as at least a sample size of 200 is needed to get meaningful results from SEM. Total sample size: 231 (SPSS-Amos was used). Model fit: X^2= 525.486 df= 236 X^2/df= 2.227 IFI= 0.935 TLI= 0.917 CFI= 0.935 RMSEA= 0.073 SRMR= 0.047. The fit indices results show that the model is good. As justified in chapter 6, the main fit indices and threshold used for this study are X^2/df=1-5, IFI>.90, TLI>.90, CFI>.90, RMSEA<.08, SRMR<.10) (Hu and Bentler 1999).

In regard to the control variables, company type has a positive effect on operational (β = 0.167, $p < 0.001$) and social (β = 0.104, $p < 0.1$) performance. However, annual turnover insignificantly affects any of the supply chain sustainability performances. This means that the quality of products, the flexibility of services and variety of products, and the speed of producing and delivering products to meet customer needs is influenced by the level at which the company is classified in the supply chain. The classification of the company or the type of activities the company engages in also influences how ethical the company's activities or actions are. Thus, whether the company operates as either a manufacturer, wholesaler, distributor and/or retailer, this does affect the company's operational and social performance.

Table 8.1: **Impact of SCI on supply chain sustainability**

Structural Paths	**Std Beta**	**Control Variables**	**Std Beta**
Supplier integration → Operational performance	.323 **	Annual turnover→ Operational performance	-.038
Supplier integration → Financial performance	.160	Annual turnover→ Financial performance	.036
Supplier integration → Social performance	.157	Annual turnover→ Social performance	.007
Supplier integration → Environmental performance	.289 *	Annual turnover→ Environmental performance	-.097
Internal integration → Operational performance	.278 *	Company type→ Operational performance	.167 **
Internal integration → Financial performance	.296 *	Company type→ Financial performance	.094
Internal integration → Social performance	.292 *	Company type→ Social performance	.104 †
Internal integration → Environmental performance	.322 *	Company type→ Environmental performance	.109
Customer integration → Operational performance	.312 **	**Variance explained (R^2)**	**R^2**
Customer integration → Financial performance	.223 †	R^2 Operational performance	.640
Customer integration → Environmental performance	.041	R^2 Environmental performance	.321
Customer integration → Social performance	.276 *	R^2 Social performance	.425
		R^2 Financial performance	.389

*** p < 0.001 ** p < 0.010 * p < 0.050 † p < 0.100

For the main direct effects, supplier integration has a positive effect on operational (β = 0.323, p < 0.01) and environmental performance (β = 0.289, p < 0.05), but an insignificant effect on financial (β = 0.160, ns) and social (β = 0.157, ns) performance. Internal integration has a positive effect on operational (β = 0.278, p < 0.05), environmental (β = 0.322, p < 0.05), financial (β = 0.296, p < 0.05), and social (β = 0.292, p < 0.05) performance. Customer integration is positively related to operational (β = 0.312, p < 0.01), financial (β = 0.223, p < 0.1), and social (β = 0.276, p < 0.05) performance, but an insignificant effect on environmental (β = 0.041, ns) performance. The results mainly indicates that internal integration is a more vital dimension (compared to supplier and customer integration) as it simultaneously improves the pharmaceutical companies operational activities, financial levels, engagement in environmentally friendly products and process, and how ethically acceptable their processes and products are to supply chain key stakeholders. However, for supplier and customer integration to achieve the same simultaneous impact on the supply chain sustainability dimensions (as described for internal integration), both dimensions must be considered and operationalised as a single unit (external integration) but not as separate dimensions.

8.1.2 The benefit of focusing on environmental performance

From the interview engagement (chapter 6), one of the interesting findings gathered was that the majority of the pharmaceutical companies in Ghana do not believe in the assertion that engaging in environmentally friendly processes and products may have any financial or other benefits. Based on this argument, this thesis further tested for the impact of environmental performance on operational performance, financial performance, social performance, and patient satisfaction using SEM (Table 7.2). Model fit: X^2= 274.309 df= 114 X^2/df= 2.406 IFI= 0.946 TLI= 0.928 CFI= 0.946 RMSEA= 0.078 SRMR= 0.046. Showing that the generated model is good.

For the control variables, company type is positively related to patient satisfaction (β = 0.175, p < 0.01), whilst annual turnover is positively related to financial (β = 0.216, p < 0.001), operational (β = 0.184, p < 0.01), and social (β = 0.170, p < 0.01) performance. On one hand, this means that the classification of the pharmaceutical companies in the pharmaceutical supply chain (e.g. manufacturer, wholesaler, retailer, etc.) influences the company's actions on how expected product needs of customers are met and how after-sales services meet customer expectations. On the other hand, the total annual sales or revenue generated by the

pharmaceutical companies also influences their operational activities, financial gains, and how ethical the products and processes of the companies are.

Table 8.2: **Impact of the environmental dimension on financial, operational, social and patient satisfaction**

Structural Paths	**Std Beta**	**Control Variables**	**Std Beta**
Environmental performance → operational performance	.740 ***	Company type→ patient satisfaction	.175 **
Environmental performance → financial performance	.517 ***	Annual turnover→ patient satisfaction	.097
Environmental performance → patient satisfaction	.548 ***	Annual turnover→ financial performance	.216 ***
Environmental performance → social performance	.803 ***	Annual turnover→ operational performance	.184 **
Control Variables	**Std Beta**	Annual turnover→ social performance	.170 **
Company type → operational performance	.074	Company type→ social performance	.023
Company type → financial performance	.023	** p < 0.010 *** p < 0.001	

R^2 Social: .701, R^2 Operational: .605, R^2 Financial: .334, R^2 Patient satisfaction: .337

For the main direct effect, environmental performance has a positive effect on operational ($\beta = 0.740$, $p < 0.001$), financial ($\beta = 0.517$, $p < 0.01$), social ($\beta = 0.803$, $p < 0.001$) and patient satisfaction ($\beta = 0.548$, $p < 0.01$). The results indicate that when the pharmaceutical companies engage in environmentally friendly processes and products, this leads to an improvement in operational activities (quality, flexibility, cost, etc.), market growth, sales and revenue, ethical processes and products, and the meeting of customer expectations through delivered products and after-sales services.

8.1.3 Moderation of external uncertainty, product innovation, resource, and leadership style on the SCI-supply chain sustainability performance relationship

For the moderation model, this thesis used the independent variables (II, SI, and CI), moderators (leadership style, resource, product innovation, and EU), control variables (annual turnover and company classification), and the interaction terms, all in a single path analysis model. Model fit for the path analysis model: $X^2= 1.862$ df= 1 $X^2/df= 1.862$ IFI= 1.00 TLI= 0.940 CFI= 1.00 RMSEA= 0.061 SRMR= 0.013. Indicating that the generated

model is better as compared to the generated model for the direct SCI impact on supply chain sustainability (sub-section 8.1.1).

For the main interaction effect (Table 8.3), resource positively moderates the relationship between supplier integration and social ($\beta = 0.155$, $p < 0.1$) and operational ($\beta = 0.172$, $p < 0.05$) performance. But negatively moderate internal integration and environmental ($\beta = -0.150$, $p < 0.1$), social ($\beta = -0.199$, $p < 0.05$), and operational performance ($\beta = -0.174$, $p < 0.05$) relationship. The results show that the amount of resources that the pharmaceutical companies are exposed to strengthens their collaboration of activities with suppliers. This, in turn, influences the social and operational outcomes of processes, products, and services that the focal firm and suppliers engage in. Interestingly the amount of resources that the pharmaceutical companies are exposed to reduces the extent to which the pharmaceutical companies collaborate their activities among internal functions. This is known to reduce the companies environmental, social, and operational performance. This gives an indication that the pharmaceutical companies may not have access to the right amount of resources to effectively and efficiently operationalise their internal integration for improved performance.

EU negatively moderate the relationship between supplier integration and environmental ($\beta = -0.200$, $p < 0.05$), and operational ($\beta = -0.124$, $p < 0.1$) performance. But positively moderate customer integration and environmental ($\beta = 0.191$, $p < 0.05$) performance, and supplier integration and financial ($\beta = 0.219$, $p < 0.05$) performance. The results indicate that in environments characterised by uncertainty, the pharmaceutical companies may find it more challenging to improve their operational activities and environmental performance through the collaboration of activities and processes with suppliers. However, the same uncertain environment rather influences the pharmaceutical companies to strengthen their integration with customers to improve upon their products and processes to be environmentally friendly. Additionally, the uncertain environment also influences the pharmaceutical companies to integrate with suppliers to improve financial performance.

Product innovation positively moderate the relationship between customer integration and social performance ($\beta = 0.218$, $p < 0.1$) only. This indicates that for the pharmaceutical companies to strengthen their integration with customers to improve upon their social performance, the rate and level at which the companies engage in innovative products also

Table 8.3: **Moderation effect of external uncertainty, product innovation, resource constraint, and leadership style.**

Predictors	**Outcome**	**Std Beta**	**Predictors**	**Outcome**	**Std Beta**
Main terms			*Main terms*		
Internal Integration (II)	Operational performance	.022	EU_x_II	Social performance	.077
II	Financial performance	.178 *	EU_x_II	Financial performance	-.071
II	Social performance	.260 ***	EU_x_II	Operational performance	-.004
II	Environmental performance	.203 *	EU_x_CI	Environmental performance	.191 *
Supplier Integration (SI)	Operational performance	.302 ***	EU_x_CI	Social performance	.085
SI	Financial performance	.048	EU_x_CI	Financial performance	-.061
SI	Social performance	.028	EU_x_CI	Operational performance	.100
SI	Environmental performance	.071	Product_x_CI	Environmental performance	.082
Customer Integration (CI)	Operational performance	.081	Product_x_CI	Social performance	.218 *
CI	Financial performance	.169 *	Product_x_CI	Financial performance	.010
CI	Social performance	.080	Product_x_CI	Operational performance	-.057
CI	Environmental performance	-.037	Product_x_II	Environmental performance	.024
Moderators			Product_x_II	Social performance	-.153
Leadership style	Operational performance	.126 ***	Product_x_II	Financial performance	.156
Leadership style	Financial performance	-.114 *	Product_x_II	Operational performance	.043
Leadership style	Social performance	-.139 **	Product_x_SI	Environmental performance	-.046
Leadership style	Environmental performance	-.073	Product_x_SI	Social performance	-.026
Resource	Environmental performance	.433 ***	Product_x_SI	Financial performance	-.106

Resource	Social performance	.215 ***	Product_x_SI	Operational performance	-.040
Resource	Financial performance	.455 ***	Leadership_x_CI	Operational performance	-.038
Resource	Operational performance	.187 ***	Leadership_x_CI	Financial performance	-.170 *
Product Innovation	Environmental performance	.143 *	Leadership_x_CI	Social performance	-.138 *
Product Innovation	Social performance	.309 ***	Leadership_x_CI	Environmental performance	-.114 †
Product Innovation	Financial performance	.013	Leadership_x_II	Environmental performance	.348 ***
Product Innovation	Operational performance	.386 ***	Leadership_x_II	Social performance	.400 ***
External Uncertainty (EU)	Environmental performance	.005	Leadership_x_II	Financial performance	.195 **
EU	Social performance	-.048	Leadership_x_II	Operational performance	.009
EU	Financial performance	-.029	Leadership_x_SI	Operational performance	-.053
EU	Operational performance	.117 **	Leadership_x_SI	Financial performance	.089
Two-way Interactions			Leadership_x_SI	Social performance	-.008
Resource_x_SI	Environmental performance	.021	Leadership_x_SI	Environmental performance	-.014
Resource_x_SI	Social performance	.155 †	*Control variables*		
Resource_x_SI	Financial performance	.034	Annual turnover	Environmental performance	-.127 **
Resource_x_SI	Operational performance	.172 *	Annual turnover	Operational performance	-.097 *
Resource_x_II	Environmental performance	-.150 †	Company classification	Social performance	.042
Resource_x_II	Social performance	-.199 *	Company classification	Financial performance	.010
Resource_x_II	Financial performance	-.076	Company classification	Operational performance	.051
Resource_x_II	Operational performance	-.174 *	Company classification	Environmental performance	.031

Resource_x_CI	Environmental performance	.015	Annual turnover	Social performance	-.047
Resource_x_CI	Social performance	-.079	Annual turnover	Financial performance	.010
Resource_x_CI	Financial performance	.034	Company classification	Operational performance	.051
Resource_x_CI	Operational performance	-.108	Company classification	Environmental performance	.031
EU_x_SI	Environmental performance	-.200 *	Annual turnover	Social performance	-.047
EU_x_SI	Social performance	-.067	Annual turnover	Financial performance	.010
EU_x_SI	Financial performance	.219 *			
EU_x_SI	Operational performance	-.124 †			
EU_x_II	Environmental performance	-.031			

*** p < 0.001 ** p < 0.010 * p < 0.050 † p < 0.100 R^2 Social performance: .697, R^2 Operational performance: .773, R^2 Financial performance: .604, R^2 Environmental performance: .673

play a key role in strengthening such activity. Leadership style positively moderates the relationship between internal integration and financial performance ($\beta = 0.195$, $p < 0.01$), social performance ($\beta = 0.400$, $p < 0.001$), and environmental performance ($\beta = 0.348$, $p < 0.001$), but negatively on customer integration and financial performance ($\beta = -0.170$, $p < 0.05$), social performance ($\beta = -0.138$, $p < 0.05$), and environmental performance ($\beta = -0.114$, $p < 0.1$). The results show that the type of leadership style the pharmaceutical companies adopt plays a key role by affecting the extent the companies collaborate their activities among internal functions to improve their financial, social, and environmental performance. However, the results also show that the type of leadership style adopted by the pharmaceutical companies reduces the extent to which the companies collaborate with their customers, which negatively affects the companies financial, social, and environmental performance. The aforementioned moderators are further explored and tested in 8.1.4.

8.1.4 Moderation among groups

8.1.4.1 High and low EU

The moderation effect of EU (grouped into High and Low) on the impact of SCI on Supply chain sustainability was tested (Table 8.4). The test shows the difference (in terms of significance and strength of impact) among the two EU groups. For the unconstrained model $X^2 = 1135.916$ df= 472, constrained model $X^2 = 1229.275$ df= 508, and difference $X^2 = 93.355$ df= 36, p-value < 0.001. The p-value of the chi-square difference test is significant; meaning the model differs across High and Low EU groups. Hence the various paths were analysed.

From Table 8.4, it can be seen that the pharmaceutical companies operate in both low and high uncertain environments. However, specific dimensions of SCI are more engaged in to improve a specific dimension of supply chain sustainability performance depending on whether the company' is exposed to either low and/or high uncertain environments. This indicates that different SCI strategies are needed to impact specific dimensions of supply chain sustainability.

8.1.4.2 Autocratic and non-autocratic leadership style

This thesis tested the moderation effect of Leadership style (grouped into autocratic and non-autocratic) on the impact of SCI on Supply chain sustainability (Table 8.5). The test shows the difference (in terms of significance and strength of impact) among the two groups. Thus

Table 8.4: **Moderation effect of high and low EU on the SCI-supply chain sustainability relationship.**

Path Name	High (EU) Beta	Low (EU) Beta	Difference in Betas	Analysis
CI → Operational performance	0.427**	0.124	0.303	The positive relationship between OPERA and CI is only significant for High.
CI → Financial performance	0.242†	0.278†	-0.036	There is no difference.
CI → Environmental performance	0.414*	-0.027	0.442†	The positive relationship between ENVIRONM and CI is stronger for High.
CI → Social performance	0.750***	0.154	0.596*	The positive relationship between SOCIA and CI is stronger for High.
SI → Operational performance	0.187	0.405*	-0.217	The positive relationship between OPERA and SI is only significant for Low.
SI → Financial performance	0.130	-0.001	0.131	There is no difference
SI → Social performance	-0.029	0.097	-0.126	There is no difference
SI → Environmental performance	0.083	0.364†	-0.281	The positive relationship between ENVIRONM and SI is only significant for Low.
II → Operational performance	0.292*	0.361†	-0.069	There is no difference.
II → Financial performance	0.355**	0.330	0.025	The positive relationship between FINA and II is only significant for High.
II → Social performance	-0.022	0.464*	-0.486*	The positive relationship between SOCIA and II is stronger for Low.
II → Environmental performance	-0.116	0.310	-0.426	There is no difference

Significance Indicators: † $p < 0.100$ * $p < 0.050$ ** $p < 0.010$ *** $p < 0.001$

Table 8.5: **Moderation effect of autocratic and non-autocratic leadership style on the SCI-supply chain sustainability relationship.**

Path Name	Autocratic Beta	Non-autocratic Beta	Difference in Betas	Analysis
SI → Operational performance	0.344**	0.105	0.239	The positive relationship between OPERA and SI is only significant for autocratic.
SI → Financial performance	0.148	-0.022	0.170	There is no difference
SI → Social performance	0.359**	-0.154	0.513*	The positive relationship between SOCIA and SI is stronger for autocratic.
SI → Environmental performance	0.553***	-0.057	0.610*	The positive relationship between ENVIRONM and SI is stronger for autocratic.
II → Operational performance	0.399*	0.270	0.129	The positive relationship between OPERA and II is only significant for autocratic.
II → Financial performance	0.545*	0.176	0.369	The positive relationship between FINA and II is only significant for autocratic.
II → Social performance	0.259	0.374†	-0.115	The positive relationship between SOCIA and II is only significant for non-autocratic.
II → Environmental performance	0.074	0.521*	-0.447	The positive relationship between ENVIRONM and II is only significant for non-autocratic.
CI → Operational performance	0.158	0.523**	-0.365	The positive relationship between OPERA and CI is only significant for non-autocratic.
CI → Financial performance	-0.075	0.562**	-0.637*	The positive relationship between FINA and CI is stronger for non-autocratic.
CI → Environmental performance	0.202	0.005	0.197	There is no difference
CI → Social performance	0.199	0.416*	-0.217	The positive relationship between SOCIA and CI is only significant for non-autocratic.

Significance Indicators**:** † $p < 0.100$ * $p < 0.050$ ** $p < 0.010$ *** $p < 0.001$

for the unconstrained model X^2= 1018.861 df= 472, constrained model X^2= 1049.609 df= 484, difference X^2= 30.748 df= 12, p-value < 0.002. The p-value for the chi-square difference test is significant, meaning that the model differs across autocratic and non-autocratic leadership style groups. Hence, the various paths were analysed.

From Table 8.5 it can be noticed that generally, the pharmaceutical companies adopt both autocratic and non-autocratic (flexible) leadership styles. Each type of the leadership style is known (Table 8.5) to strengthen the relationship between specific dimensions of SCI and supply chain sustainability. However, it can be noticed that (1) the level of integration between the focal companies and their suppliers purposely to improve financial performance, and (2) the level of integration between the focal firms and customers to purposely improve environmentally friendly products and processes, is the same for both types of leadership styles. Generally, the results indicate that different types of leadership styles are needed to collaborate activities and processes among internal functions, and with suppliers and customers to improve supply chain sustainability performance.

8.1.4.3 Resource constraint and availability

The moderation effect of Resource (grouped into resource constraint and resource availability) on the impact of SCI on Supply chain sustainability was also tested (Table 8.6). For the unconstrained model X^2= 1165.992 df= 474, constrained model X^2= 1183.627 df= 485, difference X^2= 17.635 df= 11, p-value < 0.1. The p-value for the chi-square difference test is significant, indicating that the model differs across groups. Hence, the various paths were analysed.

From Table 8.6, it can be seen that the pharmaceutical companies need access to the required amount of resources to achieve improved operational, financial, and social performance. However, in most of the cases (Table 8.6), the strength of the impact on supply chain performance as a result of collaborating activities and processes among internal functions and with suppliers is the same for pharmaceutical companies experiencing resource constraint and those having access to the needed resources. This may indicate that all the sampled pharmaceutical companies do not have access to the *optimum*/*required amount* of resources needed to largely impact their supply chain sustainability performance.

Table 8.6: **Moderation effect of resource constraint and availability on the SCI-supply chain sustainability relationship.**

Path Name	Resource constraint Beta	Resource availability Beta	Difference in Betas	Analysis
SI → Operational performance	-0.754	0.312**	-1.066*	The positive relationship between OPERA and SI is stronger for Resource availability.
SI → Financial performance	-0.453	0.135	-0.588	There is no difference
SI → Social performance	-0.729	0.107	-0.835	There is no difference
SI → Environmental performance	-0.211	0.232	-0.443	There is no difference
II → Operational performance	1.463	0.133	1.330	There is no difference
II → Financial performance	0.941	0.251*	0.689	The positive relationship between FINA and II is only significant for Resource availability.
II → Social performance	1.626	0.100	1.525†	There is no difference
II → Environmental performance	0.647	0.040	0.607	There is no difference
CI→ Operational performance	0.165	0.398***	-0.232	The positive relationship between OPERA and CI is only significant for Resource availability.
CI → Financial performance	-0.193	0.239*	-0.432	The positive relationship between FINA and CI is only significant for Resource availability.
CI → Social performance	-0.466	0.373***	-0.839	The positive relationship between SOCIA and CI is only significant for Resource availability.

Significance Indicators**:** † $p < 0.100$ * $p < 0.050$ ** $p < 0.010$ *** $p < 0.001$

8.1.4.4 Low and high product innovation

This thesis further tested the moderation effect of product innovation (grouped into low and high product innovation) on the impact of SCI on Supply chain sustainability (Table 8.7). For the unconstrained model X^2= 1423.234 df= 476, constrained model X^2= 1446.193 df= 486, difference X^2= 22.959 df= 10, p-value < 0.01. The p-value generated for the chi-square difference test is significant indicating that the model differs across groups. Hence, the various paths were analysed.

From Table 8.7, it can be noticed that the pharmaceutical companies that engage in higher levels or rates of innovative processes and products do have a stronger and/or significant impact on supply chain sustainability through the collaboration of activities among internal functions and with customers. Whilst, for the pharmaceutical companies that engage in lower levels or rate of innovative processes and products, they have a stronger and/or significant impact on supply chain sustainability through the collaboration of activities with suppliers.

8.1.5 Mediation of patient satisfaction on the SCI-supply chain sustainability relationship

For the main mediation effect (Table 8.8) using the *bootstrapping technique (bias-corrected bootstrapping with 2,000 resamples) technique*, patient satisfaction fully mediates the relationship between customer integration and environmental performance (direct effect β = -0.051, ns; indirect effect β = 0.083 p < 0.1, 95%CI= 0.008 – 0.116), customer integration and social performance (direct effect β = 0.049, ns; indirect effect β = 0.066 p < 0.05, 95%CI= 0.007 – 0.099), customer integration and financial performance (direct effect β = 0.055, ns; indirect effect β = 0.069 p < 0.1, 95%CI= 0.006 – 0.084), but partially mediates the customer integration and operational performance relationship (direct effect β = 0.251, p < 0.01; indirect effect β = 0.058 p < 0.05, 95%CI= 0.007 – 0.090).

Patient satisfaction partially mediates the relationship between internal integration and environmental performance (direct effect β = 0.264, p < 0.05; indirect effect β = 0.090 p < 0.05, 95%CI= 0.012 – 0.113), internal integration and social performance (direct effect β = 0.320, p < 0.01; indirect effect β = 0.072 p < 0.05, 95%CI= 0.012 – 0.092), internal integration and financial performance (direct effect β = 0.217, p < 0.01; indirect effect β = 0.074 p < 0.05, 95%CI= 0.007 – 0.083), and internal integration and operational performance (direct effect β = 0.179, p < 0.05; indirect effect β = 0.063 p < 0.05, 95%CI= 0.010 – 0.087).

Table 8.7: **Moderation effect of low and high product innovation on the SCI-supply chain sustainability relationship.**

Path Name	Low product innovation Beta	High product innovation Beta	Difference in Betas	Analysis
SI → Operational performance	0.797***	0.347**	0.450**	The positive relationship between OPERA and SI is stronger for Low product innovation.
SI → Financial performance	-0.218	0.127	-0.345	There is no difference
SI → Social performance	0.564*	0.065	0.499	The positive relationship between ENVIRONM and SI is only significant for Low product innovation.
SI → Environmental performance	0.514†	0.268*	0.247	There is no difference.
II → Operational performance	0.370**	0.193†	0.177	There is no difference.
II → Financial performance	-0.100	0.217†	-0.317	The positive relationship between ENVIRONM and II is only significant for High product innovation.
II → Social performance	0.178	0.365**	-0.187	The positive relationship between OPERA and CI is only significant for High product innovation.
II → Environmental performance	0.056	0.261*	-0.205	The positive relationship between FINA and CI is only significant for High product innovation.
CI→ Environmental performance	0.071	0.237†	-0.166	The positive relationship between ENVIRONM and CI is only significant for High product innovation.
CI → Social performance	-0.025	0.401***	-0.426**	The positive relationship between SOCIA and CI is stronger for High product innovation.

Significance Indicators: † $p < 0.100$ * $p < 0.050$ ** $p < 0.010$ *** $p < 0.001$

Table 8.8: **Mediation of patient satisfaction on the SCI-Supply chain sustainability relationship.**

Parameters	Direct Effect	Indirect Effect	Lower	Upper	Results
CI→Patient satisfaction→Environmental performance	-0.051	0.083†	0.008	0.116	**Full**
CI→Patient satisfaction→Social performance	0.049	0.066*	0.007	0.099	**Full**
CI→Patient satisfaction→Financial performance	0.055	0.069†	0.006	0.084	**Full**
CI→Patient satisfaction→Operational performance	0.251**	0.058*	0.007	0.090	**Partial**
II→Patient satisfaction→Environmental performance	0.264*	0.090*	0.012	0.113	**Partial**
II→Patient satisfaction→Social performance	0.320**	0.072*	0.012	0.092	**Partial**
II→Patient satisfaction→Financial performance	0.217**	0.074*	0.007	0.083	**Partial**
II→Patient satisfaction→Operational performance	0.179*	0.063*	0.010	0.087	**Partial**
SI→Patient satisfaction→Environmental performance	0.205*	0.011	-0.044	0.058	None
SI→Patient satisfaction→Social performance	0.195**	0.009	-0.036	0.048	None
SI→Patient satisfaction→Financial performance	0.232**	0.009	-0.032	0.044	None
SI→Patient satisfaction→Operational performance	0.286**	0.008	-0.034	0.045	None

Significance Indicators: † $p < 0.100$ * $p < 0.050$ ** $p < 0.010$ *** $p < 0.001$

Holistically, the results indicate that when pharmaceutical companies focus on meeting the expected product needs and after-sale services of their patients, this influences the pharmaceutical companies to strengthen their collaboration of activities and processes with customers and among internal functions. This helps to satisfy the patients by meeting their expected needs, which further improves the supply chain sustainability performance of the supply chain players. Interestingly, it was noted that integrating activities and processes with customers does not improve the financial gains of the supply chain players. Neither does this improve upon the ethical and environmentally friendly processes that the supply chain players engage in. However, the aforementioned performances can only be achieved (through customers) when the pharmaceutical companies focus on meeting the expected needs of the patients through offered products and after-sale services.

8.2 Comparison of the UK and Ghana data

8.2.1 Direct impact of SCI on supply chain sustainability

Hierarchical regression was used to analyse the direct effect of SCI on supply chain sustainability for both Ghana and the UK data (Table 8.9). In contrast to SEM, the hierarchical regression enables this thesis to model how internal integration as a single dimension and as a collective unit with external (supplier and customer) integration impacts supply chain sustainability. This effect also enables the thesis to identify the predictive power of SCI on supply chain sustainability when SCI is considered as a unidimensional construct or multidimensional construct. Besides, hierarchical regression enables this thesis to model how the impact of internal integration on supply chain sustainability changes when external integration is introduced.

8.2.1.1 Ghana

For the main direct effect (Table 8.9), internal integration has a significant positive effect on operational performance ($\beta = 0.490$, $p < 0.001$). Adding supplier and customer integration to the model resulted in a significant R^2 change, showing an increase in the model predictive power. Supplier integration ($\beta = 0.159$, $p < 0.05$) and customer integration ($\beta = 0.183$, $p < 0.05$) have a positive effect on operational performance. This shows that both the internal and external integration dimensions when considered as a collective unit have a greater impact on improving operational performance.

Internal integration has a positive effect on financial performance ($\beta = 0.317$, $p < 0.001$). Adding supplier and customer integration yielded a significant change in the model predictive power. Only supplier integration has a significant positive effect on financial performance ($\beta = 0.114$, $p < 0.1$). The results indicate that both the internal and external integration dimensions must be considered, to have a greater impact on financial performance. However, less focus must be placed on collaboration with customers, as this has no significant effect on directly improving financial performance. This could mean that in the context of Ghana, customers may play less role in the development, processing, and delivery of pharmaceutical products.

Internal integration has a positive effect on environmental performance ($\beta = 0.383$, $p < 0.001$). The introduction of supplier and customer integration yielded no significant change in the model predictive power whilst both supplier and customer integration have no significant effect on environmental performance. The results show that for pharmaceutical companies to engage in more environmentally friendly processes and products, the main focus or concentration should be on the activities of the internal functions. Thus, the operational activities of the various internal functions represent the majority of the processes that the pharmaceutical supply chain engages in to produce or deliver a specific product to end consumers. Hence, maintaining a strong collaboration among the internal functions will go a long way to ensure that all functional activities adhere to laid down environmentally friendly procedures as these functional activities largely impact the overall environmental performance of the pharmaceutical supply chains.

Internal integration has a positive effect on social performance ($\beta = 0.425$, $p < 0.001$). However, the introduction of supplier and customer integration yielded no significant change in the model predictive power. Only supplier integration has a significant positive effect on social performance ($\beta = 0.144$, $p < 0.05$). Similarly, the results indicate that for pharmaceutical companies to engage in more ethical processes and products, the main focus should be on the operational activities of the internal functions. However, the results interestingly show that focus should also be placed on the activities of suppliers. This could mean that even though the actions of suppliers may have an impact on the social outcome of supply chain activities, this impact does not cause any drastic/significant change in improving ethical processes and products across the entire supply chain.

The results generally show that in the context of Ghana, maintaining collaboration of activities and processes among internal functions plays a more key role in improving supply chain sustainability even when the pharmaceutical companies extend their collaborations to include suppliers and customers (external integration). Thus, internal integration remains the most vital dimension to mainly focus on even after operationalising supplier and customer integration.

8.2.1.2 UK

For the main direct effect (Table 8.9), internal integration has a significant positive effect on operational performance ($\beta = 0.510$, $p < 0.001$). Adding supplier and customer integration to the model resulted in a significant R^2 change. However, the effect of internal integration on operational performance changed to be insignificant ($\beta = 0.072$, ns) after adding supplier and customer integration to the model. Supplier integration ($\beta = 0.333$, $p < 0.001$) and customer integration ($\beta = 0.307$, $p < 0.001$) have a positive effect on operational performance.

Internal integration has a positive effect on financial performance ($\beta = 0.316$, $p < 0.001$). The predictive power of the model increased significantly after adding supplier and customer integration. After adding supplier and customer integration to the model, the effect of internal integration on financial performance changed to be insignificant ($\beta = 0.025$, ns). However, supplier integration ($\beta = 0.208$, $p < 0.05$) and customer integration ($\beta = 0.217$, $p < 0.05$) have a positive effect on financial performance.

Internal integration has a positive effect on environmental performance ($\beta = 0.339$, $p < 0.001$). The introduction of supplier and customer integration yielded a significant change in the model predictive power whilst both supplier ($\beta = 0.277$, $p < 0.05$) and customer ($\beta = 0.187$, $p < 0.1$) integration have a significant effect on environmental performance. However, the effect of the internal integration on environmental performance changed to be insignificant after adding supplier and customer integration to the model.

Internal integration has a positive effect on social performance ($\beta = 0.453$, $p < 0.001$). The introduction of supplier and customer integration yielded a significant change in the model predictive power. Supplier integration ($\beta = 0.191$, $p < 0.1$) and customer integration ($\beta = 0.186$, $p < 0.1$) have a significant positive effect on social performance.

The results generally show that in the context of the UK, maintaining collaboration of activities and processes among internal functions has no direct improvement on supply chain sustainability when the pharmaceutical companies begin to integrate their activities with suppliers and customers. That is, the internal integration dimension and the external (supplier and customer) integration dimension are mutually exclusive. This could mean that internal integration only serves as the foundation on which the external integration dimensions thrive. Hence, to achieve supply chain sustainability, the pharmaceutical companies may need to strengthen the collaboration among their internal functions before moving on to integrate with suppliers and customers.

8.2.2 Moderation effect of external uncertainty, product innovation, resource constraint, and leadership style on the SCI-supply chain sustainability performance relationship

For the main interaction effect (Table 8.10), for the Ghana companies, EU positively moderates the relationship between supplier integration and financial performance (β = 0.182, $p < 0.1$). For the UK companies, EU negatively moderate the relationship between supplier integration and environmental performance (β = -0.394, $p < 0.1$), but positive between customer integration and operational performance (β = 0.332, $p < 0.1$), and environmental performance (β = 0.448, $p < 0.05$). The results show that the uncertainty exposed to the Ghana companies from their environment influences them to strengthen their collaboration with suppliers to improve the players' financial performance. Whilst in the UK context, the unpredictability of events exposed to the companies from their environment influences them to integrate with customers, which leads to improvement in operational and environmental performance. However, in the same UK context, the unpredictability of events creates complexities for the companies to collaborate with suppliers to improve supply chain environmental performance.

For the Ghana companies, *product innovation* does not moderate any of the relationships between the dimensions of SCI and supply chain sustainability. Same for the UK companies except for the relationship between customer integration and social performance ($\beta = 0.368$, $p < 0.1$). This indicates that in the context of Ghana, the level or rate at which the pharmaceutical companies engage in new processes or introduces new products to the market does not influence their collaboration among internal functions and with supply chain players to achieve supply chain sustainability. However, in the context of the UK, the level

***Table 8.9*: Direct impact of supply chain integration on supply chain sustainability (Hierarchical results for Ghana and the UK)**

GHANA		**Economic**						**Environmental**			**Social**	
		Operational			**Financial**							
Predictors	**Step 1**	**Step 2**	**Step 3**	**Step 1**	**Step 2**	**Step 3**	**Step 1**	**Step 2**	**Step 3**	**Step 1**	**Step 2**	**Step 3**
Control variables												
Company type	-.010	.017	.044	-.012	.005	.009	.039	.061†	.063†	-.003	.019	.029
Annual turnover	.922***	.211	.037	.829***	.369**	.347*	.410*	-.144	-.154	.819***	.203	.152
Main terms												
II		.490***	.268***		.317***	.271***		.383***	.352***		.425***	.342***
SI			.159*			.114†			.107			.144*
CI			.183*			-.041			-.059			-.015
R^2	.122	.534	.589	.168	.459	.470	.032	.352	.360	.117	.497	.512
R^2 change		.412	.055		.291	.012		.320	.008		.380	.015
F	9.664***	52.712***	38.967***	14.021***	38.964***	24.164***	2.285†	24.995***	15.295***	9.207***	45.469***	28.581***
F change		121.984***	9.085***		74.101***	1.522		68.088***	.874		104.307***	2.131
UK		**Economic**						**Environmental**			**Social**	
		Operational			**Financial**							
Predictors	**Step 1**	**Step 2**	**Step 3**	**Step 1**	**Step 2**	**Step 3**	**Step 1**	**Step 2**	**Step 3**	**Step 1**	**Step 2**	**Step 3**
Control variables												
Company type	.048	.113*	.064	.005	.044	.009	-.015	.028†	.000	.026	.084	.054
Annual turnover	.367	-.231	-.302	.254	-.117	-.175	.302	-.094	-.116	.481	-.050	-.097
Main terms												
II		.510***	.072		.316***	.025		.339***	.021		.453***	.195
SI			.333***			.208*			.277*			.191†
CI			.307***			.217*			.187†			.186†
R^2	.011	.360	.522	.013	.237	.357	.019	.186	.281	.023	.307	.365
R^2 change		.349	.162		.224	.120		.168	.095		.284	.058
F	.494	15.941***	18.159***	.553	8.797***	9.221***	.813	6.485***	6.487***	1.011	12.571***	9.558***
F change		46.314***	14.110***		24.975***	7.759***		17.517***	5.467***		34.892***	3.798*

Table 8.10: **Moderation effect of EU, product innovation, leadership style, and resource (results for Ghana and the UK)**

Predictors	Economic				Environmental		Social	
	Operational		Financial					
	UK	**Ghana**	**UK**	**GHANA**	**UK**	**GHANA**	**UK**	**GHANA**
Control variables								
Company type	-0.028 (-0.113 0.057)	0.041 (-0.011 0.092)	-0.035 (-0.127 0.057)	-0.002 (-0.051 0.046)	-0.071 (-0.165 0.022)	0.047 (-0.013 0.107)	-0.046 (-0.139 0.048)	0.021 (-0.035 0.077)
Annual turnover	-0.507* (-0.966 -0.048)	-0.084 (-0.356 0.188)	-0.253 (-0.750 0.244)	0.227+ (-0.026 0.481)	-0.551* (-1.055 -0.048)	-0.257 (-0.571 0.058)	-0.482+ (-0.987 0.023)	0.056 (-0.238 0.349)
Main terms								
Supplier integration (SI)	0.408*** (0.224 0.591)	0.113+ (-0.011 0.237)	-0.031 (-0.230 0.168)	0.023 (-0.093 0.138)	0.018 (-0.184 0.219)	0.043 (-0.100 0.186)	-0.048 (-0.250 0.154)	0.066 (-0.068 0.199)
Internal integration (II)	-0.143 (-0.359 0.074)	0.037 (-0.082 0.157)	0.119 (-0.116 0.354)	0.132* (0.020 0.243)	0.074 (-0.163 0.312)	0.177* (0.039 0.316)	0.183 (-0.056 0.421)	0.196** (0.067 0.325)
Customer integration (CI)	-0.050 (-0.232 0.131)	0.145* (0.018 0.273)	0.272** (0.076 0.469)	0.002 (-0.117 0.121)	0.009 (-0.190 0.208)	-0.044 (-0.191 0.103)	0.032 (-0.167 0.232)	0.017 (-0.121 0.154)
Moderators								
External uncertainty (EU)	0.368** (0.136 0.601)	-0.006 (-0.132 0.119)	-0.092 (-0.344 0.160)	-0.052 (-0.169 0.065)	0.082 (-0.174 0.337)	-0.044 (-0.190 0.101)	0.001 (-0.254 0.257)	-0.081 (-0.217 0.055)
Product innovation	0.468*** (0.258 0.679)	0.334*** (0.209 0.460)	0.220+ (-0.008 0.448)	-0.044 (-0.161 0.073)	0.178 (-0.053 0.408)	0.112 (-0.033 0.257)	0.483*** (0.251 0.714)	0.169* (0.033 0.304)
Leadership style	0.179** (0.051 0.307)	0.064 (-0.023 0.151)	-0.179* (-0.318 -0.040)	-0.058 (-0.139 0.023)	-0.017 (-0.158 0.123)	-0.067 (-0.168 0.033)	-0.086 (-0.226 0.055)	-0.115* (-0.209 -0.021)
Resource	0.110	.249**	0.099	0.498***	0.409***	0.443***	0.061	0.283***

	(-0.088 0.309)	(0.106 0.393)	(-0.116 0.314)	(0.364 0.631)	(0.192 0.627)	(0.277 0.608)	(-0.157 0.279)	(0.129 0.438)
Two-way interaction								
EU x II	-0.367 (-0.812 0.079)	0.159 (-0.045 0.363)	0.379 (-0.104 0.862)	-0.067 (-0.257 0.123)	0.062 (-0.427 0.550)	-0.063 (-0.299 0.172)	0.124 (-0.366 0.614)	0.050 (-0.170 0.269)
EU x SI	-0.142 (-0.531 0.247)	-0.068 (-0.286 0.149)	0.232 (-0.189 0.654)	0.182+ (-0.021 0.384)	-0.394+ (-0.821 0.033)	-0.113 (-0.364 0.138)	0.054 (-0.374 0.481)	-0.101 (-0.336 0.133)
EU x CI	0.332+ (-0.020 0.683)	-0.061 (-0.264 0.141)	-0.149 (-0.529 0.232)	-0.045 (-0.234 0.144)	0.448* (0.062 0.833)	0.099 (-0.135 0.333)	0.304 (-0.082 0.691)	0.076 (-0.142 0.295)
Product x II	0.261 (-0.098 0.621)	-0.128 (-0.381 0.126)	0.156 (-0.234 0.545)	-0.033 (-0.269 0.203)	0.063 (-0.332 0.458)	-0.059 (-0.351 0.234)	-0.233 (-0.629 0.162)	-0.129 (-0.402 0.144)
Product x CI	-0.101 (-0.476 0.273)	0.049 (-0.196 0.294)	0.013 (-0.393 0.418)	0.037 (-0.192 0.266)	-0.136 (-0.547 0.275)	0.185 (-0.098 0.468)	0.368+ (-0.044 0.780)	0.121 (-0.143 0.385)
Product x SI	-0.048 (-0.475 0.378)	-0.046 (-0.310 0.218)	0.133 (-0.329 0.596)	-0.019 (-0.266 0.227)	0.278 (-0.190 0.746)	-0.083 (-0.388 0.222)	0.192 (-0.277 0.661)	0.013 (-0.272 0.298)
Leadership style x SI	-0.147 (-0.407 0.112)	-0.044 (-0.230 0.142)	-0.061 (-0.342 0.220)	0.164+ (-0.009 0.338)	-0.192 (-0.477 0.092)	0.018 (-0.197 0.232)	-0.209 (-0.494 0.076)	0.039 (-0.161 0.240)
Leadership style x II	0.056 (-0.263 0.375)	0.100 (-0.118 0.319)	0.160 (-0.185 0.505)	0.149 (-0.055 0.353)	0.606** (0.256 0.955)	0.348** (0.095 0.600)	0.738*** (0.387 1.088)	0.407** (0.171 0.643)
Leadership style x CI	-0.034 (-0.292 0.225)	-0.105 (-0.327 0.116)	0.139 (-0.141 0.419)	-0.199+ (-0.405 0.007)	-0.074 (-0.357 0.209)	-0.083 (-0.339 0.172)	-0.136 (-0.420 0.148)	-0.113 (-0.352 0.125)
Resource x CI	-0.246+ (-0.517 0.025)	-0.097 (-0.354 0.160)	0.015 (-0.278 0.308)	0.106 (-0.134 0.345)	-0.010 (-0.307 0.286)	-0.011 (-0.308 0.285)	-0.269+ (-0.567 0.028)	-0.005 (-0.282 0.272)
Resource x II	-0.304+	-0.313*	-0.055	-0.090	-0.200	-0.170	-0.249	-0.224+

	(-0.617 0.008)	(-0.554 -0.072)	(-0.393 0.283)	(-0.314 0.135)	(-0.543 0.143)	(-0.448 0.108)	(-0.592 0.095)	(-0.483 0.036)
Resource x SI	0.286+ (-0.050 0.623)	0.259+ (-0.002 0.520)	-0.198 (-0.562 0.167)	0.004 (-0.239 0.247)	-0.160 (-0.529 0.209)	0.087 (-0.214 0.388)	0.021 (-0.348 0.391)	0.130 (-0.151 0.411)
R^2	.808	.803	.620	.711	.747	.665	.760	.718
F	13.382***	23.278***	5.213***	14.071***	9.438***	11.347***	10.088***	14.579***
RMSE	.638	.559	.692	.522	.701	.646	.702	.603

Note: Standardised estimates (95% CI) Significance Indicators: † p < 0.100 * p < 0.050 ** p < 0.010 *** p < 0.001

or the rate at which the pharmaceutical companies introduce new products to the market creates a strong need to collaborate with customers to meet the new demands of customers and impact supply chain sustainability. This may also mean that in the context of the UK, patients play a key role in the development and delivery of pharmaceutical products compared to the Ghana context.

For the Ghana companies, *leadership style* positively moderates the relationship between supplier integration and financial ($\beta = 0.164$, $p < 0.1$) performance. In the same Ghana context, *Leadership style* positively moderates the relationship between internal integration and environmental ($\beta = 0.348$, $p < 0.01$) and social ($\beta = 0.407$, $p < 0.01$) performance, but negatively moderates the relationship between customer integration and financial ($\beta = -0.199$, $p < 0.1$) performance. For the UK companies (similar to the Ghana companies), Leadership style was also identified to positively moderate the relationship between internal integration and environmental ($\beta = 0.606$, $p < 0.01$) and social ($\beta = 0.738$, $p < 0.01$) performance. These results indicate that the leadership style that the pharmaceutical companies in Ghana and the UK adopt influences the level to which they collaborate activities and processes among their internal functions which improve environmental and social performance. However, in the context of Ghana, the leadership style adopted by the pharmaceutical companies further influences the extent to which the pharmaceutical companies collaborate their activities and processes with suppliers which improves the financial performance of the players.

For the Ghana companies, *resource* negatively moderates the relationship between internal integration and operational ($\beta = -0.313$, $p < 0.05$), and social ($\beta = -0.224$, $p < 0.1$) performance, but positively on supplier integration and operational ($\beta = 0.259$, $p < 0.1$) performance. For the UK companies, resource positively moderates the relationship between supplier integration and operational ($\beta = 0.286$, $p < 0.1$) performance, but negatively moderates the relationship between customer integration and operational ($\beta = -0.246$, $p < 0.1$), and social ($\beta = -0.269$, $p < 0.1$) performance, and internal integration and operational ($\beta = -0.304$, $p < 0.1$) performance. The results may indicate that the amount of resources accessible to the companies is inadequate. Hence, hindering a proper operationalisation of internal integration to improve operational performance (both the UK and Ghana companies), and social performance (Ghana companies only). Moreover, in the UK context only, the issue of limited resources is also affecting the extent to which the companies can

integrate their processes and activities with customers to improve the operational and social performance of the supply chain players. Although the resources may be inadequate for internal integration and customer integration, the resources are known to be adequate for both the UK and Ghana pharmaceutical companies to engage in collaborative activities and processes with supplies, which improves operational performance.

8.2.3 Mediation of patient satisfaction on the SCI-supply chain sustainability performance relationship

For the main mediation effect (Table 8.11) using the *bootstrapping technique (bias-corrected with 2,000 resamples),* for the UK companies, patient satisfaction fully mediates the relationship between customer integration and environmental performance (direct effect $\beta = 0.081$, ns; indirect effect $\beta = 0.199$ $p < 0.01$, 95%CI= 0.073 – 0.259), customer integration and social performance (direct effect $\beta = 0.082$, ns; indirect effect $\beta = 0.191$ $p < 0.001$, 95%CI= 0.071 – 0.273), but partially mediates the relationship between customer integration and financial performance (direct effect $\beta = 0.30$, $p < 0.1$; indirect effect $\beta = 0.142$ $p < 0.01$, 95%CI= 0.041 – 0.177), and customer integration and operational performance (direct effect $\beta = 0.232$, $p < 0.05$; indirect effect $\beta = 0.183$ $p < 0.001$, 95%CI= 0.074 – 0.254). The results indicate that when the pharmaceutical companies in the UK focus on meeting the expected needs of their patients through offered products and services rendered after sales, the needs of the patients are met which further leads to improving supply chain sustainability. Interestingly, the results show that the aforementioned argument is the only way to improve the ethical and environmentally friendly processes and products of the pharmaceutical companies when customer integration is considered. Thus, there is no direct impact of customer integration on environmental and social performance but only through patient satisfaction.

For the Ghana companies, patient satisfaction partially mediates the relationship between internal integration and environmental performance (direct effect $\beta = 0.341$, $p < 0.01$; indirect effect $\beta = 0.229$ $p < 0.001$, 95%CI= 0.076 – 0.225), internal integration and social performance (direct effect $\beta = 0.388$, $p < 0.001$; indirect effect $\beta = 0.153$ $p < 0.001$, 95%CI= 0.048 – 0.162), internal integration and financial performance (direct effect $\beta = 0.297$, $p < 0.05$; indirect effect $\beta = 0.204$ $p < 0.001$, 95%CI= 0.061 – 0.178), and internal integration and operational performance (direct effect $\beta = 0.260$, $p < 0.05$; indirect effect $\beta = 0.124$ $p < 0.001$, 95%CI= 0.043 – 0.153). The results indicate that when the pharmaceutical companies

in Ghana focus on meeting the expected product needs and after-sale services of their patients, this influences the pharmaceutical companies to strengthen the collaboration of activities and processes among their internal functions. This does not only lead to meeting the expected needs of patients but also improves the supply chain sustainability performance of the supply chain players. Interestingly, the results show that despite focusing on the needs and expectations of patients to improve supply chain sustainability, the companies in Ghana can impact supply chain sustainability directly by engaging in collaborative activities among internal functions.

8.3 Summary of tested hypotheses

In Table 8.12, all the tests for the suggested hypotheses are summarised and presented. Figure 8.1 and Table 8.13 also presents all the tested hypotheses in a diagrammatic form. The additionally identified interesting findings (beyond the suggested hypotheses) are further discussed in the discussion chapter (chapter 9).

8.4 Conclusion

In this chapter, survey data from 231 leading pharmaceutical companies in Ghana and the UK, were collected to enable statistically test the newly developed conceptual framework (chapter 6, Figure 6.1) which aims to provide insight into the impact of SCI on supply chain sustainability. Structural equation modelling, multi-group analysis, hierarchical regression, and multivariate analysis were performed to test all the stated hypotheses whilst comparing the collected survey data between the UK and Ghana pharmaceutical companies. From the statistical results, the majority of the suggested hypotheses were accepted (Table 8.12). In the next chapter, which is chapter 9 the findings for the tested hypotheses are thoroughly discussed.

Table 8.11: **Mediation of patient satisfaction on the SCI-supply chain sustainability relationship**

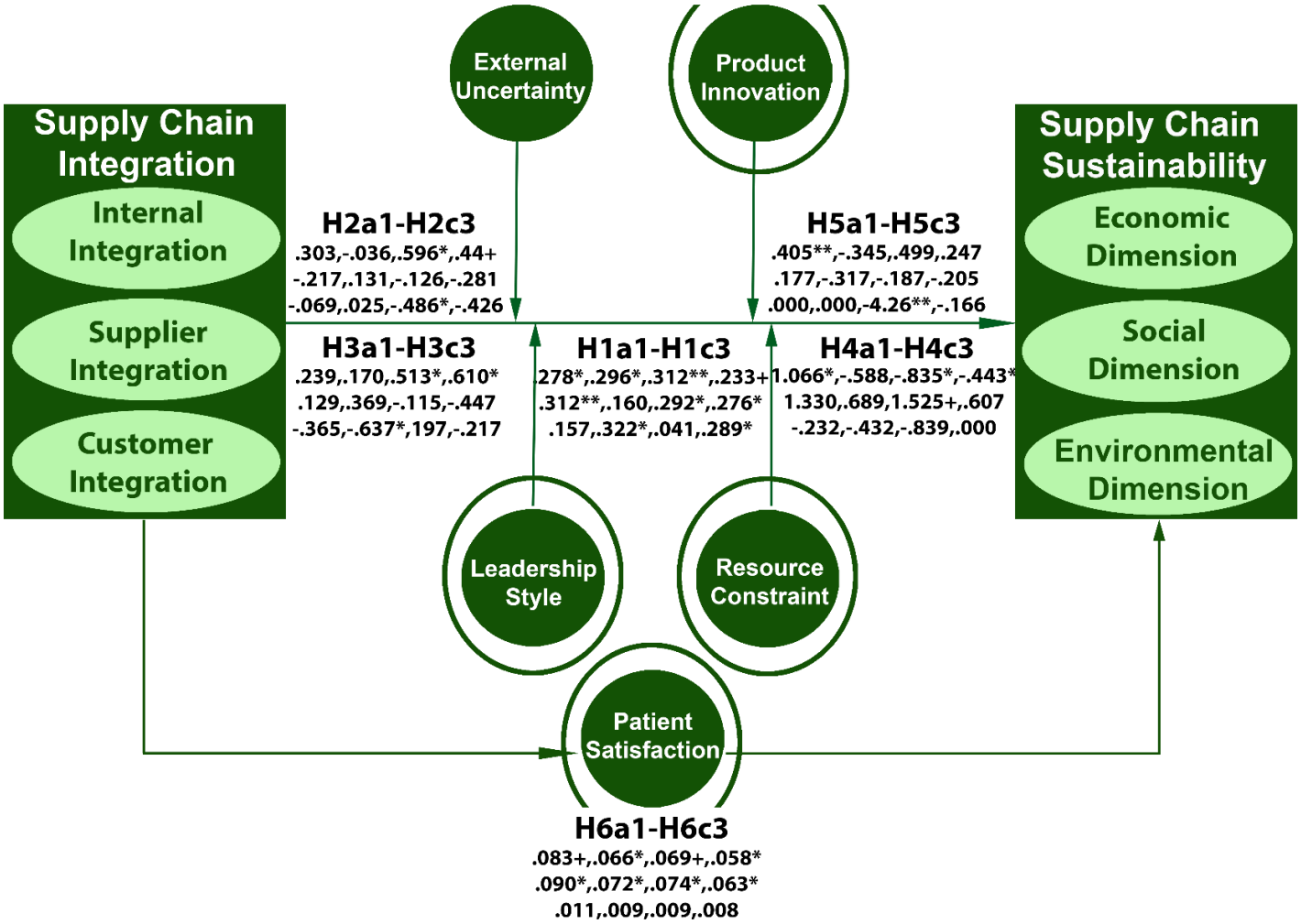
Parameters	UK					GHANA				
	Direct effect	**Indirect effect**	**Lower**	**Upper**	**Results**	**Direct effect**	**Indirect effect**	**Lower**	**Upper**	**Results**
CI → Patient Satisfaction → Environmental	0.081	0.199**	0.073	0.259	**Full**	-0.072	-0.031	-0.094	0.050	None
CI → Patient Satisfaction → Social	0.082	0.191***	0.071	0.273	**Full**	-0.010	-0.021	-0.067	0.034	None
CI → Patient Satisfaction → Financial	0.230†	0.142**	0.041	0.177	**Partial**	-0.056	-0.028	-0.074	0.037	None
CI → Patient Satisfaction → Operational	0.232*	0.183***	0.074	0.254	**Partial**	0.258**	-0.017	-0.067	0.025	None
II → Patient Satisfaction → Environmental	0.048	-0.082	-0.149	0.009	None	0.341**	0.229***	0.076	0.225	**Partial**
II → Patient Satisfaction → Social	0.208†	-0.079	-0.162	0.010	None	0.388***	0.153***	0.048	0.162	**Partial**
II → Patient Satisfaction → Financial	0.056	-0.058	-0.103	0.003	None	0.297*	0.204***	0.061	0.178	**Partial**
II → Patient Satisfaction → Operational	0.113	-0.075	-0.147	0.009	None	0.260*	0.124***	0.043	0.153	**Partial**
SI → Patient Satisfaction → Environmental	0.262†	0.072	0.000	0.143	None	0.159	-0.008	-0.086	0.075	None
SI → Patient Satisfaction → Social	0.154	0.069	-0.002	0.143	None	0.208*	-0.005	-0.060	0.049	None
SI → Patient Satisfaction → Financial	0.264*	0.051	0.000	0.106	None	0.192†	-0.007	-0.066	0.057	None
SI → Patient Satisfaction → Operational	0.327**	0.066	-0.003	0.136	None	0.208*	-0.004	-0.050	0.045	None

Significance Indicators: † $p < 0.100$ * $p < 0.050$ ** $p < 0.010$ *** $p < 0.001$

***Table 8.12*: Summary of all tested hypothesis**

Hypotheses	Hypothesis test
RQ1: What is the impact of supply chain integration on supply chain sustainability?	
H1a1: Internal integration will positively impact the economic performance of members within the supply chain.	Accepted
H1a2: Customer integration will positively impact the economic performance of members within the supply chain.	Accepted
H1a3: Supplier integration will positively impact the economic performance of members within the supply chain.	Partial
H1b1: Internal integration will positively impact the social performance of members within the supply chain.	Accepted
H1b2: Customer integration will positively impact the social performance of members within the supply chain.	Accepted
H1b3: Supplier integration will positively impact the social performance of members within the supply chain.	Rejected
H1c1: Internal integration will positively impact the environmental performance of members within the supply chain.	Accepted
H1c2: Customer integration will positively impact the environmental performance of members within the supply chain.	Rejected
H1c3: Supplier integration will positively impact the environmental performance of members within the supply chain.	Accepted
RQ2: What is the moderating effect of external uncertainty, leadership style, resource constraint, and product innovation on the impact of supply chain integration on supply chain sustainability?	
H2a: The relationship between customer integration and (1) economic (2) social (3) environmental performance will be significant and stronger for high EU.	1. Partial 2.Accepted 3. Accepted
H2b: The relationship between supplier integration and (1) economic (2) social (3) environmental performance will be significant and stronger for low uncertainty.	1. Partial 2.Rejected 3. Partial
H2c: The relationship between internal integration and (1) economic will be significant and stronger for high EU, but not for (2) social (3) environmental performance.	1. Partial 2. Accepted 3. Rejected
H3a: The relationship between supplier integration and (1) economic (3) environmental performance will be significant and stronger for autocratic leadership style, but not for (2) social performance.	1. Partial 2.Accepted 3. Accepted

H3b: The relationship between internal integration and (1) economic (3) environmental performance will be significant and stronger for autocratic leadership style, but not for (2) social performance.	1. Partial 2. Partial 3. Rejected
H3c: The relationship between customer integration and (1) economic (2) social (3) environmental performance will be significant and stronger for non-autocratic leadership style.	1. Partial 2. Partial 3. Rejected
H4a: The relationship between supplier integration and (1) economic (2) social (3) environmental performance will be significant and stronger for resource availability.	1. Partial 2.Rejected 3. Rejected
H4b: The relationship between internal integration and (1) economic (2) social (3) environmental performance will be significant and stronger for resource availability.	1. Partial 2. Rejected 3. Rejected
H4c: The relationship between customer integration and (1) economic (2) social (3) environmental performance will be significant and stronger for resource availability.	1. Partial 2. Partial 3. Rejected
H5a: The relationship between supplier integration and (1) economic (2) social (3) environmental performance will be significant and stronger for high product innovation.	All rejected
H5b: The relationship between internal integration and (1) economic (2) social (3) environmental performance will be significant and stronger for high product innovation.	1. Rejected 2. Partial 3. Partial
H5c: The relationship between customer integration and (1) economic (2) social (3) environmental performance will be significant and stronger for high product innovation.	1. Rejected 2. Accepted 3. Partial
RQ3: What is the mediating effect of patient satisfaction on the impact of supply chain integration on supply chain sustainability?	
H6a: Patient satisfaction will mediate the relationship between customer integration and (1) environmental (2) social (3) economic performance.	All accepted
H6b: Patient satisfaction will mediate the relationship between internal integration and (1) environmental (2) social (3) economic performance.	All accepted
H6c: Patient satisfaction will mediate the relationship between supplier integration and (1) environmental (2) social (3) economic performance.	All rejected



Significance Indicators: † p < 0.100 * p < 0.050 ** p < 0.010 *** p < 0.001

Figure 8.1: **Tested conceptual framework**

Table 8.13: **Reading format for the tested hypotheses in Figure 8.1**

H1a1 – H1c3	**H2a1 – H2c3**	**H3a1 – H3c3**	**H4a1 – H4c3**	**H5a1 – H5c3**	**H6a1 – H6c3**
H1a1: II→OPER	H2a1: CI→OPER	H3a1:SI→OPER	H4a1: SI→OPER	H5a1: SI→OPER	H6a1: CI→ PA_SAT→ENV__PERF
H1a1: II→FIN	H2a1: CI→FIN	H3a1: SI→FIN	H4a1: SI→FIN	H5a1: SI→FIN	H6a2: CI→ PA_SAT→ SOC_PERF
H1a2: CI→OPER	H2a2: CI→SOC	H3a2: SI→SOC	H4a2: SI→SOC	H5a2: SI→SOC	H6a3: CI→ PA_SAT→ FIN_PERF
H1a2: CI→FIN	H2a3: CI→ENV	H3a3: SI→ENV	H4a3: SI→ENV	H5a3: SI→ENV	H6a3: CI→ PA_SAT→ OPER_PERF
H1a3: SI→OPER	H2b1: SI→OPER	H3b1: II→OPER	H4b1: II→OPER	H5b1: II→OPER	H6b1: II→ PA_SAT→ ENV__PERF
H1a3: SI→FIN	H2b1: SI→FIN	H3b1: II→FIN	H4b1: II→FIN	H5b1: II→FIN	H6b2: II→ PA_SAT→ SOC_PERF
H1b1: II→SOC	H2b2: SI→SOC	H3b2: II→SOC	H4b2: II→SOC	H5b2: II→SOC	H6b3: II→ PA_SAT→ FIN_PERF
H1b2: CI→ SOC	H2b3: SI→ENV	H3b3: II→ENV	H4b3: II→ENV	H5b3: II→ENV	H6b3: II→ PA_SAT→ OPER_PERF
H1b3: SI→SOC	H2c1: II→OPER	H3c1: CI→ OPER	H4c1: CI→ OPER	H5c1: CI→OPER	H6c1: SI→ PA_SAT→ ENV__PERF
H1c1: II→ENV	H2c1: II→FIN	H3c1: CI→FIN	H4c1: CI→FIN	H5c1: CI→FIN	H6c2: SI→ PA_SAT→ SOC_PERF
H1c2: CI→ ENV	H2c2: II→SOC	H3c3: CI→ENV	H4c2: CI→SOC	H5c3: CI→ENV	H6c3: SI→ PA_SAT→FIN_PERF
H1c3: SI→ENV	H2c3: II→ENV	H3c2: CI→SOC	H4c3: CI→ENV	H5c2: CI→SOC	H6c3: SI→PA_SAT→ OPER_PERF

CHAPTER 9

DISCUSSION OF FINDINGS / RESULTS

9.0 Chapter overview

This chapter discusses the qualitative (chapter 6) and quantitative (chapter 8) results/findings. In this chapter, the major contributions for both empirical studies are argued whilst the findings are compared and contrasted with the existing literature.

This chapter synchronously discusses both the qualitative results and provides a summary of the findings, and that of the quantitative results and a summary of the tested hypotheses. The discussion shows how the results from the qualitative study informed the quantitative study.

9.1 Discussion of results

9.1.1 The simultaneous impact of supply chain integration on supply chain sustainability (RQ1)

This thesis argues that supply chain integration simultaneously impacts the three (social, economic, environmental) dimensions of sustainability performance after the discussion with the pharmaceutical companies and experts. However, in contrast to this thesis, the majority of the studies (Durach and Wiengarten 2020; Flynn et al. 2010; Munir et al. 2020; Wiengarten et al. 2014; Yu et al. 2013; Zhao et al. 2020) that analysed the impact of SCI on performance considered the economic performance only. From the qualitative findings, this thesis further argues that supply chain integration must be operationalised in an effective (achieves perceived output) and efficient (attaining effectiveness with the least possible resource available) way to impact the dimensions of supply chain sustainability. This argument is known to be in support of the SCI literature (Flynn et al. 2010; Pagell and Shevchenko 2014; Zhao et al. 2020). This thesis further argues that although some of the companies have a positive impact on the three dimensions of supply chain sustainability through supply chain integration, none of the sampled companies have a truly sustainable supply chain. Thus, none of the companies has a positive impact on the economic performance with no negative impact on the social and environmental performance (Pagell and Shevchenko 2014). However, in contrast to this study, most researchers that studied the supply chain integration- performance relationship studied the three dimensions of

sustainability in isolation and parts (Ahi and Searcy 2013; Fabbe-Costes et al. 2011; Kleindorfer et al. 2005; Pagell and Wu 2009; Seuring and Müller 2008). Hence, these studies could not establish whether the operationalisation of supply chain integration leads to achieving a truly sustainable supply chain. From the qualitative findings, this thesis further argues that although supply chain integration simultaneously impacts the three dimensions of sustainability, companies mainly focus on their economic performance only. Literature supports this argument by indicating that most companies mainly focus on increasing market shares and profit (Swink et al. 2007; Zhao et al. 2011) but pay less to no attention to how the company's operational activities and generated products affect the environment nor improve the health and safety of the community or people been served.

Additionally from the qualitative findings, this thesis argues that the main issues affecting internal integration in the sampled pharmaceutical companies are, long-duration for sharing inadequate information, and unsynchronized activities among internal departments. These issues negatively impact the company's performance. Literature supports this argument by indicating that companies that share adequate information at the right time positively affects time delivery (Flynn et al. 2010; Sabath 1995; Swink et al. 2007), responsiveness (Droge et al. 2004), and product and process development (Rosenzweig et al. 2003). From the findings, this thesis argues that the aforementioned internal integration issues are more profound among the sampled Ghana companies due to critical funding issues. Thus, purchasing sophisticated technology and equipment for efficient and effective collaboration of strategic/operational activities and the flow of adequate and timely information among internal functions is a critical issue. Externally, it was revealed that companies integrate their activities, share capacity, and information mostly with suppliers on the same level in the supply chain whilst using mainly sales representatives to introduce products and solicit information from customers. This (in support of literature) was known to mainly impact the flexibility and responsiveness of the companies (Fynes and Voss 2002; Narasimhan et al. 2010).

This thesis argues that economically, all the sampled companies face high cost of operations. This is in support of literature (Kanavos and Wouters 2014) as the activities of the pharmaceutical players are known to be highly competitive and costly, whilst most of these companies have little to no access to funds which affects their profit margins. From the qualitative findings, this thesis further argues that the funding issue is more profound among

all the sampled Ghana companies than that of the UK. This may be as a result of Ghana's weak financial system (Aryeetey and Udry 1997) and constrained financial institutions (Osei-Assibey et al. 2012) as compared to that of the UK. Socially, in support of the literature, all the sampled companies are well abreast knowing that an increase in social performance improves economic performance (Welford and Frost 2006) and gives competitive advantage (Zhu et al. 2016). Based on this knowledge, various CSR activities and ethical contributions are funded by both the sampled UK and Ghana companies towards stakeholders in the supply chain. However, from the findings, this thesis further argues that the social contributions are more profound among the sampled Ghana companies towards their employees. This may be related to the critical human resource constraint in the Ghana health sector (Appiah-Denkyira 2013). Environmentally, the key issue identified was the wrongful disposal of products which this thesis argues to be more noticed among the retailers and end consumers in Ghana. This (in support of literature) may be due to the less enforcement of environmental rules and regulations by regulators in Ghana and most developing countries as compared to the UK and other developed countries (Yadav and Smith 2012). From the findings, this thesis argues that most of the identified social and environmental activities being engaged by the sampled companies are mostly done in isolation. Thus, there is less collaboration of social and environmentally related activities with suppliers and customers and other key supply chain stakeholders' to enable optimise these activities.

In further testing from an objective and generalisable perspective (to affirm the stated qualitative results in the previous paragraphs) by using survey data, this thesis further argues that through supply chain integration, all the three *(social, economic, environmental)* dimensions of supply chain sustainability can be positively impacted simultaneously, and not only in isolation/parts (Table 9.1). This argument is in contrast to the literature (Ahi and Searcy 2013; Wu and Pagell 2011) as literature have only demonstrated the direct impact of supply chain integration on either the economic, social, or environmental dimensions, but not the aforementioned three dimensions collectively. Thus, no studies have been undertaken to show the direct and simultaneous impact of supply chain integration on all three *(social, economic, environmental)* dimensions of supply chain sustainability. Although this thesis reveals that all three supply chain integration dimensions collectively impact the three dimensions of supply chain sustainability simultaneously, this is not the case when the impact of the external integration dimensions of supply chain integration are analysed

separately. Thus, supplier integration was identified not to have a significant direct impact on financial (Wiengarten et al. 2019) and social performance, but significant on operational (Wiengarten et al. 2019) and environmental performance. This, in contrast to literature (Cheah et al. 2007; Wolf 2011; Zhu et al. 2016) shows that suppliers may behave badly but may not reflect on the social performance of the supply chain. This may be supported by the fact that suppliers play less role in impacting social activities within the supply chain as social activities or interventions are more tailed towards the downstream of the supply chain. In support of literature, customer integration replaces the supplier integration insignificant findings by showing a significant direct impact on financial (Flynn et al. 2010; Wiengarten et al. 2019) and social performance (Collins et al. 2007). Hence, resulting in having external integration simultaneously impact on all the supply chain sustainability dimensions. The results imply that the effectiveness of suppliers affects operational and environmental performance, but only for suppliers supplying environmentally friendly quality products. However, this does not determine how "well" suppliers are treated socially by the focal firms. In support of literature, sourcing of environmentally friendly quality products may incur a high direct financial cost (Wolf 2011) in the short term but may result in high financial gains for the long term. Similarly, from the findings, this thesis argues that customer integration significantly impacts all the supply chain sustainability dimensions except environmental performance. This may uniquely imply that environmental performance is mainly influenced by the processes adopted by suppliers, and the processes and generated output by firms. Although the results for the external integration-supply chain sustainability relationship are in line with previous literature (Flynn et al. 2010; Wiengarten et al. 2019), all the identified insignificances may imply that there may be additional contextual factors that affect these direct relationships (section 9.1.3 and 9.1.4).

Moreover, this thesis argues that internal integration simultaneously impacts all three dimensions of supply chain sustainability. Thus, in support of literature, internal integration has a positive impact on the social (Han and Huo 2020; Welford and Frost 2006), environmental (Griffith and Bhutto 2008; Han and Huo 2020) and economic (Durach and Wiengarten 2020; Flynn et al. 2010; Munir et al. 2020; Wiengarten et al. 2019; Wong et al. 2011; Zhao et al. 2020) dimensions of supply chain sustainability. Indicating that although external integration is important, internal integration plays a more critical role in achieving truly sustainable supply chains compared to external integration. In support of literature, this may be attributed to the fact that internal integration serves as the foundation (Flynn et al.

2010; Han and Huo 2020) upon which supply chain integration thrives. Thus, a strong internal base will affect all performances as companies may have full control over their internal operations/activities, compared to that of suppliers and customers of which full control may pose as a challenge for the focal companies. This argument may also raise the concern that companies need to effectively and efficiently integrate their internal activities to properly operationalise and reap the full benefit of external integration. This supports the need for companies to ensure that internal functions share sustainability responsibilities purposely to optimally achieve supply chain sustainability (Wolf 2011).

This thesis reveals that all the dimensions of supply chain integration must be collectively considered as (1) in support of literature, the supply chain integration dimensions have different impacts on various performance measures (Flynn et al. 2010; Souder et al. 1998; Wong et al. 2011) (2) supplier and customer integration when considered in isolation do not simultaneously impact all the three dimensions of supply chain sustainability except internal integration. Hence it is important for companies to invest more in internal integration and operationalise supplier and customer integration collectively. This is discussed in detail in chapter 10 section 10.3 (practical implications) (3) in support of literature, the effectiveness and efficiency of external integration thrive on internal integration (Flynn et al. 2010; Han and Huo 2020).

***Table 9.1*: Impact of SCI on SCS**

Structural Paths	***β***	**Hypothesis test**	**Control Variables**	***β***
SI→OPER_PERF	.323**	H1a3: supported	AN_TRN→OPER_PERF	-.038
SI→FIN_PERF	.160	H1a3: not supported	AN_TRN→FIN_PERF	.036
SI→SOC_PERF	.157	H1b3: not supported	AN_TRN→SOC_PERF	.007
SI→ENV__PERF	.289*	H1c3: supported	AN_TRN→ENV__PERF	-.097
II→OPER_PERF	.278*	H1a1: supported	COMP_TYP→OPER_PERF	.167**
II→FIN_PERF	.296*	H1a1: supported	COMP_TYP→FIN_PERF	.094
II→SOC_PERF	.292*	H1b1: supported	COMP_TYP→SOC_PERF	.104†
II→ENV__PERF	.322*	H1c1: supported	COMP_TYP→ENV__PERF	.109
CI→OPER_PERF	.312**	H1a2: supported	**Variance explained (R^2)**	**R^2**
CI→FIN_PERF	.223†	H1a2: supported	OPER_PERF	.640
CI→ SOC_PERF	.276*	H1b2: supported	FIN_PERF	.389
CI→ ENV__PERF	.041	H1c2: not supported	ENV__PERF	.321
			SOC_PERF	.425

X^2=525.486 df=236 X^2/df=2.227 IFI=.935 TLI=.917 CFI=.935 RMSEA=.073 SRMR=.047. *** $p < 0.001$ ** $p < 0.010$ * $p < 0.050$ † $p < 0.100$

From the results, this thesis argues that the UK and Ghana companies also reveal the critical significance of internal integration in achieving a simultaneous impact on the three dimensions of supply chain sustainability (Table 9.2). Thus in both the UK (developed country) and Ghana (developing country) context, internal integration plays a very critical role in achieving supply chain sustainability. The UK results further identify supplier and customer integration as equally critical dimensions to simultaneously impact supply chain sustainability whilst that of Ghana further reveals supplier integration only. This thesis argues that the aforementioned differences in the context of Ghana and the UK may be attributed to a number of reasons. For example in Ghana, it is noted that customers do not play a vital role in product development, production of the final product, and the deliveries of products. Thus, customers have a less decisional influence on the specific products produced by the companies as compared to that of the UK. However, in Ghana, the main focus is on the suppliers who are highly expected to supply the rightfully specified inputs (example raw materials) to customers (mainly manufacturers and wholesalers) in a timely manner. This is very crucial as all AI raw material suppliers for pharmaceutical manufacturers in Ghana are located in far overseas countries, e.g. India. Hence the effectiveness and efficiency of the supplier's activities have a great impact on the local manufacturers and the entire supply chain. On the contrary, this thesis argues that in the UK, customers are more involved in product development and the final product delivery process. Hence, customers play and have a huge influence on the entire supply chain. Interestingly in the context of the UK, it is argued that the impact of external (supplier and customer) and internal integration are mutually exclusive. Thus, internal integration has no significant impact on supply chain sustainability when external integration is introduced. This may uniquely imply that in a developed country context internal integration only serves as the foundation on which the equally important external (supplier and customer) dimensions are effectively and efficiently implemented. However, in the context of Ghana, this thesis argues that internal integration remains a critical dimension after introducing integration with suppliers and customers. Indicating that in both the developing and developed country context, internal integration remains the most critical dimension or strategy in implementing supply chain integration to achieve supply chain sustainability despite the introduction and operationalisation of external integration. All the findings with regards to the impact of supply chain integration on supply chain sustainability among the *UK and Ghana companies* are summarised in Table 9.2.

This thesis argues that focusing on environmental performance leads to an increase in financial performance, operational performance, social performance, and patient satisfaction (Table 9.3). This is in support of literature, as some studies have revealed that focusing on environmental performance leads to better financial performance (Collins et al. 2007; Montabon et al. 2007), operational performance (Hart 1995; Shrivastava 1995), and patient

Table 9.2: **SCI-SCS relationship: Key similarities and differences between the UK and Ghana companies**

Similarities	Differences
• Internal integration positively impacts economic, environmental, and social performance.	• Internal integration loses significance when external integration is introduced. This applies to the UK context only.
• Both supplier and customer integration positively impact operational performance.	• Customer integration does not impact financial, environmental, and social performance. This applies to the Ghana context only.
	• Supplier integration does not impact environmental performance. This applies to the Ghana context only.

satisfaction (Wolf 2011). However, this thesis extends these results by also showing an increase in social performance. The results (Table 9.3) imply that engaging in environmentally friendly quality products and processes influences the quality, cost, and flexibility of the operational activities (Hart 1995) of supply chains. Also, in support of literature when companies engage in reducing their solid and liquid waste, and efficiently utilise energy and make use of more recyclable materials, this does not only improve upon their financial performance (Collins et al. 2007) but also leads to satisfying customers who are especially peculiar in knowing the environmentally friendly conditions in which products are produced (Collins et al. 2007; Wolf 2011). In support of literature, this thesis argues that all the aforementioned results may be influenced by the high pressure from most supply chain stakeholders over the years to help tackle the increasing sustainability issues (Wolf 2011) facing the planet earth. These results mainly contribute to answering one of the most sorted/asked questions in supply chain sustainability literature, *does it pay to be sustainable*? (Pagell and Shevchenko 2014). Our results say "YES", it does pay not only to the companies but also to the end consumers.

Table 9.3: **Impact of the environmental dimension on financial, operational, social, and patient satisfaction.**

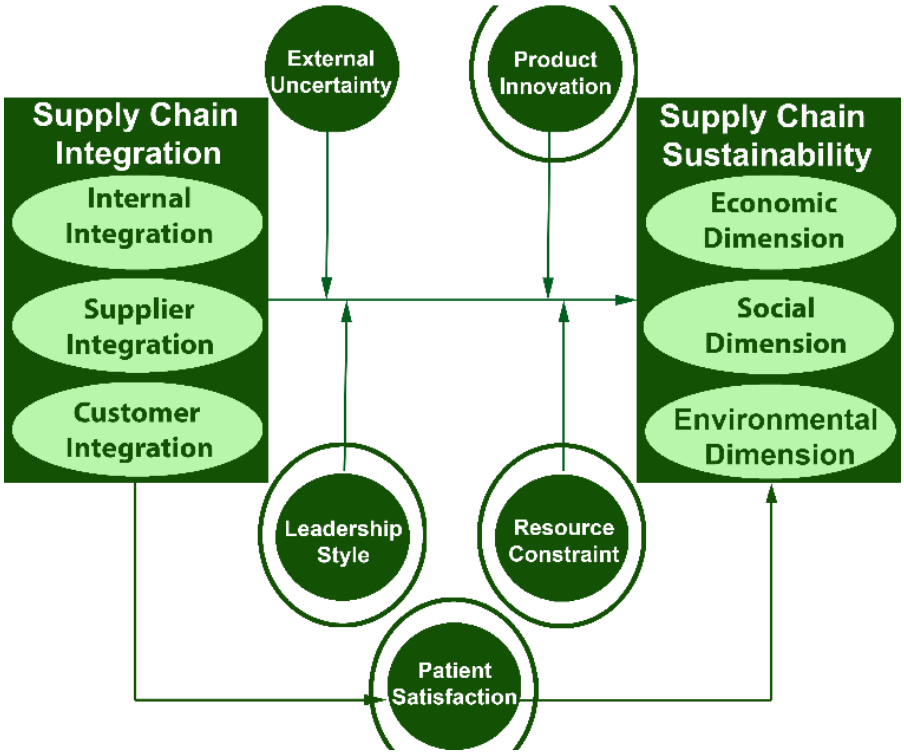
Structural Paths	Std Beta	Control Variables	Std Beta
ENV__PERF → OPER_PERF	.740 ***	Company type→ PA_SAT	.175 **
ENV__PERF → FIN_PERF	.517 ***	Annual turnover→ PA_SAT	.097
ENV__PERF → PA_SAT	.548 ***	Annual turnover→ FIN_PERF	.216 ***
ENV__PERF → SOC_PERF	.803 ***	Annual turnover→ OPER_PERF	.184 **
Control Variables	**Std Beta**	Annual turnover→ SOC_PERF	.170 **
Company type → OPER_PERF	.074	Company type→ SOC_PERF	.023
Company type → FIN_PERF	.023		

**p < 0.010 ***p < 0.001 R^2 Social:.701, R^2 Operational:.605, R^2 Financial:.334, R^2 Patient satisfaction:.337

9.1.2 Proposed framework for the SCI-supply chain sustainability relationship (RQ2)

The second contribution to literature is by proposing a framework that provides insight into the internal and external factors which enhance or impede supply chain sustainability through supply chain integration (Figure 9.1). In contrast to literature (Gimenez et al. 2012; Souder et al. 1998; Wong et al. 2011; Wolf 2011), from the proposed framework this thesis argues that in addition to the EU exposed to the pharmaceutical companies, the key IECF's; product innovation, leadership style, patient satisfaction, and resource constraints must be collectively considered to achieve supply chain sustainability through supply chain integration. Thus the rate and level at which new and specialised products are introduced to the market, the level of strictness or flexibility exhibited by company leaders, how well the demand or customer product requirements are met mainly through product efficacy and effectiveness, and the level of financial and human resource accessible to the companies are all known to influence the companies level of operationalising supply chain integration and how this affects their sustainability performance. In contrast to this study, although many scholars have studied how performance is impacted by product innovation (Hult et al. 2004; Zhou 2006), leadership style (Cheng et al. 2004), patient satisfaction (Dotson and Allenby 2010; Narayanan et al. 2011; Yu et al. 2013), and resource constraints (Baucus and Near 1991), most of these studies considered the IECF's in isolation and parts. Also, the majority of the literature (in contrast to this study) does not consider how these IECF's collectively influence the impact of supply chain integration on the three dimensions of supply chain sustainability. From the analysis, this thesis makes the following arguments; Firstly, it was noted that due to the current complexities of diseases, all the sampled companies are relying more on innovative products that are sustainable to remain competitive and relevant. Secondly, the autocratic leadership style was highly noted among all the sampled companies

in Ghana and the UK. This was mainly operationalised by having leaders' exhibit strict orders over subordinates, leaders taking decisions without the collective effort or input of co-workers and subordinates, and less transparency of mostly financially related activities between company leaders and co-workers and subordinates. This identified type of leadership style was known to be mainly influenced by the business form/type, sole proprietorship/private companies. In support of literature, the type of leadership style adopted was also known to influence company performance (Cheng et al. 2004). Thirdly, all the companies mainly focused on satisfying the end patient through the efficacy and effectiveness of manufactured/sold products to increase economic gains (Narayanan et al. 2011). Lastly, it was noticed that all the pharmaceutical companies face critical financial and human resource constraints which affect their capabilities to meet expected demands and engage in additional social and environmental activities. However, this thesis argues that the aforementioned issue is highly noted among the Ghana companies. In general, this thesis argues that the proposed framework can be used to formulate and test hypotheses in future research. Table 9.4 shows the generated key factors (themes), quotes from the respondents, and relative literature which supports the proposed framework.



Note: Circled factors are the additionally identified internal and external contextual factors

Figure 9.1: **Proposed framework for supply chain sustainability through supply chain integration**

***Table 9.4*: Emergent key factors (themes) from the study of the UK and Ghana companies and relative literature**

Themes	Key dimensions (where applicable)	Quotes from sampled companies	Literature
Supply Chain integration	*Internal integration*	It is stressful when you demand something from another department and their schedule doesn't fit in with your request which ends up in long hours of wait and delays.	Narasimhan et al. (2010) (s); Swink et al. (2007) (s).
	Customer integration	Beyond that when it gets to the retail level, if you have your sales reps or marketing reps, they solicit and introduce the products and they let them know the companies you importing from. This helps to increase our sales and profit.	Griffin and Hauser (1996) (s); Narayanan et al. (2011) (s); Narasimhan and Kim (2002) (s).
	Supplier integration	There is virtually no competition among wholesalers however they do trade together. Sometimes they do barter trade which reduces cost and improves flexibility.	Flynn et al. (2010) (c); Scannell et al. (2000) (s); Schoenherr and Swink (2012) (s).
Supply chain sustainability	*Economic*	There are payment issues mostly due to NHIS inconsistencies. The debt affects the product range that the company provides to customers. There is also a high cost for production, rising from high power tariffs and the high cost of labor.	Breen (2008) (s); Macarthur (2007) (s); Yu et al. (2014) (s).
	Environmental	We are not conscious of the environment. Most of us use plastics instead of paper bags. I don't think I will gain a competitive advantage when I'm conscious of the environment and use more friendly materials.	Corbett and Klassen (2006) (c); Pagell and Wu (2009) (c); Rao and Holt (2005) (c).
	Social	The working condition is OK and the pay is comfortable. We use 5% of our annual salary to train personnels. We engage in numerous CSR activities. Yes, we experience counterfeit but FMD is to help eliminate counterfeit from the chain.	Balabanis et al. (1998) (s); EFPIA (2020).
External uncertainty		It is a very dynamic industry. Unfortunately, the market is very erratic. Regulations are uncertain and they change frequently from time to time. What is good today might not be good tomorrow.	Harper and Gyansa-Lutterodt 2009 (s); Shah (2004) (s).
Additionally identified internal and external contextual factors			
	human	Pharmacists are scarce to get as there are only a few. Pharmacies fortunate to get a Pharmacist are expensive to hire. There are over 1900 pharmacies and over 3000 over the counter medicines seller facilities currently in Ghana. In the Greater Accra region, we have only just two inspectors, thus the regional manager and the assistant	Breen (2008) (s); Macarthur (2007) (s); Yadav and Smith (2012) (s).

Resource constraints		which makes it difficult for regular monitoring and checks. They don't only do monitoring and checks, they receive applications, site inspections, final inspections, and general office management. Hence proper or effective supervision and law enforcement is a serious challenge.	
	financial	On top of all this is finances. How strong is your financial muscle like? We face money issues. The financial pressure is so huge and there is no funding anywhere. When you get all these orders, do you have the input to supply the required quantity and deliver within time? That is not possible.	USAID (2011) (s); Yadav and Smith (2014) (s).
Product innovation		We collaborate to implement new ideas and products because of how regulations are always changing and to satisfy our patients. I think the main problem we are facing here today is that the disease we are trying to tackle is more complicated.	Hult et al. (2004) (s); Zhou (2006) (s).
Leadership style		Day to day management and decisions are mainly made by the owner alone. Financial decision is mainly controlled by the owner of the company, yes one-man company. Even to the extent that the chief accountant does not know the full size of the elephant.	Chen et al. (2004) (c); Farh and Cheng (2000) (s).
Patient satisfaction		There will always be issues when it comes to regulators. However, we focus on the patient and make sure what we give them is quality, safe, effective and efficient. Satisfying our patients help us to grow as a company.	Dotson and Allenby (2010) (s); Narayanan et al. (2011) (s).

1. (s): Given reference supports quote 2. (c): Given reference contradicts the quote

Based on the proposed framework (Figure 9.1) after the discussion with the pharmaceutical companies and experts, the thesis further tested (using survey data) how the newly identified IECF's moderate and mediate the SCI-supply chain sustainability relationship as detailed in the proposed framework.

9.1.3 Moderation of the SCI-supply chain sustainability performance relationship (RQ2)

9.1.3.1 External uncertainty

This thesis argues that EU strengthens the relationship between customer integration and environmental performance, supplier integration and financial performance, but reduces the strength between supplier integration and environmental and operational performance. Thus, EU creates the need (due to the unpredictability of events) for supplier integration (Goyal 2005) but does not necessarily improve the quality and cost (operational) of operations. Rather this need requires high resource investment to operationalise supplier integration (Wong et al. 2011). This may be in the form of keeping a higher inventory to serve as buffer stock (Kim et al. 2001a). Additionally, neither does the created need due to EU improve reduction and improper disposal of waste (environmental). However, in support of literature, it is argued that the need facilitates effective and efficient delivery and flexibility (Wong et al. 2011) from suppliers which leads to an increase in financial performance. This may imply that the unpredictability of events is more sensitive to external activities (delivery and flexibility) compared to internal (quality and cost) activities (Wong et al. 2011). Lastly, (in support of literature) in an uncertain environment where deep scanning of the market is needed (Yu et al. 2011) coupled with customers growing awareness and interest for environmentally friendly products, companies may strengthen their integration of activities and flow of transparent, adequate and timely information with customers to identify and fulfil the aforementioned environmental requests from customers.

From the results, this thesis argues that the positive impact of customer integration on environmental and social performance is stronger in environments exposed to high EU. Similarly, the positive impact of internal integration and social performance is also stronger in environments exposed to high EU. Also, it is only in high uncertain environments that the positive relationship between internal integration and financial performance is significant. However, in environments characterised by low uncertainty, the positive relationship between supplier integration and operational and environmental performance is significant,

but not that of high EU. Hence this thesis argues that to achieve a stronger positive effect on performance in high uncertain environments, a need is created for higher internal and customer integration. Whilst in low uncertain environments a high need is created for supplier integration. These arguments imply that in highly uncertain environments, a high collaboration of operational and strategic activities with internal functions and with customers is highly needed to gain adequate information on product/service demand to mitigate/manage the unpredictability of demands in the supply chain. However, in low uncertain environments, the unpredictability of demands from customers might not pose challenges. Hence, the main focus will be on getting the right amount of products from suppliers to meet predicted/forecasted demands. All the findings with regards to the moderation effect of *High and Low EU* on the supply chain integration – supply chain sustainability relationship are summarised in Table 9.5.

Table 9.5: **Moderation effect of high and low EU on the SCI-SCS relationship.**

Path Relationship	High (EU) *β*	Low (EU) *β*	*β* difference	Results analysis	Hypothesis test
CI → OPER_PERF	0.427**	0.124	0.303	Only significant for High	H2a1: partially supported
CI → FIN_PERF	0.242†	0.278†	-0.036	Same	H2a1: not supported
CI → SOC_PERF	0.750***	0.154	0.596*	Stronger for High	H2a2: supported
CI → ENV__PERF	0.414*	-0.027	0.442†	Stronger for High	H2a3: supported
SI → OPER_PERF	0.187	0.405*	-0.217	Only significant for Low	H2b1: partially supported
SI → FIN_PERF	0.130	-0.001	0.131	Same	H2b1: not supported
SI → SOC_PERF	-0.029	0.097	-0.126	Same	H2b2: not supported
SI → ENV__PERF	0.083	0.364†	-0.281	Only significant for Low	H2b3: partially supported
II → OPER_PERF	0.292*	0.361†	-0.069	Same	H2c1: not supported
II → FIN_PERF	0.355**	0.330	0.025	Only significant for High	H2c1: partially supported
II → SOC_PERF	-0.022	0.464*	-0.486*	stronger for Low	H2c2: supported
II → ENV__PERF	-0.116	0.310	-0.426	Same	H2c3: not supported

*** p < 0.001 ** p < 0.010 * p < 0.050 † p < 0.100 Partial: means significant for either high or low only

In comparing the UK and Ghana companies, this thesis argues that EU strengthens the relationship between customer integration and operational performance in the UK setting only, whilst EU strengthens the supplier integration-financial performance in the context of Ghana only. From the results, it is further argued that although EU strengthens the relationship between customer integration and environmental performance among the UK companies, EU dampens the relationship between supplier integration and environmental performance within the same UK context. From the results and raised arguments, this thesis

can conclude that the UK and Ghana companies experience both low and high EU, however, the UK companies are more exposed to *high* EU compared to that of Ghana. This conclusion can be supported by the qualitative findings where it was identified that the UK companies operate in more markets/countries worldwide compared to the Ghana companies that largely operate in selected sectors in Africa only. Hence the UK companies are more exposed to high and wider pharmaceutical regulations, evolving complexities of pharmaceutical activities, diverse demands, and different technological uncertainties from different countries where they operate, as compared to the Ghana companies. However, in support of literature, the Ghana companies may experience the high EU due to the less rigorous, highly resource constraint, and less regulated pharmaceutical system in Ghana (Yadav and Smith 2012). Hence, making activities within/across the supply chain highly susceptible to unpredictability. All the findings with regards to the moderating effect of EU on the impact of supply chain integration on supply chain sustainability among the *UK and Ghana companies* are summarised in Table 9.6.

Table 9.6: **External uncertainty: Key similarities and differences between the UK and Ghana companies**

Similarities	Differences
	• EU strengthens the relationship between customer integration and operational performance. Applies to UK context only.
	• EU strengthens the relationship between supplier integration and financial performance. Applies to Ghana context only.
	• EU strengthens the relationship between customer integration and environmental performance. Applies to UK context only.
	• EU reduces the strength of the relationship between supplier integration and environmental performance. Applies to UK context only.
	• Generally, the UK context is more exposed to high EU compared to Ghana.

9.1.3.2 Leadership style

This thesis argues that leadership style is a significant moderator that affects the supply chain integration-supply chain sustainability relationship. Leadership style was identified to reduce the positive relationship between customer integration and financial, social, and environmental performance. Nevertheless, leadership style tends to strengthen the positive relationship between internal integration and environmental performance, social

performance, and financial performance. Based on these results, this thesis argues that the leadership style adopted by companies play a more critical role in strengthening the benefit derived from integrating all functional activities within a company compared to externally integrating with customers. Literature supports this argument, as the significance of leadership support has been mentioned in previous literature as an important driver for implementing supply chain strategies (Pagell and Wu 2009). Wolf (2011) further revealed that with companies characterised by unclear sustainability goals and directions, leadership support can be used to compensate for such shortfalls. Hence, these literature findings support the thesis results (to a large extent) by indicating the critical role leadership style plays in improving performance.

The thesis further argues that the pharmaceutical companies characterised by the adoption of the autocratic leadership style have a stronger positive relationship between supplier integration and operational, social, and environmental performance. This indicates that to ensure suppliers perform in a sustainable way, the autocratic leadership style poses as a superior strategy to use compared to a non-autocratic leadership style. Thus, suppliers are given no room (through strict orders) to compromise on the given specifications of ordered inputs/products or specified processes. Additionally, from the results, it is argued that the internal integration-supply chain sustainability relationship is only significant for companies practicing autocratic leadership except for social and environmental performance. This implies that to achieve social performance internally, a flexible and all-inclusive approach is more appropriate. A flexible approach may generate the right platform for all internal stakeholders to share their ideas/thoughts, and be partakers in decision making, which may further create a sense of belonging and safety in the minds of these stakeholders. In support of literature, having such a platform may also lead to an increase in workers' morale which may reflect in company productivity levels (Gold et al. 2013; Welford and Frost 2006). The flexible approach may also ensure that internal stakeholders are involved in developing, implementing, and operationalising environmental rules/regulations which will reflect in the firms engaged operations and generated products. Also, the relationship between customer integration and financial performance is stronger for the non-autocratic leadership style. Similarly, the relationship between customer integration and operational, and social performance is only significant for companies adopting a non-autocratic leadership style. Drawing from these results, this thesis argues that to impact on the various dimensions of supply chain sustainability through customer integration, a flexible and all-inclusive

Table 9.7: **Moderation effect of autocratic and non-autocratic leadership style on the SCI-supply chain sustainability relationship.**

Path Name	Autocratic Beta	Non-autocratic Beta	Difference in Betas	Analysis	Hypothesis test
SI → OPER_PERF	0.344**	0.105	0.239	Only significant for autocratic.	H3a1: partially supported
SI→ FIN_PERF	0.148	-0.022	0.170	Same	H3a1: not supported
SI → SOC_PERF	0.359**	-0.154	0.513*	Stronger for autocratic.	H3a2: supported
SI → ENV__PERF	0.553***	-0.057	0.610*	Stronger for autocratic.	H3a3: supported
II → OPER_PERF	0.399*	0.270	0.129	Only significant for autocratic	H3b1: partially supported
II → FIN_PERF	0.545*	0.176	0.369	Only significant for autocratic.	H3b1: partially supported
II → SOC_PERF	0.259	0.374†	-0.115	Only significant for non-autocratic.	H3b2: partially supported
II → ENV__PERF	0.074	0.521*	-0.447	Only significant for non-autocratic.	H3b3: not supported
CI → OPER_PERF	0.158	0.523**	-0.365	Only significant for non-autocratic.	H3c1: partially supported
CI → FIN_PERF	-0.075	0.562**	-0.637*	Stronger for non-autocratic.	H3c1: supported
CI → ENV__PERF	0.202	0.005	0.197	Same	H3c3: not supported
CI → SOC_PERF	0.199	0.416*	-0.217	Only significant for non-autocratic.	H3c2: partially supported

Significance Indicators: † $p < 0.100$ * $p < 0.050$ ** $p < 0.010$ *** $p < 0.001$ Partial: significant for either one of the two groups only

approach is more effective and efficient. All the findings concerning the moderation effect of *autocratic and non-autocratic leadership styles* on the supply chain integration–supply chain sustainability relationship are summarised in Table 9.7.

In the context of Ghana, this thesis argues that leadership style is known to strengthen the relationship between supplier integration and financial performance, but reduce the relationship between customer integration and financial performance within the same Ghana context (Table 9.8). Based on these results, this thesis further argues that the majority of the Ghana companies when integrating with customers adopt an autocratic leadership approach. In relating this argument to our previous leadership style results, this may uniquely imply that in the context of Ghana (developing country), it is more beneficial to adopt a flexible leadership approach when integrating with customers but a strict approach when integrating with suppliers. Moreover, leadership style strengthens the relationship between internal integration and environmental and social performance, for both the UK and Ghana companies. Drawing from this result, this thesis further argues that for companies (in both developed and developing countries) to achieve environmental and social performance internally, a flexible leadership approach is more effective and efficient. Thus a flexible approach will ensure that internal stakeholders are involved in collectively implementing and operationalising environmental rules/regulations. The all-inclusive approach may

Table 9.8: **Leadership style: Key similarities and differences between the UK and Ghana companies**

Similarities	Differences
• Leadership style strengthens the relationship between internal integration and environmental and social performance.	• Leadership style strengthens the relationship between supplier integration and financial performance. Applies to Ghana context only.
• To achieve environmental performance through internal integration, a flexible leadership approach is more effective/efficient.	• Leadership style reduces the relationship between customer integration and financial performance. Applies to Ghana context only.
• To achieve social performance through internal integration, a more flexible leadership approach is more effective/efficient.	• It is more beneficial to adopt a flexible leadership approach when integrating with customers but a strict approach when integrating with suppliers. Applies to Ghana context only.

further create a sense of belonging and safety in the minds of these internal stakeholders. However, a strict approach will ensure workers adhere to organisational strategies to improve economic performance. In general, this thesis concludes that to optimally integrate internal functions to impact all the dimensions of supply chain sustainability, both strict (economic) and flexible (environmental and social) leadership approach is needed. Whilst for integration with customers, only a flexible approach is beneficial. All the findings for the moderating effect of leadership style on the impact of supply chain integration on supply chain sustainability among the *UK and Ghana companies* are summarised in Table 9.8.

9.1.3.3 Resource (constraints and availability)

This thesis argues that the number of *resources* accessible to companies affects the supplier integration-operational and social performance relationships, internal integration and environmental, social, and operational performance relationships. Although the aforementioned results uniquely show the moderating effect of resource on the supply chain integration-supply chain sustainability relationship, other studies also found a significant *direct* relationship between resource and performance (Bradley et al. 2011; Daniel et al. 2004; Mishina et al. 2010; Tran et al. 2018). From the thesis results, companies with available resources were known to have a stronger positive relationship for supplier integration and operational performance, compared to companies experiencing resource constraints. This thesis argues that companies with available resources or the needed input can *effectively and efficiently* collaborate their strategic/operational activities *and ensure adequate and timely flow of information* with customers to positively impact their operational, financial, and social performance. The same result for customer integration and financial performance was revealed for the internal integration and financial performance relationship. In support of literature, all the aforementioned findings may imply that when companies experience resource constraints, liability may be created which limits strategic choices (Baucus and Near 1991) and may affect the effectiveness of operationalising supply chain integration. Such limitations may serve as drivers for companies to also engage in unlawful activities mainly to curb the impact of constraints (Baucus and Near 1991). Based on this assertion, this thesis argues that having at disposal the needed/required amount of resources is vital for operationalising and reaping the full benefit of the supply chain integration-supply chain sustainability relationship. All the discussed findings with regards to the moderation effect of *resource constraint and availability* on the supply chain integration–supply chain sustainability relationship are summarised in Table 9.9.

Table 9.9: **Moderation effect of resource constraint and availability on the SCI-supply chain sustainability relationship.**

Path Name	Resource constraint Beta	Resource availability Beta	Difference in Betas	Analysis	Hypothesis test
SI → OPER_PERF	-0.754	0.312**	-1.066*	Stronger for Resource availability.	H4a1: supported
SI→ FIN_PERF	-0.453	0.135	-0.588	Same	H4a1: not supported
SI → SOC_PERF	-0.729	0.107	-0.835	Same	H4a2: not supported
SI → ENV__PERF	-0.211	0.232	-0.443	Same	H4a3: not supported
II → OPER_PERF	1.463	0.133	1.330	Same	H4b1: not supported
II → FIN_PERF	0.941	0.251*	0.689	Only significant for Resource availability.	H4b1: partially supported
II → SOC_PERF	1.626	0.100	1.525†	Same	H4b2: not supported
II → ENV__PERF	0.647	0.040	0.607	Same	H4b3: not supported
CI → OPER_PERF	0.165	0.398***	-0.232	Only significant for Resource availability.	H4c1: partially supported
CI → FIN_PERF	-0.193	0.239*	-0.432	Only significant for Resource availability.	H4c1: partially supported
CI → SOC_PERF	-0.466	0.373***	-0.839	Only significant for Resource availability.	H4c3: partially supported

Significance Indicators: † $p < 0.100$ * $p < 0.050$ ** $p < 0.010$ *** $p < 0.001$ Partial: significant for either one of the two groups only

This thesis argues that in the UK context, resource dampens the relationship strength between customer integration and operational and social performance. Whilst for Ghana, resource does not affect any of the relationships between customer integration and the three dimensions of supply chain sustainability, clearly indicating the presence of constraint resources to effectively and efficiently integrate with customers to impact supply chain sustainability. Thus, (in support of literature) without access to the needed resources, no meaningful/significant performance can be achieved (Mishina et al. 2010; Tran et al. 2018) as the effectiveness/efficiency of operationalising supply chain integration will be highly affected. This thesis further argues that for both the UK and Ghana, resource dampens the strength of the relationship between internal integration and operational performance but strengthens that between supplier integration and operational performance. The results uniquely imply that both the UK and Ghana pharmaceutical companies are facing critical resource constraints, which is negatively affecting how effective and efficient the companies are integrating activities among internal functions and with customers to impact supply chain sustainability. The study reveals that (both UK and Ghana) although access to available resources is needed to achieve stronger significant (positive) internal and customer-supply chain sustainability relationships, fewer resources can be effectively and efficiently managed/utilised to integrate activities with suppliers to improve operational performance. In contrast to literature (Baucus and Near 1991; Mishina et al. 2010) we can exceptionally imply that having fewer resources forces companies to find different effective and efficient ways to integrate with suppliers as customer orders need to be fulfilled to ensure business continuity. The results may also peculiarly imply that fewer resources are needed to effectively and efficiently integrate with suppliers to achieve supply chain sustainability, whilst (in support of literature) that of internal and customer integration requires higher resources (Mishina et al. 2010; Tran et al. 2018). All the findings with regards to the moderating effect of resource on the impact of supply chain integration on supply chain sustainability among the *UK and Ghana companies* are summarised in Table 9.10.

9.1.3.4 Product innovation

From the results, this thesis argues that product innovation is a significant moderator that affects the supply chain integration-supply chain sustainability performance relationship. On one hand, for companies engaging in low product innovation (compared to high product innovation), the positive relationship between supplier integration and operational performance is stronger. Whilst the relationship between supplier integration and

Table 9.10: **Resource: Key similarities and differences between the UK and Ghana companies**

Similarities	Differences
• Resource reduces the strength between internal integration and operational performance.	• Resource reduces the strength between customer integration and operational and social performance. This applies to the UK context only.
• Resource strengthens the relationship between supplier integration and operational performance.	• For Ghana only, resource does not affect the relationship between customer integration and all the dimensions of supply chain sustainability.
• Companies in both countries face resource constraints.	
• Fewer resources can be effectively/efficiently utilized to achieve significant supplier integration-operational performance relationship.	
• To achieve supply chain sustainability through internal and customer integration requires high resources.	

environmental performance is also only significant for the companies engaging in low innovative products. On the other hand, this thesis further argues that for companies engaging in high product innovation only, the relationship between customer integration and social performance is stronger, while the relationship between customer integration and environmental performance is only significant. In addition to the results, it is argued that the relationship between internal integration and financial, operational, and environmental performance is only significant for companies engaging in high product innovation. Based on all the aforementioned unique results, this thesis can conclude that for companies engaging in high product innovation to reap the benefits of supply chain integration on supply chain sustainability, critical emphasis must be placed on internal and customer integration. Whilst for companies engaging in low product innovation supplier integration must be prioritised. Thus, to engage in continuously producing new products that are well-tailored to the needs of consumers, emphasis must be placed on integrating with consumers to enable a proper understanding of their needs through an adequate and timely flow of information. In support of literature, operationalising such understood needs also largely depends on the effective and efficient collaboration of activities/processes and the flow of information among internal functions through which the newly developed products are produced (Wong et al. 2013). Hence justifying the thesis argument of emphasising on

customer and internal integration for companies engaging in highly innovative products. Also, for companies engaging in low innovative products, there is less introduction of new and sophisticated products to the market as compared to highly innovative products. Hence, (in support of literature) this thesis argues that effective and efficient integration of activities, processes, and flow of information with suppliers (Flynn et al. 2010; Wiengarten et al. 2012; Wiengarten et al. 2019) is critical to ensure a constant, consistent and seamless flow of the same/similar products to customers. All the findings with regards to the moderation effect of *High and Low product innovation* on the supply chain integration–supply chain sustainability relationship are summarised in Table 9.11.

After comparing the UK and Ghana companies, this thesis argues that product innovation strengthens the relationship between customer integration and social performance, however, this is noted for the UK companies only. Hence in relation to the previous thesis results were the relationship between customer integration and social performance is known to be stronger for high product innovation, this thesis can conclude that the UK companies are engaging in highly innovative products as compared to that of Ghana. This conclusion can be supported by the thesis's previous argument that the UK companies operate in a wider and diverse market which necessitates high product innovation to ensure competitiveness and business continuity. Also, the UK companies operate in a more complex and competitive market where all the giant pharmaceutical companies operate (Christel 2018; Ellis 2019). Hence, in support of literature (Gomes et al. 2003; Wong et al. 2013), for companies to thrive in such competitive markets, product innovation plays a key role. All the findings regarding the moderating effect of product innovation on the impact of supply chain integration on supply chain sustainability among the *UK and Ghana companies* are summarised in Table 9.12.

Table 9.11: **Moderation effect of low and high product innovation on the SCI-supply chain sustainability relationship.**

Path Name	Low product innovation Beta	High product innovation Beta	Difference in Betas	Analysis	Hypothesis test
SI → OPER_PERF	0.797***	0.347**	0.450**	Stronger for Low	H5a1: not supported
SI→ FIN_PERF	-0.218	0.127	-0.345	Same	H5a1: not supported
SI → SOC_PERF	0.564*	0.065	0.499	Only significant for Low	H5a2: not supported
SI → ENV__PERF	0.514†	0.268*	0.247	Same	H5a3: not supported
II → OPER_PERF	0.370**	0.193†	0.177	Same	H5b1: not supported
II → FIN_PERF	-0.100	0.217†	-0.317	Only significant for High	H5b1: partially supported
II → SOC_PERF	0.178	0.365**	-0.187	Only significant for High	H5b2: partially supported
II → ENV__PERF	0.056	0.261*	-0.205	Only significant for High	H5b3: partially supported
CI → ENV__PERF	0.071	0.237†	-0.166	Only significant for High	H5c3: partially supported
CI → SOC_PERF	-0.025	0.401***	-0.426**	Stronger for High	H5c2: supported

Significance Indicators: † $p < 0.100$ * $p < 0.050$ ** $p < 0.010$ *** $p < 0.001$ Partial: significant for either one of the two groups only

Table 9.12: **Product innovation: Key similarities and differences between the UK and Ghana companies**

Similarities	Differences
	• Product innovation strengthens the relationship between customer integration and social performance. Applies to UK context only.
	• The UK companies are engaging in high innovative products compared to the Ghana companies.

9.1.4 Mediation of patient satisfaction on the SCI-supply chain sustainability performance relationship (RQ3)

The study makes a great effort to further explain the inconsistent positive (Wiengarten et al. 2019) and negative/insignificant (Yu et al. 2013) supply chain integration-performance results in the supply chain integration literature, using the factor patient satisfaction. This thesis argues that patient satisfaction fully mediates the relationship between customer integration and financial performance. The raised argument is in support of literature (Yu et al. 2013). This thesis goes on to argue that patient satisfaction fully mediates the relationship between customer integration and environmental, and social performance whilst partially mediating that of customer integration and operational performance. Thus (in support of the literature) for environmental, social (Wolf 2011) and financial (Yu et al. 2013) performance, these performances are more sensitive and heavily influenced by the direct needs/actions of patients, which are *further* inculcated into operational activities. Hence supporting the partial mediation results for the customer integration-operational performance relationship. The study further argues that patient satisfaction partially mediates the relationship between internal integration and all the dimensions of supply chain sustainability. This implies that internal integration (1) *directly* removes departmental barriers (Flynn et al. 2010; Wiengarten et al. 2014) which improves economic performance; facilitates transparency which helps to tackle the social interest of workers and improves workers' motivation and skills, hence improving social performance (Gold et al. 2013); facilitates environmentally friendly processes/products through joint development, efficient resource utilisation (Flynn et al. 2010) and waste reduction which improves environmental performance (2) *but* also enables satisfying customers through the offering of right/needed products and services which further impacts supply chain sustainability. This supports the initial thesis assertion (section 9.1.1) that internal integration serves as the main foundation for operationalising supply chain integration. From the results, this thesis argues that patient satisfaction mediates

customer integration-supply chain sustainability and the internal integration-supply chain sustainability relationship only. But, the majority of the mediations ensure that patients are satisfied, which increases profitability and competitive advantage (Anderson et al. 1994). All the discussed findings with regards to the mediation effect of *patient satisfaction* on the supply chain integration–supply chain sustainability relationship are summarised in Table 9.13.

Table 9.13: **Mediation of patient satisfaction on the SCI-SCS relationship.**

Parameters	Direct Effect β	Indirect Effect β	Lower 95%CI	Upper 95%CI	Results (Mediation)	Hypothesis test
CI→ PA_SAT→ENV__PERF	-0.051	0.083†	0.008	0.116	Full	H6a1: supported
CI→ PA_SAT→ SOC_PERF	0.049	0.066*	0.007	0.099	Full	H6a2: supported
CI→ PA_SAT→ FIN_PERF	0.055	0.069†	0.006	0.084	Full	H6a3: supported
CI→ PA_SAT→ OPER_PERF	0.251**	0.058*	0.007	0.090	Partial	H6a3: supported
II→ PA_SAT→ ENV__PERF	0.264*	0.090*	0.012	0.113	Partial	H6b1: supported
II→ PA_SAT→ SOC_PERF	0.320**	0.072*	0.012	0.092	Partial	H6b2: supported
II→ PA_SAT→ FIN_PERF	0.217**	0.074*	0.007	0.083	Partial	H6b3: supported
II→ PA_SAT→ OPER_PERF	0.179*	0.063*	0.010	0.087	Partial	H6b3: supported
SI→ PA_SAT→ ENV__PERF	0.205*	0.011	-0.044	0.058	None	H6c1: not supported
SI→ PA_SAT→ SOC_PERF	0.195**	0.009	-0.036	0.048	None	H6c2: not supported
SI→ PA_SAT→FIN_PERF	0.232**	0.009	-0.032	0.044	None	H6c3: not supported
SI→PA_SAT→ OPER_PERF	0.286**	0.008	-0.034	0.045	None	H6c3: not supported

Significance Indicators: † $p < 0.100$ * $p < 0.050$ ** $p < 0.010$ *** $p < 0.001$

This thesis argues that the mediation of patient satisfaction on the relationship between customer integration and the dimensions of supply chain sustainability is identified for the UK companies only. Whilst that for internal integration and the dimensions of supply chain sustainability is identified in the context of the Ghana companies only. These results further support the thesis's previous claim that in the UK (developed country) context, customers play a vital role in product development and product delivery processes which affects operational performance. In support of the literature, such customers are also more concerned about the ethical conditions under which products are produced and how these products are also environmentally friendly (Wolf 2011). All these factors influence the type of products and services companies do offer to satisfy patients downstream of the supply chain (Wolf 2011; Yu et al. 2013). However, in the context of Ghana (developing country), this thesis argues that customers are more concerned about the efficacy (quality) and price

of the final products they are purchasing which largely relies on the effectiveness and efficiency of internal operations. Also, these customers do not play any major role in product development and product delivery processes.

In conclusion, our findings support the literature by demonstrating that patient satisfaction is a key missing factor that can be used to explain to a large extent, the inconsistent positive (Wiengarten et al. 2019) and negative/insignificant (Yu et al. 2013) supply chain integration-supply chain sustainability results. All the findings with regards to the mediating role of patient satisfaction on the impact of supply chain integration on supply chain sustainability among the *UK and Ghana companies* are summarised in Table 9.14.

9.2 Summary of all the tested hypotheses and the identified findings

In Table 9.15, all the findings (similarities and differences between the UK and Ghana context) on the impact of supply chain integration on supply chain sustainability and how this impact is moderated by resource, EU, product innovation, and leadership style are presented. Table 9.15 further details the findings on the mediation role of patient satisfaction on the supply chain integration–supply chain sustainability relationship, considering the UK and Ghana context. Table 9.16 gives a summary of all the tested hypotheses and results. The collection of all these results were used to propose the model (Figure 9.1) that provides insight into the internal and external factors which contribute to enhancing supply chain sustainability through supply chain integration.

9.3 Conclusion

The qualitative study aimed to identify and propose a framework that provides insight into the internal and external factors which enhance or hinder supply chain sustainability through supply chain integration. Drawing from the qualitative findings, the quantitative study aimed to statistically build and test a model that provides insight into the impact of supply chain integration on supply chain sustainability. From both empirical studies this thesis demonstrates that: (RQ1) through supply chain integration, all the three dimensions of supply chain sustainability can be simultaneously impacted (RQ2) the supply chain integration-supply chain sustainability relationship is moderated by EU, leadership style, resource, and product innovation (RQ3) the supply chain integration-supply chain sustainability relationship is mediated by patient satisfaction.

Table 9.14: **Mediation of patient satisfaction on the SCI-supply chain sustainability relationship**

Parameters	UK					GHANA				
	Direct effect	**Indirect effect**	**Lower**	**Upper**	**Results**	**Direct Effect**	**Indirect Effect**	**Lower**	**Upper**	**Results**
CI→PA_SAT→ENV__PERF	0.081	0.199**	0.073	0.259	**Full**	-0.072	-0.031	-0.094	0.050	None
CI→PA_SAT→SOC_PERF	0.082	0.191***	0.071	0.273	**Full**	-0.010	-0.021	-0.067	0.034	None
CI→PA_SAT→FIN_PERF	0.230†	0.142**	0.041	0.177	**Partial**	-0.056	-0.028	-0.074	0.037	None
CI→PA_SAT→OPER_PERF	0.232*	0.183***	0.074	0.254	**Partial**	0.258**	-0.017	-0.067	0.025	None
II→PA_SAT→ENV__PERF	0.048	-0.082	-0.149	0.009	None	0.341**	0.229***	0.076	0.225	**Partial**
II→PA_SAT→SOC_PERF	0.208†	-0.079	-0.162	0.010	None	0.388***	0.153***	0.048	0.162	**Partial**
II→PA_SAT→FIN_PERF	0.056	-0.058	-0.103	0.003	None	0.297*	0.204***	0.061	0.178	**Partial**
II→PA_SAT→OPER_PERF	0.113	-0.075	-0.147	0.009	None	0.260*	0.124***	0.043	0.153	**Partial**
SI→PA_SAT→ENV__PERF	0.262†	0.072	0.000	0.143	None	0.159	-0.008	-0.086	0.075	None
SI→PA_SAT→SOC_PERF	0.154	0.069	-0.002	0.143	None	0.208*	-0.005	-0.060	0.049	None
SI→PA_SAT→FIN_PERF	0.264*	0.051	0.000	0.106	None	0.192†	-0.007	-0.066	0.057	None
SI→PA_SAT→OPER_PERF	0.327**	0.066	-0.003	0.136	None	0.208*	-0.004	-0.050	0.045	None

Significance Indicators: † p < 0.100 * p < 0.050 ** p < 0.010 *** p < 0.001 Partial: both direct and indirect effect are significant

Table 9.15: **Key similarities and differences between the UK and Ghana context**

Supply Chain Integration	
Similarities	Differences
Internal integration positively impacts economic, environmental, and social performance.	Internal integration loses significance when external integration is introduced. This applies to the UK context only.
Both supplier and customer integration positively impact operational performance.	Customer integration does not impact financial, environmental, and social performance. This applies to the Ghana context only.
	Supplier integration does not impact environmental performance. This applies to the Ghana context only.
External Uncertainty	
Similarities	Differences
	EU strengthens the relationship between customer integration and operational performance. Applies to the UK only.
	EU strengthens the relationship between supplier integration and financial performance. Applies to Ghana only.
	EU strengthens the relationship between customer integration and environmental performance in the UK only but reduces the same relationship in Ghana context.
	EU reduces the strength relationship between customer integration and environmental performance. Applies to the UK only.
	Generally, the UK context is exposed to high EU compared to Ghana.
Leadership style	
Similarities	Differences
Leadership style strengthens the relationship between internal integration and environmental and social performance.	Leadership style strengthens the relationship between supplier integration and financial performance. Applies to Ghana context only.

To achieve environmental performance through internal integration, a flexible leadership approach is more effective/efficient.	Leadership style reduces the relationship between customer integration and financial performance. Applies to Ghana context only.
To achieve social performance through internal integration, a more flexible leadership approach is more effective/efficient.	It is more beneficial to adopt a flexible leadership approach when integrating with customers but a strict approach when integrating with suppliers. Applies to Ghana context only.
Resource (constraint and availability)	
Similarities	Differences
Resource reduces the strength between internal integration and operational performance.	Resource reduces the strength between customer integration and operational and social performance. This applies to the UK context only.
Resource strengthens the relationship between supplier integration and operational performance.	Resource does not affect the relationship between customer integration and all the dimensions of supply chain sustainability. This applies to the Ghana context only.
Companies in both countries face resource constraint.	
Fewer resources can be effectively/efficiently utilized to achieve significant supplier integration-operational performance relationship.	
To achieve supply chain sustainability through internal and customer integration requires high resources.	
Product innovation	
Similarities	Differences
	Product innovation strengthens the relationship between customer integration and social performance. Applies to UK context only.
	The UK companies are engaging in high innovative products than the Ghana companies.
Patient satisfaction	

Similarities	Differences
Patient satisfaction does not mediate the relationship between supplier integration and all the dimensions of supply chain sustainability.	Patient satisfaction mediates the relationship between customer integration and all the dimensions of supply chain sustainability. However, this applies to the UK context only.
	Patient satisfaction mediates the relationship between internal integration and all the dimensions of supply chain sustainability. However, this applies to Ghana context only.

Table 9.16: **Summary of all tested hypothesis**

Hypotheses	Hypothesis test
RQ1: What is the impact of supply chain integration on supply chain sustainability?	
H1a1: Internal integration will positively impact the economic performance of members within the supply chain.	Accepted
H1a2: Customer integration will positively impact the economic performance of members within the supply chain.	Accepted
H1a3: Supplier integration will positively impact the economic performance of members within the supply chain.	Partial
H1b1: Internal integration will positively impact the social performance of members within the supply chain.	Accepted
H1b2: Customer integration will positively impact the social performance of members within the supply chain.	Accepted
H1b3: Supplier integration will positively impact the social performance of members within the supply chain.	Rejected
H1c1: Internal integration will positively impact the environmental performance of members within the supply chain.	Accepted

H1c2: Customer integration will positively impact the environmental performance of members within the supply chain.	Rejected
H1c3: Supplier integration will positively impact the environmental performance of members within the supply chain.	Accepted
RQ2: What is the moderating effect of external uncertainty, leadership style, resource constraint, and product innovation on the impact of supply chain integration on supply chain sustainability?	
H2a: The relationship between customer integration and (1) economic (2) social (3) environmental performance will be significant and stronger for high EU.	1. Partial 2.Accepted 3. Accepted
H2b: The relationship between supplier integration and (1) economic (2) social (3) environmental performance will be significant and stronger for low uncertainty.	1. Partial 2.Rejected 3. Partial
H2c: The relationship between internal integration and (1) economic will be significant and stronger for high EU, but not for (2) social (3) environmental performance.	1. Partial 2. Accepted 3. Rejected
H3a: The relationship between supplier integration and (1) economic (3) environmental performance will be significant and stronger for autocratic leadership style, but not for (2) social performance.	1. Partial 2.Accepted 3. Accepted
H3b: The relationship between internal integration and (1) economic (3) environmental performance will be significant and stronger for autocratic leadership style, but not for (2) social performance.	1. Partial 2. Partial 3. Rejected
H3c: The relationship between customer integration and (1) economic (2) social (3) environmental performance will be significant and stronger for non-autocratic leadership style.	1. Partial 2. Partial 3. Rejected
H4a: The relationship between supplier integration and (1) economic (2) social (3) environmental performance will be significant and stronger for resource availability.	1. Partial 2.Rejected 3. Rejected
H4b: The relationship between internal integration and (1) economic (2) social (3) environmental performance will be significant and stronger for resource availability.	1. Partial 2. Rejected 3. Rejected
H4c: The relationship between customer integration and (1) economic (2) social (3) environmental performance will be significant and stronger for resource availability.	1. Partial 2. Partial 3. Rejected
H5a: The relationship between supplier integration and (1) economic (2) social (3) environmental performance will be significant and stronger for high product innovation.	All rejected

H5b: The relationship between internal integration and (1) economic (2) social (3) environmental performance will be significant and stronger for high product innovation.	1. Rejected 2. Partial 3. Partial
H5c: The relationship between customer integration and (1) economic (2) social (3) environmental performance will be significant and stronger for high product innovation.	1. Rejected 2. Accepted 3. Partial
RQ3: What is the mediating effect of patient satisfaction on the impact of supply chain integration on supply chain sustainability?	
H6a: Patient satisfaction will mediate the relationship between customer integration and (1) environmental (2) social (3) economic performance.	All accepted
H6b: Patient satisfaction will mediate the relationship between internal integration and environmental (2) social (3) economic performance.	All accepted
H6c: Patient satisfaction will mediate the relationship between supplier integration and (1) environmental (2) social (3) economic performance.	All rejected

Chapter 10

CONCLUSION

10.0 Chapter overview

This chapter presents a general summary of the entire thesis and details the contribution of the thesis. This chapter first gives an overview of the thesis, followed by the theoretical contribution, and practical implications of the thesis.

10.1 Overview of the thesis

The thesis was organised into 10 chapters. The first chapter (Introduction) mainly argued that as firms are now operating in a more global, competitive, and highly unpredictable external environment, it is important for research to focus on finding effective ways for firms to manage their supply chains. It was argued that SCI is identified by literature as a potential strategy that can be used to manage the aforementioned complexities whilst positively impacting on economic, social, and environmental performance. The pharmaceutical industry was argued as one of the key industries known to supply and distribute essential drugs for global consumption. This made it essential for the study to focus on the pharmaceutical industry and explore how the industry can effectively and efficiently operationalise SCI to impact supply chain sustainability.

After introducing the thesis as summarised in the first paragraph, a literature review on the main constructs were presented. This chapter mainly uncovered the main gaps in the SCI, supply chain sustainability, and EU literature. This chapter mainly argued that little research has been done to explore the simultaneous impact of SCI on the three dimensions of supply chain sustainability, and to explore the contextual conditions within which the relationship between SCI and supply chain sustainability is most effective. Based on these gaps the research questions were developed (chapter 2, section 2.4).

As the research questions were answered using the context of the pharmaceutical industry, the pharmaceutical supply chain in both the UK (developed countries) and Ghana (developing countries) were reviewed. In this chapter, all the identified issues facing the pharmaceutical industry were classified under the economic, social, and environmental

dimensions of supply chain sustainability. Based on the review presented in chapter 2, various dimensions of SCI were proposed as solutions for addressing the identified issues facing the pharmaceutical industry. Based on the review on the main constructs in chapter 2 and the pharmaceutical industry in chapter 3, the posited hypotheses based on the research questions were detailed in the next chapter.

Following up on the raised gaps in the literature chapter, the theoretical framework chapter detailed the theoretical background for the research. The contingency theory was used to argue that the impact of SCI on supply chain sustainability is influenced by the level of EU exposed to the firms in their operating environment. The dynamic capability theory was used to argue that firms need the capacity to create/modify/extend resources through effective/efficient SCI to impact supply chain sustainability. The stakeholder theory was also used to argue that for firms to fulfill their business goals toward its stakeholders whilst maintaining the ethics and principles in managing the organisation, it is important to involve all the supply chain players in studying the SCI-supply chain sustainability relationship. The chapter provided the theoretical framework and posited hypotheses (chapter 4, Figure 4.1).

After proposing the theoretical framework, details of the methodology to be adopted to answer the research questions/hypotheses were detailed. The use of critical realism was justified and how it will enable answer the research questions were also detailed. It was argued that the pharmaceutical industry in both the UK and Ghana house a number of giant leading pharmaceutical companies known for their large market sizes, financial contribution to the global economy, and vital supply chain activities of producing and supplying essential drugs to medical stores, health centres and households globally. Hence the pharmaceutical industry in Ghana and the UK were selected. The chapter justified the use of semi-structured interviews for the qualitative study and survey for the quantitative study. 18 leading pharmaceutical companies in the UK and Ghana were interviewed whilst 231 pharmaceutical companies were surveyed through an online and face-to-face approach. Thematic analysis was justified to be used for analysing the interview data whilst SEM, multigroup analysis, multivariate analysis, and hierarchical regression were detailed as the main analysis to be used for the survey data.

Details of the interview findings and analysis were presented. This chapter argued that supply chain sustainability can be achieved through effective and efficient SCI. However, to make this output attainable, the IECF's; EU, patient satisfaction, leadership style, product innovation, and resource constraint, must be collectively considered. These key factors can enhance or hinder supply chain sustainability through SCI.

Based on the newly identified IECF's, the initially developed conceptual model was reformulated and the preliminary data analysis was also presented. This chapter argued that the newly identified IECF's leadership style, product innovation, and resource constraint will be added to the conceptual framework as moderators whilst patient satisfaction was added as a mediator. Based on this new development, the research questions for the thesis were revised (chapter 7, section 7.2).

The updated conceptual framework was then tested using SEM, path analysis, hierarchical regression, and multi-group analysis. It was noted that SCI simultaneously impacts the three dimensions of supply chain sustainability. However, this impact varies across the UK and Ghana context.

The thesis then discussed the presented interview findings and that of the tested updated conceptual framework. This chapter mainly argued that through SCI, all the three dimensions of supply chain sustainability can be positively impacted simultaneously (RQ1). However, this is not the case when the external integration dimensions are analysed separately. The study also argued that the SCI-supply chain sustainability relationship is moderated by different levels of EU, the amount of resources available to firms, the type of leadership style adopted by firms, and the rate at which a firm engages in product innovation (RQ2). Additionally, the extent to which a firm satisfies its customers, through its products and services was argued to mediate the relationship between SCI and supply chain sustainability (RQ3). Hence, the proposed framework argued that the IECF's: EU, patient satisfaction, leadership style, product innovation, and resource constraint, must be collectively considered to achieve supply chain sustainability as these factors enhance or hinder supply chain sustainability through SCI.

In the conclusion chapter, the thesis provided an overview of the thesis and detailed the theoretical, and practical implications of the study.

10.2 Theoretical contribution

Firstly, in contrast to the literature (Boon-itt and Wong 2010; Danese and Romano 2011; Durach and Wiengarten 2020; Flynn et al. 2010; Han and Huo 2020; Narasimhan and Kim 2002; Vanpoucke et al. 2000) this study contributes to the stakeholder theory and SCI literature by collectively considering all the key stakeholders (manufacturers, wholesalers, distributors, retailers) within/across the supply chain in demonstrating the impact of SCI on supply chain sustainability. Previous research that studied the SCI-performance relationship mostly considered only the focal firms (Durach and Wiengarten 2020; Munir et al. 2020; Wiengarten et al. 2014; Yu et al. 2013), ignoring the other important stakeholders located upstream and downstream of the supply chain. In addition to the aforementioned stakeholders, the qualitative study further considers the regulators and national trading associations for the pharmaceutical industry in both the UK and Ghana. All the stakeholders *collectively* play vital strategic and operational roles in the effective and efficient operationalisation of SCI to achieve supply chain sustainability. Hence this study (in contrast to the aforementioned literature) gives more representative and collective results for the study of the SCI-supply chain sustainability relationship.

Secondly, in contrast to the literature (Boon-itt and Wong 2010; Flynn et al. 2010; Fynes et al. 2005; Srinivasan et al. 2011; Wong et al. 2011; Yeung et al. 2013) this thesis further contributes to the contingency theory and SCI literature by demonstrating the moderating effect of different levels of EU on the SCI-supply chain sustainability relationship in two distinct geographical contexts. Thus, the study considers companies in both Ghana- a developing country and the UK- a developed country. Both selected countries also holistically capture the diverse types/levels of EU exposed to pharmaceutical companies. In contrast to this study, most studies that adopted the contingency approach in studying the SCI-performance relationship mostly considered the developing (Wong et al. 2011) and the developed country context in isolation/parts. Interestingly, this thesis results show how EU in these two contexts affects the SCI-supply chain sustainability relationship distinctively and similarly. Interestingly, this thesis also demonstrates how the SCI-supply chain sustainability relationship is moderated in environments exposed to both high and low EU's. Hence our study, in contrast to literature (Boon-itt and Wong 2010; Wong et al. 2011) gives more comprehensive results by not only demonstrating the SCI-supply chain sustainability relationship, but also how the aforementioned relationship changes/behaves in a developing and developed country context, and in a low and high EU context. In contrast to the SCI

literature (Wiengarten et al. 2019; Yu et al. 2013) this thesis further contributes to the contingency theory and SCI literature by demonstrating how the SCI-supply chain sustainability relationship is mediated by patient satisfaction in the aforementioned two distinct contexts. In contrast to this study, most research that studied the mediating role of customer satisfaction on the SCI-performance relationship *mainly* focused on companies in developing countries (Yu et al. 2013) whilst paying less attention to companies in the developed countries. From the results, this thesis interestingly argues that patient satisfaction mediates the customer integration-supply chain sustainability relationship in the UK context only. Whilst patient satisfaction mediates the internal integration-supply chain sustainability relationship in the Ghana context only. Hence, this study in contrast to the SCI literature (Wiengarten et al. 2019; Yu et al. 2013) gives more representative results by comparing how patient satisfaction mediates the SCI-supply chain sustainability relationship in two distinct contexts.

Thirdly, in contrast to many SCI studies (Danese and Romano 2011; Devaraj et al. 2007; Durach and Wiengarten 2020; Frohlich and Westbrook 2001; Zhao et al. 2020) this thesis also provides and validate a more holistic taxonomy of (1) SCI by considering supplier integration, customer integration and internal integration (2) Performance measure in the SCI literature by considering economic (operational and financial), social and environmental performance. Many scholars (in contrast to this study) (He et al. 2014; Jitpaiboon et al. 2013; Schoenherr and Swink 2012; Weingarten et al. 2014; Zhang and Huo 2013) have studied SCI from only the perspective of supplier integration and customer integration whilst ignoring arguably the most critical dimension, internal integration (Flynn et al. 2010; Zhao et al. 2020). This study both expands the taxonomy of SCI and affirms the conceptualisation that internal integration is the most critical dimension which serves as the foundation upon which supplier and customer integration thrives/functions (Flynn et al. 2010). Additionally, in contrast to this study, many scholars (Danese and Romano 2011; Devaraj et al. 2007; Durach and Wiengarten 2020; Flynn et al. 2010; Munir et al. 2020; Narasimhan and Kim 2002; Schoenherr and Swink 2012; Vanpoucke et al. 2017; Weingarten et al. 2014; Wong et al. 2011; Yu et al. 2013) have studied performance measures for SCI from mostly the economic dimension whilst ignoring the social and environmental performance. Although this study uniquely expands the taxonomy of supply chain sustainability by considering the social, economic, and environmental performance, this thesis also confirms the conceptualisation that focusing on environmental performance leads to patient satisfaction

and better social and economic performance. Hence, in general, this study (in contrast to all the aforementioned literature) interestingly gives more comprehensive findings and a holistic conclusion on the impact of SCI on supply chain sustainability.

Lastly, in contrast to the SCI literature (Fawcett et al. 2011; Seuring and Müller 2008; Vanpoucke et al. 2014) the qualitative findings contribute to the dynamic capability theory by demonstrating how in the two (Ghana and the UK) distinct contexts, pharmaceutical companies create, modify and use generated resources through SCI to manage the impact of the diverse types and levels of EU on their supply chain sustainability performance. Also, in contrast to this study, sparse SCI studies that applied the dynamic capability theory (Fawcett et al. 2011; Seuring and Müller 2008; Vanpoucke et al. 2014) mostly limited their study to the SCI-*economic* performance relationship. Whilst most do not consider all the key players within and across the entire supply chain (Oh and Rhee 2008; Pagell and Shevchenko 2014). Hence, this study (in contrast to the SCI literature) contributes to the use/application of the dynamic capability theory in the study of the impact of SCI on not only economic performance, but also social and environmental performance.

10.3 Practical implications

This study gives well-tested guidance/suggestions for practitioners mainly operating in the pharmaceutical industry in both developed and developing countries. Firstly, for practitioners in both developed and developing countries to achieve supply chain sustainability through SCI, practitioners should first operationalise and strengthen the collaboration of activities and flow of adequate and timely information among internal functions before investing in external integration. The results of this thesis reveal that customer integration and supplier integration thrive on the foundation of internal integration. Hence supporting the action of practitioners first investing to achieve a seamlessly integrated system across internal functions before moving on to invest in integrating with suppliers and customers. However, this thesis informs practitioners to operationalise supplier and customer integration (external integration) collectively as each of the aforementioned dimensions does not simultaneously impact the economic, social, and environmental performance. Hence it is important for practitioners to implement the supplier and customer integration collectively to impact the three dimensions of supply chain sustainability.

Secondly, practitioners from both developed and developing countries should invest more in environmentally friendly activities and products, as this leads to better operational, financial, and social performance. Examples of environmentally friendly activities peculiar to the pharmaceutical industry are the reduction of wastewater, a decrease in improper solid/liquid wastes disposal, and efficient use of energy. Companies that invest more in environmentally friendly activities and products satisfy their customers by meeting their environmental needs/demands.

Thirdly, this thesis informs practitioners to invest more in strengthening the collaboration of strategic/operational activities and the flow of adequate and timely information among internal functions and with suppliers when operating in low uncertain environments. Although in low uncertain environments the unpredictability of events/activities is slightly low, this low unpredictability is more noticed for internal events/activities and events/activities with suppliers. Hence justifying the reason why practitioners operating in low uncertain environments should focus and invest more in internal integration and supplier integration to enable have a significant amount of control over the few uncertainties. In addition, practitioners operating in high uncertain environments should invest more in strengthening collaboration among their internal functions whilst strengthening the joint product and process planning, and flow of adequate and timely information with customers. Thus in highly uncertain environments, the high unpredictability of events/activities is mostly noticed for internal events/activities and demands from customers. Hence practitioners need to invest more in strengthening the integration of activities among internal functions and that with suppliers to mitigate the negative impact of high unpredictability of events/activities in the supply chain.

Fourthly, practitioners in both developed and developing countries should adopt a flexible leadership approach when integrating with customers but a strict leadership approach when integrating with suppliers. Flexible leadership can be exhibited by not always behaving in a commanding way/manner in front of/towards customers, by not being too strict towards customers, by not asking customers to always take your advice but rather give customers the platform to express themselves whilst taking customer views into consideration. However, the strict leadership approach can be exhibited by exercising strict discipline over collaborative activities with suppliers to ensure suppliers obey laid down procedures and instructions at all times. Adopting such leadership style depending on whether integrating

with suppliers or customers in a developing country context is known (from the thesis results) to improve financial and operational performance. Furthermore, for practitioners in developed and developing countries to achieve environmental performance through their internal functions/activities, a flexible leadership approach is more effective and efficient. Thus involving employees in creating, implementing and operationalising environmental rules and regulations will ensure that the firm engages in environmentally friendly operations which will reflect in the generated products as well. Also, for practitioners in both developed and developing countries to achieve social performance through their internal functions/activities, a flexible leadership approach is more effective and efficient. Thus maintaining a more inclusive approach by ensuring the views of workers or co-workers are taking into consideration, a safer and healthy working environment can be created for workers.

Fifthly, this thesis informs practitioners from both developed and developing countries that access to adequate resources are needed to effectively and efficiently operationalise internal and customer integration to impact supply chain sustainability. Thus practitioners need to have access to financial capital or should have the capability to secure the necessary funds to purchase the right input needed to effectively and efficiently collaborate activities and ensure the flow of timely and adequate information among internal functions and with customers. However, practitioners in both developed and developing countries should note that although the majority of the pharmaceutical companies experience resource constraints, this thesis informs that fewer resources can be used to effectively and efficiently integrate with suppliers to achieve better operational performance.

Sixthly, this thesis informs practitioners engaging in low innovative products are to invest more in strengthening their collaboration of strategic/operational activities and the flow of adequate and timely information with suppliers. Thus, for practitioners engaging in low innovative products, there is less introduction of new and sophisticated products to the market as compared to practitioners engaging in high innovative products. Hence, effective and efficient integration with suppliers is vital to ensure a consistent and seamless flow of the same/similar products to meet customer demands or requirements. On the other hand, practitioners engaging in high product innovation should invest more in strengthening the integration of activities and the flow of adequate and timely information among internal functions and with customers. Thus practitioners engaging in highly innovative products

need to strongly integrate with customers to enable gather adequate, timely, and accurate information about the exact requirements/needs/services demanded by patients to inform new product development. However, with strong, well-coordinated activities and flow of information among internal functions, the gathered data from patients can further be channelled into continuous production of new products and offering of services to meet the exact identified needs of patients.

Seventhly, this thesis informs practitioners in developed countries to invest more in customer integration whilst practitioners in developing countries should invest more in supplier integration as these lead to patient satisfaction which further impacts supply chain sustainability. Thus in the UK context, it was noticed that strengthening the involvement of customers in product and development processes, and through an adequate, timely, and transparent flow of information with customers leads to patient satisfaction, mostly in the form of meeting customer needs and after-sale services. These outcomes are known to impact supply chain sustainability. However, in the context of Ghana, strengthening joint planning, maintaining high levels of operational and strategic partnership, and adequate and timely flow of information with suppliers leads to meeting customer needs and after-sale services, which further impact supply chain sustainability.

Lastly, the proposed and tested framework can be used by practitioners as an evaluation tool. Thus the pharmaceutical players can use the proposed framework to (1) make SCI, leadership style, product innovation, and patent satisfaction *decisions* whilst taking into consideration the number of resources available/accessible, and the level of EU exposure (2) assess critically and rigorously how the aforementioned decisions are helping to achieve the social, economic, and environmental performance goals of the company.

10.4 Limitations of the research

Although the study demonstrates the impact of SCI on supply chain sustainability, there are some limitations especially taking into consideration the time factor for the thesis.

As the first part of the study adopted the qualitative approach, there is a limited generalisation. However, the interview part of the research serves as a precursor to identifying and understanding in-depth the different factors affecting supply chains'

sustainability performance. The framework proposed informs theory and can be used to formulate and test hypotheses in future research (detailed in chapter 6).

The true population (manufacturers, wholesalers, distributors, retailers, regulators, etc.) for the pharmaceutical industry is unknown. Hence, it can be perceived that the used sample size (231) for the quantitative study might not be representative enough. There is also a limitation as far as the sample size distribution among the UK and Ghana players is concerned. Thus the used sample size for the UK (89) and Ghana (142) was not even across both contexts. Lastly, the study excluded the customers/patients and AI raw material suppliers who also contribute immensely to the effective and efficient functioning of the pharmaceutical supply chain.

10.5 Future research

Future research should gather data from different industries and countries. This will help explore how different industries and countries can influence the results. Future research should also empirically test the proposed framework using a higher and same sample size distribution for the developed and developing country context. This will help further validate the rigorousness of the results and proposed model.

Despite the findings demonstrating that SCI impacts all the supply chain sustainability dimensions, future research should use a longitudinal study to test the long-term impact of SCI on supply chain sustainability. This will enable study how the relationship between SCI and supply chain sustainability is affected when the involved players have integrated their operations over a long period. Also, it will be interesting for future research to test and understand the interaction and mediating effect of the SCI dimensions on the supply chain sustainability performance construct. As the pharmaceutical industry uses high forms of technology for their operations, and rely more on extensive data for making informed decisions, it will be interesting for future research to also incorporate technology and big data as new constructs into the proposed framework. Thus future research can test how the use of technology and big data by the pharmaceutical companies mediate the impact of SCI on the three dimensions of supply chain sustainability.

Additionally, it will be interesting for future research to analyse the direct impact of leadership styles, resource (constraints and availability), product innovation, and patient satisfaction on supply chain sustainability. This will reveal how the aforementioned factors affect supply chain sustainability from a different perspective and not only from a contextual perspective or through SCI.

Lastly, future research should also consider the customers/patients, and AI raw material suppliers. This will enable explore how adding these key stakeholders affect the relationship between SCI and supply chain sustainability.

REFERENCES

Abpi (2018). *Regulatory Affairs*. Available at: https://www.abpi.org.uk/what-we-do/research-medical-and-innovation/regulatory-affairs/ (Accessed: 20 June 2018).

Agarwal, A., Shankar, R. and Tiwari, M.K. (2007). Modeling agility of supply chain. *Industrial Marketing Management, 36*(4), pp. 443-457.

Ahi, P. and Searcy, C. (2013). A comparative literature analysis of definitions for green and sustainable supply chain management. *Journal of Cleaner Production, 52*, pp. 329-341.

Alfalla-Luque, R., Medina-Lopez, C. and Dey, P.K. (2013). Supply chain integration framework using literature review. *Production Planning & Control*, 24(8-9), pp. 800-817.

Amegashie-Viglo, S. and Nikoi, J.A.K. (2014). Supply Chain Management of the Pharmaceutical Industry for Quality Health Care Delivery: Consumer Perception of Ernest Chemists Limited as a Pharmaceutical Service Provider in Ghana. *Supply Chain Management, 4*(8).

An, W., Xu, Y. and Zhang, J. (2018). Resource constraints, innovation capability and corporate financial fraud in entrepreneurial firms. *Chinese Management Studies*, 12(1), pp. 1-18.

Andersen, I. (1998). *The obvious reality – Choice of social science method*. Student literature, Lund.

Anderson, E.W., Fornell, C. and Lehmann, D.R. (1994). Customer satisfaction, market share, and profitability: Findings from Sweden. *Journal of Marketing, 58*(3), pp. 53-66.

Anseel, F., Lievens, F., Schollaert, E. and Choragwicka, B. (2010). Response rates in organizational science, 1995–2008: A meta-analytic review and guidelines for survey researchers. *Journal of Business and Psychology, 25*(3), pp. 335-349.

APPG, A. (2013). *Report of the APPG inquiry into medicines shortages*. Available at: http://www.appg.org.uk/downloads/APPG%20Pharmacy%20-%20Report%20of%20Inquiry%20Into%20NHS%20Medicines%20Shortages.pdf (Accessed: 23 October 2018).

Appiah-Denkyira, E., Herbst, C.H., Soucat, A., Lemiere, C. and Saleh, K. (2013). *Toward interventions in human resources for health in Ghana: evidence for health workforce planning and results*. The World Bank.

Archer, M. (1988). *Culture and Agency*. Cambridge: Cambridge, 13 University Press.

Archer, M., Bhaskar, R., Collier, A., Lawson, T. and Norrie, A. (2013). *Critical realism: Essential readings*. Routledge.

Armistead, C.G. and Mapes, J. (1993). The impact of supply chain integration on operating performance. *Logistics Information Management*, 6(4), pp. 9-14.

Artz, K.W., Norman, P.M., Hatfield, D.E. and Cardinal, L.B. (2010). A longitudinal study of the impact of R&D, patents, and product innovation on firm performance. *Journal of Product Innovation Management, 27*(5), pp. 725-740.

Aryeetey, E. and Udry, C. (1997). The Characteristics of Informal Financial Markets in sub-Sahara Africa. *Journal of Africa Economies*, 6(1), pp. 1-28.

Asif, M., Searcy, C., Zutshi, A. and Fisscher, O.A. (2013). An integrated management systems approach to corporate social responsibility. *Journal of Cleaner Production*, 56, pp. 7-17.

Aslam, H., Blome, C., Roscoe, S. and Azhar, T.M. (2018). Dynamic supply chain capabilities. *International Journal of Operations & Production Management*, 38(12), pp. 2266-2285.

Augier, M. and Teece, D.J. (2009). Dynamic capabilities and the role of managers in business strategy and economic performance. *Organization Science*, 20(2), pp. 410-421.

Bai, C. and Sarkis, J. (2010). Integrating sustainability into supplier selection with grey system and rough set methodologies. *International Journal of Production Economics*, 124(1), pp. 252-264.

Balabanis, G., Phillips, H.C. and Lyall, J. (1998). Corporate social responsibility and economic performance in the top British companies: are they linked? *European Business Review*, 98(1), pp. 25-44.

Bansal, P. (2005). Evolving sustainably: A longitudinal study of corporate sustainable development. *Strategic Management Journal*, 26(3), pp. 197-218.

Bart, T. N. (2008). Parallel trade of pharmaceuticals: a review of legal, economic, and political

aspects. *Value Health*, 11, pp. 996-1005.
Baucus, M.S. and Near, J.P. (1991). Can illegal corporate behavior be predicted? An event history analysis. *Academy of Management Journal*, 34(1), pp. 9-36.
Baucus, M.S. and Near, J.P. (1991). Can illegal corporate behavior be predicted? An event history analysis. *Academy of Management Journal*, 34(1), pp. 9-36.
Beske, P., Land, A. and Seuring, S. (2014). Sustainable supply chain management practices and dynamic capabilities in the food industry: A critical analysis of the literature. *International Journal of Production Economics*, 152, pp. 131-143.
Bhaskar, R. (1975). *A Realist Theory of Science*. Leeds: Leeds Books.
Bhatti, N., Maitlo, G., Shaikh, N., Hashmi, M. and Shaikh, F. M. (2012). The impact of autocratic and democratic leadership style on job satisfaction. *International Business Research, 5*, pp. 192-201.
Birgli, A. (2013). *An evaluation of medicines shortages in Europe with more in-depth review of these in France, Greece, Poland, Spain and the United Kingdom*. Available at: http://static.correofarmaceutico.com/docs/2013/10/21/evaluation.pdf (Accessed: 18 June 2018).
Blome, C., Schoenherr, T. and Rexhausen, D. (2013). Antecedents and enablers of supply chain agility and its effect on performance: a dynamic capabilities perspective. *International Journal of Production Research*, 51(4), pp. 1295-1318.
Boon-Itt, S. and Wong, C. Y. (2011). The moderating effects of technological and demand uncertainties on the relationship between supply chain integration and customer delivery performance. *International Journal of Physical Distribution & Logistics Management*, 41(3), pp. 253-276.
Bowersox, D.J., Closs, D.J. and Stank, T.P. (1999). *21ST Century Logistics: Making Supply Chain Integration A reality*. Oak Brook, IL: Council of Logistics Management.
Bradley, S.W., Shepherd, D.A. and Wiklund, J. (2011). The importance of slack for new organizations facing 'tough' environments. *Journal of Management Studies*, 48(5), pp. 1071-1097.
Breen, L. (2008). A preliminary examination of risk in the pharmaceutical supply chain in the National Health Service (NHS), UK. *Journal of Service Science and Management*, 1, pp. 6.
Buckley, G.J. and Gostin, L.O. (2013). *Countering the problem of falsified and substandard drugs*. National Academies Press.
Business dictionary (2018). *Uncertainty*. Available at: http://www.businessdictionary.com/definition/uncertainty.html (Accessed: 1 December 2018).
Byrne, B. M. (2013). *Structural equation modeling with AMOS: Basic concepts, applications, and programming*. Routledge.
Cao, M. and Zhang, Q. (2011). Supply chain collaboration: Impact on collaborative advantage and firm performance. *Journal of Operations Management*, 29(3), pp. 163-180.
Chandani, Y., Noel, M., Pomeroy, A., Andersson, S., Pahl, M.K. and Williams, T. (2012). Factors affecting availability of essential medicines among community health workers in Ethiopia, Malawi, and Rwanda: solving the last mile puzzle. *The American Journal of Tropical Medicine and Hygiene*, 87(5), pp. 120-126.
Chang, S.C., Lin, N.P. and Sheu, C. (2002). Aligning manufacturing flexibility with environmental uncertainty: evidence from high-technology component manufacturers in Taiwan. *International Journal of Production Research*, 40(18), pp. 4765-4780.
Cheah, E.T., Chan, W.L. and Chieng, C.L.L. (2007). The corporate social responsibility of pharmaceutical product recalls: An empirical examination of US and UK markets. *Journal of Business Ethics*, 76(4), pp. 427-449.
Chen, I.J. and Paulraj, A. (2004). Towards a theory of supply chain management: the constructs and measurements. *Journal of Operations Management*, 22(2), pp. 119-150.
Cheng (2014). *Supply chain management: Business information*. Available at: http://www.biz-development.com/SupplyChain/6.20.14.supply-chain-management-business-information.htm (Accessed: 18 January 2018).

Cheng, B.S., Chou, L.F., Wu, T.Y., Huang, M.P. and Farh, J.L. (2004). Paternalistic leadership and subordinate responses: Establishing a leadership model in Chinese organizations. *Asian Journal of Social Psychology*, 7(1), pp. 89-117.

Childerhouse, P. and Towill, D. (2011). Arcs of supply chain integration. *International Journal of Production Research*, 49(24), pp. 7441-7468.

Chin, T.A., Hamid, A.B.A., Rasli, A. and Tat, H.H. (2014). A literature analysis on the relationship between external integration, environmental uncertainty and firm performance in Malaysian SMEs. *Procedia-Social and Behavioral Sciences*, 130, pp. 75-84.

Christel, M. (2018). *Pharm Exec's Top 50 Companies*. Available at: http://www.pharmexec.com/pharm-execs-top-50-companies-2018 (Accessed: 26 October 2019).

Clark, K.B. and Fujimoto, T. (1991). *Product development performance: Strategy, organization, and management in the world auto industry*. Harvard Business School Press, Boston, MA.

Cockburn, I.M. (2004). The changing structure of the pharmaceutical industry. *Health Affairs*, 23(1), pp. 10-22.

Collins dictionary (2018). *Definition of uncertainty*. Available at: https://www.collinsdictionary.com/dictionary/english/uncertainty (Accessed: 12 February 2018).

Collins, E., Lawrence, S., Pavlovich, K. and Ryan, C. (2007). Business networks and the uptake of sustainability practices: the case of New Zealand. *Journal of Cleaner Production*, 15(8-9), pp. 729-740.

Cone (2015). *2015 cone communication / ebiquity CSR study report*. Available at: https://www.conecomm.com/research-blog/2015-cone-communications-ebiquity-global-csr-study#download-research (Accessed: 20 July 2020).

Corbett, C.J. and Klassen, R.D. (2006). Extending the horizons: environmental excellence as key to improving operations. *Manufacturing & Service Operations Management*, 8(1), pp. 5-22.

Costa, V.B. (2017). *The impact of regulatory policies on the supply chain resilience: regulation as supply chain resilience reducer in the medical and pharmaceutical supply chain in Brazil*. Doctoral dissertation.

Costello, A.B. and Osborne, J. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research, and Evaluation*, 10(1), pp. 7.

Costelloe, E., Guinane, M., Nugent, F., Halley, O. and Parsons, C. (2014). An audit of drug shortages in a community pharmacy practice. *Irish Journal of Medical Science*, 184(2), pp. 435-440.

Cozza, C., Malerba, F., Mancusi, M.L., Perani, G. and Vezzulli, A. (2012). Innovation, profitability and growth in medium and high-tech manufacturing industries: evidence from Italy. *Applied Economics*, 44(15), pp. 1963-1976.

Cramton, C.D. (2001). The mutual knowledge problem and its consequences for dispersed collaboration. *Organization Science*, 12(3), pp. 346–371.

Creswell, J.W. (2009). Mapping the field of mixed methods research. *Journal of Mixed Method Research*, 3(2), pp. 95-108

Creswell, J.W. and Maietta, R.C. (2002). Qualitative research. *Handbook of Research Design and Social Measurement*, 6(1), pp. 143-184.

Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16(3), pp. 297-334.

Danese, P. and Romano, P. (2011). Supply chain integration and efficiency performance: A study on the interactions between customer and supplier integration. *Supply Chain Management: An International Journal*, 16(4), pp. 220-230.

Danese, P., Molinaro, M. and Romano, P. (2020). Investigating fit In Supply Chain Integration: A Systematic Literature Review On Context, Practices, Performance Links. *Journal of Purchasing and Supply Management*, doi: 10.1016/j.pursup.2020.100634 (Accessed: 20 August 2020).

Danese, P., Romano, P. and Formentini, M. (2013). The impact of supply chain integration on responsiveness: The moderating effect of using an international supplier

network. *Transportation Research Part E: Logistics and Transportation Review*, 49(1), pp. 125-140.

Daniel, F., Lohrke, F.T., Fornaciari, C.J. and Turner Jr, R.A. (2004). Slack resources and firm performance: a meta-analysis. *Journal of Business Research*, 57(6), pp. 565-574.

De Faria, P. and Mendonça, J. (2011). Innovation strategy by firms: do innovative firms grow more? *International Journal of Entrepreneurship and Small Business*, 12(2), pp. 173-184.

Delloitte (2018). *A bold future for the life sciences regulation: Predictions for 2025*.

Devaraj, S., Krajewski, L. and Wei, J.C. (2007). Impact of eBusiness technologies on operational performance: the role of production information integration in the supply chain. *Journal of Operations Management*, 25(6), pp. 1199-1216.

Donaldson, L. (2001), *The Contingency Theory of Organizations*, Sage Publications.

Donkor, F. (2015). *Analysis of challenges in the pharmaceutical supply chains in developed countries (UK) and how they lead to drug shortages and impacts retailers and end consumers*. Dissertation, University of Westminster- UK.

Dooyoung, S., Kalinowski, J. and El-Enein, G. (1998). Critical implementation issues in total quality management. *SAM Advanced Management Journal*, 63(1), pp. 10–14.

Dotson, J.P. and Allenby, G.M. (2010). Investigating the strategic influence of customer and employee satisfaction on firm financial performance. *Marketing Science*, 29(5), pp. 895–908.

Dow, D., Samson, D. and Ford, S. (1999). Exploding the myth: do all quality management practices contribute to superior quality performance? *Production and Operations Management,* 8(1), pp. 1–27.

Droge, C., Jayaram, J. and Vickery, S.K. (2004). The effects of internal versus external integration practices on time-based performance and overall firm performance**.** *Journal of Operations Management,* 22(6), pp. 557-573.

Duncan, R.B. (1972). Characteristics of organizational environments and perceived environmental uncertainty. *Administrative Science Quarterly*, pp. 313-327.

Durach, C.F. and Wiengarten, F. (2020). Supply chain integration and national collectivism. *International Journal of Production Economics*, doi: 10.1016/j.ijpe.2019.107543 (Accessed: 20 August 2020).

Elkington, J. (1994). Towards the sustainable corporation: win–win–win businessstrategies for sustainable development. *California Management Review*, 36(2), pp. 90-10.

Elkington, J. (1998).Partnerships from cannibals with forks: the triple bottom line of 21stcentury business. *Environmental Quality Management*, 8(1), pp. 37-51.

Ellis, M. (2019). *Who are the top 10 pharmaceutical companies in the world? 2019*. Available at: https://www.proclinical.com/blogs/2019-3/the-top-10-pharmaceutical-companies-in-the-world-2019 (Accessed: 11 November 2019).

Enyinda, C., Briggs, C. and Bachkar, K. (2009). Managing risk in pharmaceutical global supply chain outsourcing: applying analytic hierarchy process model. In *Asbbs Annual Conference: Lasvegas,* 16.

EFPIA (2020). *World anti-counterfeiting day: joining forces in the fight against falsified medicine*. Available at: https://www.efpia.eu/news-events/the-efpia-view/blog-articles/world-anti-counterfeiting-day-joining-forces-in-the-fight-against-falsified-medicines/ (Accessed: 11 July 2020).

Ettlie, J.E. and Stoll, H.W. (1990). *Managing the design-manufacturing process*. McGraw-Hill College.

European Union (2014). *Competition issues in the distribution of pharmaceuticals*. Available at: http://ec.europa.eu/competition/international/multilateral/2014_feb_distribution_of_pharmaceuticals_en.pdf (Accessed: 22 October 2018).

Fabbe-Costes, N. and Jahre, M. (2008). Supply chain integration and performance: a review of the evidence. *The International Journal of Logistics Management*, 19(2), pp. 130-154.

Fabbe-Costes, N., Roussat, C., Taylor, M. and Taylor, A. (2014). Sustainable supply chains: a framework for environmental scanning practices. *International Journal of Operations & Production Management*, 34(5), pp. 664-694.

Farh, J.L. and Cheng, B.S. (2000). A cultural analysis of paternalistic leadership in Chinese organizations. *Management and Organizations in the Chinese Context*. Palgrave Macmillan, London.

Farh, J.L., Liang, J., Chou, L.F. and Cheng, B.S. (2008). Paternalistic leadership in Chinese organizations: Research progress and future research directions. In *Leadership and Management in China: Philosophies, Theories, and Practices*, pp. 171-205. Cambridge University Press.

Fawcett, S.E., Wallin, C., Allred, C., Fawcett, A.M. and Magnan, G.M. (2011). Information technology as an enabler of supply chain collaboration: a dynamic-capabilities perspective. *Journal of Supply Chain Management*, 47(1), pp. 38-59.

FDA (2011). *Guidance for industry: Bar code label requirements, questions and answers*. Washington, DC.

Ferlie, E., Fitzgerald, L., Wood, M. and Hawkins, C. (2005). The non-spread of innovations: the mediating role of professionals. *Academy of Management Journal*, 48(1), pp. 117-134.

Field, A. (2009). *Discovering statistics using SPSS*. London: Sage.

Field, A. (2013). *Discovering statistics using IBM SPSS statistics*. Sage.

Fisher, M., Hammond, J., Obermeyer, W. and Raman, A. (1997). Configuring a supply chain to reduce the cost of demand uncertainty. *Production and Operations Management*, 6(3), pp. 211-225.

Florence, A. and Lee, V. (2011). Personalised medicines: More tailored drugs, more tailored delivery. *International Journal of Pharmaceutics*, 415(1-2), pp. 29-33.

Flynn, B.B., Huo, B. and Zhao, X. (2010). The impact of supply chain integration on performance: A contingency and configuration approach. *Journal of Operations Management*, 28(1), pp. 58-71.

Fombrun, C.J. (2005). *The leadership challenge: building resilient corporate reputations*. In: Doh, J.P., Stumpf, S.A. (Eds.), Handbook on Responsible Leadership and Governance in Global Business. Edward Elgar, Cheltenham, pp. 54–68.

Fornell, C. and Larcker, D.F. (1981). *Structural equation models with unobservable variables and measurement error: Algebra and statistics*. Sage.

Forrester, I. S. and Dawes, A. (2010). *Parallel trade in prescription medicines in the European Union: The Age of Reason?* Munich Personal RePEc Archive.

Forza, C. (2002). Survey research in operations management: a process-based perspective. *International Journal of Operations & Production Management*, 22(2), pp. 152-194.

Freeman, E. R. (2005). The Development of Stakeholder Theory: An Idiosyncratic Approach, in Smith, K. G. and Hitt, M. A. (2005). *Great Minds in Management: The Process of Theory Development*. Oxford University Press, Oxford, pp. 417–435.

Freeman, R. (1984). Edward: Strategic Management. *A Stakeholder Approach*, New York.

Friedman, A.L. and Miles, S. (2002). Developing stakeholder theory. *Journal of Management Studies*, 39(1), pp. 1-21.

Frohlich, M. T. and Westbrook, R. (2001). Arcs of Integration: An International Study of Supply Chain Strategies. *Journal of Operations Management*, 19(2), pp. 185-200.

Fynes, B. and Voss, C. (2002). The moderating effect of buyer-supplier relationships on quality practices and performance. *International Journal of Operations & Production Management*, 22(6), pp. 589-613.

Fynes, B., De Búrca, S. and Marshall, D. (2004). Environmental uncertainty, supply chain relationship quality and performance. *Journal of Purchasing and Supply Management*, 10(4-5), pp. 179-190.

Fynes, B., De Búrca, S. and Voss, C. (2005). Supply chain relationship quality, the competitive environment and performance. *International Journal of Production Research*, 43(16), pp. 3303-3320.

Geary, S., Childerhouse, P. and Towill, D. (2002). Uncertainty and the seamless supply chain. *Supply Chain Management Review*, 6, pp. 52–60.

George, G., Wiklund, J. and Zahra, S. (2005). Ownership and the internationalization of small firms. *Journal of Management*, 31(2), pp. 210-233.

Germain, R., Dröge, C. and Daugherty, P.J. (1994). The effect of just-in-time selling on organizational structure: an empirical investigation. *Journal of Marketing Research*, 31(4), pp. 471-483.

Ghasemi, A. and Zahediasl, S. (2012). Normality tests for statistical analysis: a guide for non-statisticians. *International Journal of Endocrinology and Metabolism*, 10(2), pp. 486.

Gibbert, M., Ruigrok, W. and Wicki, B. (2008). What passes as a rigorous case study? *Strategic Management Journal*, 29(13), pp. 1465–1474.

Gimenez, C. and Ventura, E. (2005). Logistics-production, logistics-marketing and external integration: their impact on performance. *International Journal of Operations & Production Management*, *25*(1), pp. 20-38.

Gimenez, C., Sierra, V. and Rodon, J. (2012). Sustainable operations: Their impact on the triple bottom line. *International Journal of Production Economics*, 140(1), pp. 149-159.

Glaser, B. G. and Strauss, A. L. (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Aldine, Chicago, IL.

Gligor, D.M., Esmark, C.L. and Holcomb, M.C. (2015). Performance outcomes of supply chain agility: when should you be agile? *Journal of Operations Management*, 33, pp. 71-82.

Gold, S., Hahn, R. and Seuring, S. (2013). Sustainable supply chain management in "Base of the Pyramid" food projects—A path to triple bottom line approaches for multinationals? *International Business Review*, 22(5), pp. 784-799.

Goodland, R. (1995). The Concepts of Environmental Sustainability. *Annual Review of Ecology and Systematics*, pp. 1-24.

Govindarajan, V. (1984). Appropriateness of accounting data in performance evaluation: an empirical examination of environmental uncertainty as an intervening variable. *Accounting, Organizations and Society*, 9(2), pp. 125-135.

Goyal, M. (2005). *Managing operational flexibility under demand uncertainty*. Available at: https://repository.upenn.edu/dissertations/AAI3197676 (Accessed: 2 May 2018).

Greene, J., Caracelli, V. and Graham, W. (1989). Toward a conceptual framework for mixed-method evaluation designs. *Educational Evaluation and Policy Analysis*, 11, pp. 255-274.

Griffin, A. and Hauser, J.R. (1996). Integrating R&D and marketing: a review and analysis of the literature. *Journal of Product Innovation Management*, 13(3), pp. 191-215.

Griffith, A. and Bhutto, K. (2008). Improving environmental performance through integrated management systems (IMS) in the UK. *Management of Environmental Quality: An International Journal*, 19(5), pp. 565-578.

Guba, E.G. and Lincoln, Y.S. (1994). Competing paradigms in qualitative research. *Handbook of Qualitative Research*, *2*(163-194), pp. 105.

Gunasekaran, A. and Ngai, E. W. T. (2004). Information Systems in Supply Chain Integration and Management. *European Journal of Operational Research*, 159, pp. 269–295.

Gupta, A.K. and Govindarajan, V. (1991). Knowledge flows and the structure of control within multinational corporations. *Academy of Management Review*, 16(4), pp. 768-792.

Hair, J.R., Anderson R.E., Tatham R.L. and Black, W.C. (1995). *Multivariate Data Analysis with Readings*. Prentice Hall, Englewood, NJ.

Hair, J.F., Black, W.C., Babin, B.J. and Anderson, R.E. (2010). *Multivariate data analysis: International Version*. New Jersey, Pearson.

Hair, J.F., Ringle, C.M. and Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing theory and Practice*, 19(2), pp. 139-152.

Hall, J. (2000). Environmental supply chain dynamics. *Journal of Cleaner Production*, 8(6), pp. 455-71.

Han, Z. and Huo, B. (2020). The impact of green supply chain integration on sustainable performance. *Industrial Management & Data Systems*, 120(4), pp. 657-674.

Harper, J. and Gyansa-Lutterodt, M. (2007). The viability of pharmaceutical manufacturing in Ghana to address priority endemic diseases in the West Africa sub-region. *Eschborn, Germany, German Society for Technical Cooperation (GTZ) GmbH*.

Hart, S.L. (1995). A natural-resource-based view of the firm. *Academy of Management Review*, 20(4), pp. 986-1014.

He, Y. and Lai, K.K. (2012). Supply chain integration and service oriented transformation: Evidence from Chinese equipment manufacturers. *International Journal of Production Economics*, 135(2), pp. 791-799.

Heale, R. and Twycross, A. (2015). Validity and reliability in quantitative studies. *Evidence-Based Nursing*, 18(3), pp. 66-67.

Heikkilä, J. (2002). From supply to demand chain management: efficiency and customer satisfaction. *Journal of Operations Management*, 20(6), pp. 747-767.

Helfat, C. E., Finkelstein, S., Mitchell, W., Peteraf, M. A., Singh, H., Teece, D. J. and Winter, S. G. (2007). *Dynamic Capabilities: Understanding Strategic Change in Organizations*. Malden, MA: Blackwell.

Henseler, J., Ringle, C.M. and Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, *43*(1), pp. 115-135.

Ho, H. P-Y. and Choi, T.M. (2012). A Five-R analysis for sustainable fashion supply chain management in Hong Kong: a case analysis. *Journal of Fashion Marketing and Management: An International Journal*, 16(2), pp. 161-175.

Hogerzeil, H.V. (2006). Essential medicines and human rights: what can they learn from each other? *Bulletin of the World Health Organization*, 84, pp. 371-375.

Homburg, C. and Stock, R.M. (2004). The link between sales people's job satisfaction and customer satisfaction in a business-to-business context: a dyadic analysis. *Journal of the Academy of Marketing Science*, 32(2), pp. 144.

Hu, L.T. and Bentler, P.M. (1999). Cut off criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: a Multidisciplinary Journal*, 6(1), pp. 1-55.

Huang, M.C., Yen, G.F. and Liu, T.C. (2014). Re-examining supply chain integration and the supplier's performance relationships under uncertainty. .*Supply Chain Management: An International Journal*, 19(1), pp. 64-78.

Huang, R.J., Zhang, Y., Bozzetti, C., Ho, K.F., Cao, J.J., Han, Y., Daellenbach, K.R., Slowik, J.G., Platt, S.M., Canonaco, F. and Zotter, P. (2014). High secondary aerosol contribution to particulate pollution during haze events in China. *Nature*, 514(7521), pp. 218.

Hult, G.T.M., Hurley, R.F. and Knight, G.A. (2004). Innovativeness: Its antecedents and impact on business performance. *Industrial Marketing Management*, 33(5), pp. 429-438.

Huo, B., Ye, Y., Zhao, X. and Shou, Y. (2016). The impact of human capital on supply chain integration and competitive performance. *International Journal of Production Economics*, 178, pp. 132-143.

Jayaram, J., Tan, K.C. and Nachiappan, S.P. (2010). Examining the interrelationships between supply chain integration scope and supply chain management efforts. *International Journal of Production Research*, 48(22), pp. 6837-6857.

Jitpaiboon, T., Dobrzykowski, D.D., Ragu-Nathan, T.S. and Vonderembse, M.A. (2013). Unpacking IT use and integration for mass customisation: a service-dominant logic view. *International Journal of Production Research*, 51(8), pp. 2527-2547.

Kanavos, P. and Wouters, O. (2014). *Competition issues in the distribution of pharmaceuticals*. Available at: http://eprints.lse.ac.uk/56006/1/__lse.ac.uk_storage_LIBRARY_Secondary_libfile_shared_repository_Content_Wouters,%20O_Competition%20issues_Wouters_Competition%20issues_2014.pdf (Accessed: 26 October 2018).

Kanavos, P., Schurer, W. and Vogler, S. (2011). *The pharmaceutical distribution chain in the European Union: structure and impact on pharmaceutical prices*. Available at: http://eprints.lse.ac.uk/51051/1/Kanavos_pharmaceutical_distribution_chain_2007.pdf (Accessed: 25 October 2018).

Killick, J. (2006). *Parallel trade in Europe - The tide is turning*. Available at: http://www.brusselslegal.com/article/display/2556/Parallel_Trade_in_Europe_the_Tide_is_Turning (Accessed: 1 October 2018).

Kim, J., Realff, M.J. and Lee, J.H. (2011a). Optimal design and global sensitivity analysis of biomass supply chain networks for biofuels under uncertainty. *Computers & Chemical*

Engineering, 35(9), pp. 1738-1751.
Kim, S.W. (2009). An investigation on the direct and indirect effect of supply chain integration on firm performance. *International journal of production economics*, 119(2), pp. 328-346.
Kim, Y., Choi, T.Y., Yan, T. and Dooley, K. (2011b). Structural investigation of supply networks: A social network analysis approach. *Journal of Operations Management*, 29(3), pp. 194-211.
Kleindorfer, P.R., Singhal, K. and Wassenhove, L.N. (2005). Sustainable operations management. *Production and Operations Management*, *14*(4), pp. 482-492.
Koh, R., Schuster, E. W., Chackrabarti, I. and Bellman, A. (2003). *Securing the pharmaceutical supply chain*. Available at: http://www.racoindustries.com/downloads/RFID/Pharmaceutical%20Supply%20Chain.pdf (Accessed: 5 October 2018).
Koufteros, X., Vonderembse, M. and Jayaram, J. (2005). Internal and external integration for product development: the contingency effects of uncertainty, equivocality, and platform strategy. *Decision Sciences*, 36(1), pp. 97-133.
Kraljic, P. (1983). Purchasing must become supply management. *Harvard business review*, *61*(5), pp. 109-117.
Lai, K.H., Wong, C.W. and Cheng, T.E. (2008). A coordination-theoretic investigation of the impact of electronic integration on logistics performance. *Information & Management*, *45*(1), pp. 10-20.
Lawrence, P.R. and Lorsch, J.W. (1967). Differentiation and integration in complex organizations. *Administrative Science Quarterly*, pp. 1-47.
Lee, C.W., Kwon, I.W.G. and Severance, D. (2007). Relationship between supply chain performance and degree of linkage among supplier, internal integration, and customer. *Supply chain management: an International journal*, 12(6), pp. 444-452.
Leisinger, K. M. (2005). The Corporate Social Responsibility of the Pharmaceutical Industry: Idealism without Illusion and Realism without Resignation. *Business Ethics Quarterly*, 15(4), pp. 577–594.
Li, W.Y., Chow, P.S., Choi, T.M. and Chan, H.L. (2016). Supplier integration, green sustainability programs, and financial performance of fashion enterprises under global financial crisis. *Journal of Cleaner Production*, 135, pp. 57-70.
Liu, H., Wei, S., Ke, W., Wei, K.K. and Hua, Z. (2016). The configuration between supply chain integration and information technology competency: A resource orchestration perspective. *Journal of Operations Management*, 44, pp. 13-29.
Macarthur, D. (2007). *European pharmaceutical distribution: Key players, challenges and future strategies.* London: Informa UK Ltd.
Mackelprang, A.W., Robinson, J.L., Bernardes, E. and Webb, G.S. (2014). The relationship between strategic supply chain integration and performance: a meta-analytic evaluation and implications for supply chain management research. *Journal of Business Logistics*, 35(1), pp. 71-96.
Maddow, J. (1995). Time to demystify JIT. *Transportation & Distribution*, 36(10), pp. 76.
Maiga, D. and Williams-Jones, B. (2010). Assessment of the impact of market regulation in Mali on the price of essential medicines provided through the private sector. *Health Policy*, 97(2–3), pp. 130–5.
Malhotra, N.K. and Dash, S. (2011). *Marketing Research: An Applied Orientation*. Pearson.
Mangan, J., Lalwani, C., Butcher, T. and Javapour, R. (2011). *Global Logistics and Supply Chain Management.* John Wileys and Sons, UK.
Maini, F. (2014). UK: *Risk and regulation: A wave of change for PHARMA*. Available at: https://www.mondaq.com/uk/life-sciences-biotechnology-nanotechnology/332498/risk-and-regulation-a-wave-of-change-for-pharma (Accessed: 1 May 2020).
Martins, C.L. and Pato, M.V. (2019). Supply chain sustainability: A tertiary literature review. *Journal of Cleaner Production*, 225, pp. 995-1016.
McGrath, G. R. and MacMillan, I. C. (2000). *Entrepreneurial Mindset: Strategies for continuously creating opportunity in an age of uncertainty*. Harvard Business School Press Books.
McKee, S. (2015). *UK drug shortages harming patients in 75% of cases*. Available at:

http://file:///Volumes/Untitled/project/published%20academic%20journals,%20articles,%20reports%20etc./Article%20%3E%20UK%20drug%20shortages%20harming%20patients%20in%2075%25%20of%20cases.webarchive (Accessed: 19 October 2018).

Meyer, P. B. (2008). *New technologies and earnings variation within occupations since 1960*. Office of Productivity and Technology, U.S. Bureau of Labor Statistics.

Midgley, G., Nicholson, J.D. and Brennan, R. (2017). Dealing with challenges to methodological pluralism: The paradigm problem, psychological resistance and cultural barriers. *Industrial Marketing Management*, 62, pp. 150-159.

Miemczyk, J., Johnsen, T.E. and Macquet, M. (2012). Sustainable purchasing and supply management: a structured literature review of definitions and measures at the dyad, chain and network levels. *Supply Chain Management: An International Journal*, 17(5), pp. 478-496.

Miles, M. B. and M. A. Huberman (1994). *Qualitative Data Analysis: An Expanded Sourcebook*. Sage, Thousand Oaks, CA.

Milliken, F.J. (1987). Three types of perceived uncertainty about the environment: State, effect, and response uncertainty. *Academy of Management Review*, 12(1), pp. 133-143.

Mingers, J. (2001). Combining IS research methods: towards a pluralist methodology. *Information Systems Research*, 12(3), pp. 240-259.

Mingers, J. and Brocklesby, J. (1997). Multimethodology: Towards a framework for mixing methodologies. *Omega*, 25(5), pp. 489-509.

Mingers, J., Mutch, A. and Willcocks, L. (2013). Critical realism in information systems research. *MIS Quarterly*, 37(3), pp. 795-802.

Mishina, Y., Pollock, T.G. and Porac, J.F. (2004). Are more resources always better for growth? Resource stickiness in market and product expansion. *Strategic Management Journal*, 25(12), pp. 1179-1197.

Montabon, F., Sroufe, R. and Narasimhan, R. (2007). An examination of corporate reporting, environmental management practices and firm performance. *Journal of operations management*, 25(5), pp. 998-1014.

Morash, E.A. (2001). Supply chain strategies, capabilities, and performance. *Transportation Journal*, 41(1), pp. 37-54.

Morash, E.A., Droge, C. and Vickery, S. (1997). Boundary spanning interfaces between logistics, production, marketing, and new product development. *International Journal of Physical Distribution and Logistics Management*, 27(5-6), pp. 350-369.

Morse, J.M. (1991). Approaches to qualitative-quantitative methodological triangulation. *Nursing Research*, 40(2), pp. 120-123.

Munir, M., Jajja, M.S.S., Chatha, K.A. and Farooq, S. (2020). Supply chain risk management and operational performance: The enabling role of supply chain integration. *International Journal of Production Economics*, doi: 10.1016/j.ijpe.2020.107667 (Accessed: 20 August 2020).

Narasimhan, R. and Kim, S.W. (2002). Effect of supply chain integration on the relationship between diversification and performance: evidence from Japanese and Korean firms. *Journal of Operations Management*, 20(3), pp. 303-323.

Narasimhan, R., Swink, M. and Viswanathan, S. (2010). On decisions for integration implementation: An examination of complementarities between product-Process technology integration and supply chain integration. *Decision Sciences*, 41(2), pp. 355-372.

Narayanan, S., Balasubramanian, S. and Swaminathan, J. (2011). Managing outsourced software projects: an analysis of project performance and customer satisfaction. *Production and Operations Management*, 20(4), pp. 508–521.

Naslund, D. and Hulthen, H. (2012). Supply chain management integration: a critical analysis. *Benchmarking: An International Journal*, 19(4-5), pp. 481-501.

Naughton, B., Roberts, L., Dopson, S., Chapman, S. and Brindley, D. (2016). Effectiveness of medicines authentication technology to detect counterfeit, recalled and expired medicines: a two-stage quantitative secondary care study. *BMJ open*, 6(12), doi: 10.1136/bmjopen-2016-013837.

Ngodo, O.E. (2008). Procedural justice and trust: The link in the transformational leadership-organisational outcomes relationship. *International Journal of Leadership Studies*, 4(1), pp. 82-100.

Nuertey, D. (2015). *Sustainable supply chain management for Cocoa in Ghana.* Doctoral dissertation.

O'brien, R.M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality & Quantity*, 41(5), pp. 673-690.

Ofori-Amanfo, J. (2014). *Supply management capabilities and operations performance of UK manufacturing small and medium sized enterprises (SMEs)*. Doctoral dissertation, University of Leeds.

Oh, J. and Rhee, S.K. (2008). The influence of supplier capabilities and technology uncertainty on manufacturer-supplier collaboration: A study of the Korean automotive industry. *International Journal of Operations & Production Management*, 28(6), pp. 490-517.

Ojokuku, R.M., Odetayo, T.A. and Sajuyigbe, A.S. (2012). Impact of leadership style on organizational performance: a case study of Nigerian banks. *American Journal of Business and Management*, 1(4), pp. 202-207.

Osei-Assibey, E., Bokpin, G.A. and Twerefou, D.K. (2012). Microenterprise financing preference. *Journal of Economic Studies*, 39(1), pp. 84-105.

Oxford dictionary (2017). *Integrate*. Available at: https://en.oxforddictionaries.com/definition/integrate (Accessed: 12 December 2017).

Oxford dictionary (2018). *Regulation*. Available at: https://en.oxforddictionaries.com/definition/regulation (Accessed: 20 July 2018).

Paeleman, I. and Vanacker, T. (2015). Less is more, or not? On the interplay between bundles of slack resources, firm performance and firm survival. *Journal of Management Studies*, 52(6), pp. 819-848.

Pagell, M. (2004). Understanding the factors that enable and inhibit the integration of operations, purchasing and logistics. *Journal of Operations Management*, 22(5), pp. 459-487.

Pagell, M. and Shevchenko, A. (2014). Why research in sustainable supply chain management should have no future. *Journal of Supply Chain Management*, 50(1), pp. 44-55.

Pagell, M. and Wu, Z. (2009). Building a more complete theory of sustainable supply chain management using case studies of 10 exemplars. *Journal of Supply Chain Management*, 45(2), pp. 37-56.

Pagell, M. and Gobeli, D. (2009). How plant managers' experiences and attitudes toward sustainability relate to operational performance. *Production and Operations Management*, 18(3), pp. 278–299.

Pallant, J. (2010). *A step by step guide to data analysis using SPSS*, Berkshire UK: McGraw-Hill Education.

Paulraj, A. (2011). Understanding the relationships between internal resources and capabilities, sustainable supply management and organizational sustainability. *Journal of Supply Chain Management*, 47(1), pp.19-37.

Paulraj, A., Lado, A.A. and Chen, I.J. (2008). Inter-organizational communication as a relational competency: Antecedents and performance outcomes in collaborative buyer–supplier relationships. *Journal of Operations Management*, 26(1), pp. 45-64.

Petersen, K.J., Handfield, R.B. and Ragatz, G.L. (2005). Supplier integration into new product development: coordinating product, process and supply chain design. *Journal of Operations Management*, 23(3-4), pp. 371-388.

Pett, M. A., Lackey, N. R. and Sullivan, J. J. (2003). *Making sense of factor analysis: The use of factor analysis for instrument development in health care research.* Thousand Oaks, CA: Sage Publications.

Philips, J. (1981). Assessing measurement error in key informant reports: a methodological note on organizational analysis in marketing. *Journal of Marketing Research*, 8, pp. 395-415.

Pitman, G.A. and Sanford, J.P. (1994). The Foreign Corrupt Practices Act revisited: Attempting to regulate" ethical bribes" in global business. *Journal of Supply Chain Management*, 30(3), pp. 15.

Podsakoff, P.M., Mackenzie, S.B., Lee, J.-Y. and Podsakoff, N.P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), pp. 879.

Porter, M.F. (1980). An algorithm for suffix stripping. *Program*, 14(3), pp. 130-137.

Powell, T. (1995). TQM as competitive advantage: a review and empirical study. *Strategic Management Journal*, 16(1), pp. 15-37.

Prater, E., Biehl, M. and Smith, M.A. (2001). International supply chain agility-Trade-offs between flexibility and uncertainty. *International Journal of Operations & Production Management*, 21(5/6), pp. 823-839.

Preuss, L. (2005). Rhetoric and reality of corporate greening: a view from the supply chain management function. *Business Strategy and the Environment*, 14(2), pp. 123-39.

Pullman, M.E., Maloni, M.J. and Carter, C.G. (2009). Food for thought: social versusenvironmental sustainability programs and performance outcomes. *Journal of Supply Chain Management*, 45(4), pp. 38–54.

PwC (2013). *Next-generation supply chains, efficient, fast, and tailored*. Available at: https://www.cfoinnovation.com/next-generation-supply-chains-efficient-fast-and-tailored (Accessed: 15 January 2020).

PwC (2018). *Brexit: Implications for Pharma and Life Sciences companies*. Available at: www.pwc.co.uk › assets › brexit-for-pharma-and-is-global-flyer (Accessed: 15 January 2020)

Qi, Y., Zhao, X. and Sheu, C. (2011). The impact of competitive strategy and supply chain strategy on business performance: the role of environmental uncertainty. *Decision Sciences*, 42(2), pp. 371-389.

Ragatz, G. L., Handfield, R. B. and Petersen, K. J. (2002). Benefits Associated With Supplier Integration into New Product Development under Conditions of Technology Uncertainty. *Journal of Business Research*, 55, pp. 389-400.

Rahn, M. (2020). *Factor analysis: a short introduction, part 1.* Available at: https://www.theanalysisfactor.com/factor-analysis-1-introduction/#:~:text=In%20every%20factor%20analysis%2C%20there,factors%20as%20there%20are%20variables.&text=The%20eigenvalue%20is%20a%20measure,than%20a%20single%20observed%20variable (Accessed: 15 January 2020).

Rajeev, A., Pati, R.K., Padhi, S.S. and Govindan, K. (2017). Evolution of sustainability in supply chain management: A literature review. *Journal of Cleaner Production*, 162, pp. 299-314.

Rao, P. and Holt, D. (2005). Do green supply chains lead to competitiveness and economic performance? *International Journal of Operations & Production Management*, 25(9), pp. 898-916.

Reichhart, A. and Holweg, M. (2007). Creating the customer-responsive supply chain: a reconciliation of concepts. *International Journal of Operations & Production Management*, 27(11), pp. 1144-1172.

Ricci, M. T. (2006). *Revolution in the Pharmaceutical Supply Chain Drug Discovery & Development*.

Richey, R.G. Jr., Chen, H., Upreti, R., Fawcett, S.E. and Adams, F.G. (2009).The moderating role of barriers on the relationship between drivers to supply chain integration and firm performance. *International Journal of Physical Distribution & Logistics Management*, 39(10), pp. 826-840.

Rosenzweig, E. D., Roth, A.V. and Dean, J.W. Jr. (2003). The influence of an integration strategy on competitive capabilities and business performance: An exploratory study of consumer products manufacturers. *Journal of Operations Management*, 21, pp. 437–456.

Rossetti, C., Handfield, R. and Dooley, K. (2011). Forces, trends, and decisions in pharmaceutical supply chain management. *International Journal of Physical Distribution & Logistics Management*, 41(6), pp. 601-622.

Roy, R., Shehab, E., Tiwari, A., Baines, T.S., Lightfoot, H.W., Benedettini, O. and Kay, J.M. (2009). The servitization of manufacturing. *Journal of Manufacturing Technology Management*, 20(5), pp. 547-567.

Russo, M.V. and Fouts, P.A. (1997). A resource-based perspective on corporate environmental

performance and profitability. *Academy of Management Journal*, 40(3), pp. 534-559.
Sabath, R. (1995). Volatile demand calls for quick response: the integrated supply chain. *Logistics Information Management*, 8(2), pp. 49-52.
Santoso, T., Ahmed, S., Goetschalckx, M. and Shapiro, A. (2005). A stochastic programming approach for supply chain network design under uncertainty. *European Journal of Operational Research*, 167(1), pp. 96-115.
Sapienza, H.J. and Grimm, C.M. (1997). Founder characteristics, start-up process, and strategy/ structure variables as predictors of short line railroad performance. *Entrepreneurship Theory and Practice*, 22(1), pp. 5-25.
Sanders, N. R. (2008). Pattern of information technology use: the impact on buyer - suppler coordination and performance. *Journal of Operations Management*, 26(3), pp. 349-367.
Saunders, M. N. K., Saunders, M., Lewis, P. and Thornhill, A. (2011). *Research methods for business students*, 5TH Edition, Pearson Education India.
Scannell, T.V., Vickery, S.K. and Droge, C.L. (2000). Upstream supply chain management and competitive performance in the automotive supply industry. *Journal of Business Logistics*, 21(1), pp. 23.
Schneider, J. L., Wilson, A. and Rosenbeck, J. M. (2010). Pharmaceutical companies and sustainability: an analysis of corporate reporting. *Benchmarking: An International Journal*, 17, pp. 421-434.
Schoenherr, T. (2009). Logistics and supply chain management applications within a global context: an overview. *Journal of Business Logistics*, 30(2), pp. 1-25.
Schoenherr, T. and Swink, M. (2012). Revisiting the arcs of integration: Cross-validations and extensions. *Journal of Operations Management*, 30(1-2), pp. 99-115.
Scott, W.R. and Cole, R.E. (2000). *The quality movement and organization theory*. Sage Publications, Incorporated.
Seuring, S. and Müller, M. (2008). From a literature review to a conceptual framework for sustainable supply chain management. *Journal of Cleaner Production*, 16(15), pp. 1699-1710.
Shah, N. (2004). Pharmaceutical supply chains: key issues and strategies for optimisation. *Computers & Chemical Engineering*, 28(6-7), pp. 929-941.
Shah, N. (2005). Process industry supply chains: advances and challenges. *Computer & Chemical Engineering*, 29, pp. 1225–1235.
Shah, N., Samsatli, N. J., Sharif, M., Borland, J. N. and Papageorgiou, L. G. (2000). Modelling and optimisation for pharmaceutical and fine chemical process development. *American Institute of Chemical Engineers Symposium Series*, 323(96), pp. 31–45.
Shou, Y., Li, Y., Park, Y. and Kang, M. (2018). Supply chain integration and operational performance: the contingency effects of production systems. *Journal of Purchasing and Supply Management*, 24(4), pp. 352-360.
Shrivastava, P. (1995). Environmental technologies and competitive advantage. *Strategic Management Journal*, 16(S1), pp. 183-200.
Siggelkow, N. (2007). Persuasion with case studies. *Academy of Management Journal*, 50(1), pp. 20-24.
Silverman, D. (2011). *Qualitative Research*. 3rd Edition. London: Sage Publications.
Sisco, C., Chorn, B. and Pruzan-Jorgensen, P.M. (2011). *Supply chain sustainability: A practical guide for continuous improvement*. United Nations Global Compact.
Slater, S.F. and Narver, J.C. (1994). Does competitive environment moderate the market orientation-performance relationship? *The Journal of Marketing*, pp. 46-55.
Sloan, T.W. (2010). Measuring the Sustainability of Global Supply Chains: Current Practices and Future Directions. *Journal of Global Business Management*, 6(1), pp. 92-107.
Song, Y., Cai, J. and Feng, T. (2017). The influence of green supply chain integration on firm performance: A contingency and configuration perspective. *Sustainability*, *9*(5), pp. 763.
Souder, W.E., Sherman, J.D. and Davies-Cooper, R**.** (1998). Environmental uncertainty, organizational integration, and new product development effectiveness: a test of contingency theory. *Journal of Product Innovation Management*, 15, pp. 520-533.
Sousa, R. and Voss, C.A. (2008). Contingency research in operations management practices. *Journal of Operations Management*, 26(6), pp. 697-713.

Sousa, R. and Voss, C. (2002). Quality management re-visited: a reflective review and agenda for future research. *Journal of Operations Management*, 20(1), pp. 91-109.

Sposito, V.A., Hand, M.L. and Skarpness, B. (1983). On the efficiency of using the sample kurtosis in selecting optimal estimators. *Communications in Statistics-simulation and Computation*, 12(3), pp. 265-272.

Srinivasan, M., Mukherjee, D. and Gaur, A.S. (2011). Buyer–supplier partnership quality and supply chain performance: Moderating role of risks, and environmental uncertainty. *European Management Journal*, 29(4), pp. 260-271.

Stank, T.P., Keller, S.B. and Closs, D.J. (2001). Performance benefits of supply chain logistical integration. *Transportation Journal*, pp. 32-46.

Statisticssolutions (2020a). *Factor analysis*. Available at: https://www.statisticssolutions.com/factor-analysis-sem-factor-analysis/ (Accessed: 12 November 2019).

Statisticssolutions (2020b). *Confirmatory factor analysis*. Available at: https://www.statisticssolutions.com/confirmatory-factor-analysis/ (Accessed: 12 November 2019).

Statswiki (2020). *Confirmatory factor analysis*. Available at: http://statwiki.kolobkreations.com/index.php?title=Confirmatory_Factor_Analysis (Accessed: 12 November 2019).

Stevenson, M. and Spring, M. (2007). Flexibility from a supply chain perspective: definition and review. *International Journal of Operations & Production Management*, 27(7), pp. 685-713.

Stock, G.N., Greis, N.P. and Kasarda, J.D. (2000). Enterprise logistics and supply chain structure: the role of fit. *Journal of Operations Management*, *18*(5), pp. 531-547.

Suansawat, R. (2013). *The influence of supply chain integration and green supply chain management practices on sustainable firm performance in Thai manufacturing industry*. Doctoral dissertation, University of Hull.

Sulaiman, I. and Boachie-Danquah, B. (2017). *Ghana's Mergers & Acquisitions Report 2017*. Available at: https://drive.google.com/file/d/0B8S7ODNbOsDZSDRqdDBfR0RhbUE/view (Accessed: 2 February 2020).

Sun, R.Y. (2002). *The relationship among the leadership style, organizational culture and organizational effectiveness based on competing value framework: An empirical study for the institute of technology in Taiwan.* Doctoral dissertation, National Taipei University, Taipei, Taiwan.

Sutcliffe, K.M. and Zaheer, A. (1998). Uncertainty in the transaction environment: an empirical test. *Strategic Management Journal*, 19(1), pp. 1-23.

Swink, M., Narasimhan, R. and Wang, C. (2007). Managing beyond the factory walls: effects of four types of strategic integration on manufacturing plant performance. *Journal of Operations Management*, 25(1), pp. 148-164.

Tan, J. and Peng, M.W. (2003). Organizational slack and firm performance during economic transitions: two studies from an emerging economy. *Strategic Management Journal*, 24(13), pp. 1249-1263.

Taylor, J. (2001). Recommendations on the control and monitoring of storage and transportation temperatures of medicinal products. *Pharmaceutical Journal*, 267, pp. 128-31.

Taylor, J., Munro, G., Lee, G. and McKendrick, A. (2006). Good manufacturing practice and good distribution practice: an analysis of regulatory inspection findings for 2004–05. *Pharmaceutical Journal*, 270, pp. 127-9.

Teddlie, C. and Tashakkori, A. (2009). *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioral sciences*. Sage Publications.

Teece, D.J., Pisano, G. and Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), pp. 509-533.

Thierry, M., Salomon, M., Van Nunen, J. and Van Wassenhove, L. (1995). Strategic issues in product recovery management. *California Management Review*, 37(2), pp. 114-136.

Torjman, S. (2000). *The social Dimension of Sustainable Development*. Available at: http://citeseerx.ist.psu.edu/viewdoc/summary (Accessed: 9 February 2018).
Tran, K.T., Nguyen, P.V. and Nguyen, L.M. (2018). The Role of Financial Slack, Employee Creative Self-Efficacy and Learning Orientation in Innovation and Organizational Performance. *Administrative Sciences*, 8(4), pp. 82.
Tuma, M. (2005). *The European pharmaceutical wholesale industry: Structure, trends and socio-economic importance*. Institute for Pharma-economic Research.
Turner, W. (1994). Sleaze and how to bust it: Different forms of corruption. *Purchasing and Supply Management*, pp. 17-17.
UK Trade and Investment (2013). *UK stratified medicine*. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/301775/UK_Stratified_Medicine.pdf (Accessed: 24 September 2018).
UKGOV (2012). *Mid-sized Businesses*. Available at: https://www.gov.uk/government/collections/mid-sized-businesses (Accessed: 20 July 2018).
UKGOV (2017). *Medicines and Healthcare products Regulatory Agency Annual Report and Accounts 2016/17*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/630517/MHRA_Annual_Report_and_Accounts_16-17.pdf (Accessed: 20 July 2018).
UN (1987). *Report of the world commission on environment and development: Our common future*. United Nations General Assembly, Development and International Co-operation: Environment.
USAID (United States Agency for International Development) (2011). *Using last mile distribution to increase access to health commodities*. Arlington, VA: USAID DELIVER Project.
Van der Vaart, T. and van Donk, D.P. (2008). A critical review of survey-based research in supply chain integration. *International journal of production economics*, 111(1), pp. 42-55.
Van der Vorst, J.G. and Beulens, A.J. (2002). Identifying sources of uncertainty to generate supply chain redesign strategies. *International Journal of Physical Distribution & Logistics Management*, 32(6), pp. 409-430.
Vanpoucke, E., Vereecke, A. and Muylle, S. (2017). Leveraging the impact of supply chain integration through information technology. *International Journal of Operations & Production Management*, 37(4), pp. 510-530
Vanpoucke, E., Vereecke, A. and Wetzels, M. (2014). Developing supplier integration capabilities for sustainable competitive advantage: A dynamic capabilities approach. *Journal of Operations Management*, 32(7-8), pp. 446-461.
Vereecke, A. and Muylle, S. (2006). Performance improvement through supply chain collaboration in Europe. *International Journal of Operations & Production Management*, 26(11), pp. 1176-1198.
Vickery, S.K., Jayaram, J. and Calantone, R. (2003). The effects of an integrative supply chain strategy on customer service and financial performance: an analysis of direct versus indirect relationships. *Journal of Operations Management*, 21(5), pp. 523-539.
Vogler, S., Habl, C., Leopold, C. and Rosian-Schikuta, I. (2010). *PPRI Report*. Available at: http://ec.europa.eu/health/ph_projects/2004/action1/docs/action1_2004_frep_05_en.pdf (Accessed: 25 October 2018).
Voss, C. (1995). Alternative paradigms for manufacturing strategy. *International Journal of Operations & Production Management*, 15(4), pp. 5-16.
Waddock, S.A., Bodwell, C. and Graves, S.B. (2002). Responsibility: The new business imperative. *Academy of Management Perspectives*, 16(2), pp. 132-148.
Wagner, S.M., Grosse-Ruyken, P.T. and Erhun, F. (2012). The link between supply chain fit and financial performance of the firm. *Journal of Operations Management*, *30*(4), pp. 340-353.
Walliman, N. (2011). *Your research project: Designing and planning your work*. Sage Publications.
Ward, P.T. and Duray, R. (2000). Manufacturing strategy in context: environment, competitive strategy and manufacturing strategy. *Journal of Operations Management*, 18(2), pp. 123-138.

Welford, R. and Frost, S. (2006). Corporate social responsibility in Asian supply chains. *Corporate Social Responsibility and Environmental Management,* 13, pp. 166-176.

West, S.G., Finch, J.F. and Curran, P.J. (1995). *Structural equation models with non-normal variables: Problems and remedies.* Sage Publications.

Wiengarten, F., Humphreys, P., McKittrick, A. and Fynes, B. (2013). Investigating the impact of e-business applications on supply chain collaboration in the German automotive industry. *International Journal of Operations & Production Management*, 33(1), pp. 25-48.

Wiengarten, F., Li, H., Singh, P.J. and Fynes, B. (2019). Re-evaluating supply chain integration and firm performance: linking operations strategy to supply chain strategy. *Supply Chain Management: An International Journal*, 24(4), pp. 540-559.

Wiengarten, F., Pagell, M., Ahmed, M.U. and Gimenez, C. (2014). Do a country's logistical capabilities moderate the external integration performance relationship? *Journal of Operations Management*, 32(1-2), pp. 51-63.

Williams, B.D., Roh, J., Tokar, T. and Swink, M. (2013). Leveraging supply chain visibility for responsiveness: The moderating role of internal integration. *Journal of Operations Management*, 31(7-8), pp. 543-554.

Wirtz, V.J., Hogerzeil, H.V., Gray, A.L., Bigdeli, M., de Joncheere, C.P., Ewen, M.A., Gyansa-Lutterodt, M., Jing, S., Luiza, V.L., Mbindyo, R.M. and Möller, H. (2017). Essential medicines for universal health coverage. *The Lancet*, *389*(10067), pp. 403-476.

Wolf, J. (2011). Sustainable supply chain management integration: a qualitative analysis of the German manufacturing industry. *Journal of Business Ethics*, 102(2), pp. 221-235.

Wong, C. Y., Boon-itt, S. and Wong. C. W. Y. (2011). The contingency Effects of Environmental Uncertainty on the Relationship between Supply Chain Integration and Operational Performance. *Journal of Operations Management,* 29, pp. 604–615.

Wong, C.W. (2013). Leveraging environmental information integration to enable environmental management capability and performance. *Journal of Supply Chain Management*, 49(2), pp. 114-136.

Wong, C.W., Kee-Hung Lai, Y. and Cheng, T. C. E. (2009). Complementarities and alignment of information systems management and supply chain management. *International Journal of Shipping and Transport Logistics*, 1(2), pp. 156-171.

Wong, C.W., Lai, K.H. and Ngai, E.W.T. (2009). The role of supplier operational adaptation on the performance of IT-enabled transport logistics under environmental uncertainty. *International Journal of Production Economics*, 122(1), pp. 47-55.

Wong, C.W., Sancha, C. and Thomsen, C.G. (2017). A national culture perspective in the efficacy of supply chain integration practices. *International Journal of Production Economics*, 193, pp. 554-565.

Wong, C.W., Wong, C.Y. and Boon-itt, S. (2013). The combined effects of internal and external supply chain integration on product innovation. *International Journal of Production Economics*, 146(2), pp. 566-574.

Wong, C.Y. and Boon-Itt, S. (2008). The influence of institutional norms and environmental uncertainty on supply chain integration in the Thai automotive industry. *International Journal of Production Economics*, 115(2), pp. 400-410.

Wood, G. (1995). Ethics at the purchasing/sales interface: an international perspective. *International Marketing Review*, *12*(4), pp. 7-19.

World Commission on Environment and Development (WCED) (1987*). Our Common Future.* Oxford University Press, New York.

World Health Organisation (WHO) (2006). *Regional workshop on improving procurement & supply management systems in the African region*.

Wouters, O.J., Kanavos, P.G. and McKee, M. (2017). Comparing generic drug markets in Europe and the United States: prices, volumes, and spending. *The Milbank Quarterly*, 95(3), pp. 554-601.

Wu, F., Yeniyurt, S., Kim, D. and Cavusgil. S. T. (2006). The Impact of Information Technology on Supply Chain Capabilities and Firm Performance: A Resource-based View. *Industrial Marketing Management*, 35(4), pp. 493-504.

Wu, P., Gao, L., Chen, Z. and Li, X. (2016). Managing reputation loss in China: in-depth analyses of financial restatements. *Chinese Management Studies*, 10(2), pp. 312-345.

Wu, Z. and Pagell, M. (2011). Balancing priorities: Decision-making in sustainable supply chain management. *Journal of Operations Management*, 29(6), pp. 577-590.

Xie, Y. and Breen, L. (2012). Greening community pharmaceutical supply chain in UK: a cross boundary approach. *Supply Chain Management: An International Journal*, 17(1), pp. 40-53.

Yadav, P. (2015). Health product supply chains in developing countries: diagnosis of the root causes of underperformance and an agenda for reform. *Health Systems & Reform*, 1(2), pp. 142-154.

Yadav, P. and L. Smith. (2012). Pharmaceutical company strategies and distribution systems in emerging markets. *Elsevier Encyclopedia on Health Economics*, 3, pp. 1-8.

Yeung, K., Lee, P.K., Yeung, A.C. and Cheng, T.C.E. (2013). Supplier partnership and cost performance: The moderating roles of specific investments and environmental uncertainty. *International Journal of Production Economics*, 144(2), pp. 546-559.

Yin, R. K. (2002). *Case Study Research: Design and Methods*, 3rd Edition, 5, Sage Publications, Thousand Oaks, CA.

Yin, R.K. (1994). *Case Study Research: Design and Methods*, Sage, Beverly Hills, CA.

Ying, L. (2006). *Supply chain flexibility: Antecedents, driving force impacts on performance*. Doctoral dissertation, University of Toledo.

Yu, W., Chavez, R., Jacobs, M., Wong, C.Y. and Yuan, C. (2019). Environmental scanning, supply chain integration, responsiveness, and operational performance. *International Journal of Operations & Production Management*. 39(5), pp. 787-814.

Yu, W., Jacobs, M.A., Chavez, R. and Feng, M. (2017). The impacts of IT capability and marketing capability on supply chain integration: a resource- based perspective. *International Journal of Production Research*, 55(14), pp. 4196-4211.

Yu, W., Jacobs, M.A., Salisbury, W.D. and Enns, H. (2013). The effects of supply chain integration on customer satisfaction and financial performance: An organizational learning perspective. *International Journal of Production Economics*, 146(1), pp. 346-358.

Yu, X., Shi, Y. and Yu, M. (2014). *The dilemma of Chinese pharmaceutical market*. Australian Centre for Economic Research on Health (ACERH), Australian National University. Canberra ACT 0200, Australia.

Zhang, M. and Huo, B. (2013). The impact of dependence and trust on supply chain integration. *International Journal of Physical Distribution & Logistics Management*, 43(7), pp. 544-563.

Zhao, G., Feng, T. and Wang, D. (2015). Is more supply chain integration always beneficial to financial performance? *Industrial Marketing Management*, 45, pp. 162-172.

Zhao, X., Huo, B., Selend, W. and Yeung, J. (2011). The impact of internal integration and relationship commitment on external integration. *Journal of Operations Management*, 29, pp. 17-32.

Zhao, X., Wang, P. and Pal, R. (2020). The effects of agro-food supply chain integration on product quality and financial performance: Evidence from Chinese agro-food processing business. *International Journal of Production Economics*, doi: 10.1016/j.ijpe.2020.107832 (Accessed: 20 August 2020).

Zhou, K.Z. (2006). Innovation, imitation, and new product performance: The case of China. *Industrial Marketing Management*, 35(3), pp. 394-402.

Zhu, D.H., Sun, H. and Chang, Y.P. (2016). Effect of social support on customer satisfaction and citizenship behavior in online brand communities: The moderating role of support source. *Journal of Retailing and Consumer Services*, 31, pp. 287-293.

Zhu, Q., Geng, Y. and Lai, K.H. (2010). Circular economy practices among Chinese manufacturers varying in environmental-oriented supply chain cooperation and the performance implications. *Journal of Environmental Management*, 91(6), pp. 1324-1331.

Zhu, Q., Krikke, H. and Caniels, M.C. (2018). Supply chain integration: value creation through managing inter-organizational learning. *International Journal of Operations & Production Management*, 38(1), pp. 211-229.

Zhu, Q., Sarkis, J. and Lai, K.H. (2007). Green supply chain management: pressures, practices and performance within the Chinese automobile industry. *Journal of Cleaner Production*, 15(11-12), pp. 1041-1052.

Zhu, Q.H., Sarkis, J. and Geng, Y. (2005). Green supply chain management in China: pressures, practices and performance. *International Journal of Operations & Production Management*, 25(5-6), pp. 449-68.

APPENDICES

Appendix A: key reviewed papers supporting thesis gaps

***Table A*: key reviewed papers supporting thesis gaps**

Author(s)	Scope	Industry	Methodology	Key terms	Journal	Country scope	Theory	Unit of Analysis	Dimension (CI, SI, II)
Frohlich and Westbrook (2001)	Integration, Operational performance	Manufacturing (Fabricated metals)	Quantitative	Coordination, Aligning seamlessly (integration)	JOM	Global except Africa		Firm level	CI, SI,
Wong et al. (2013)	Integration, Innovation performance,	Manufacturing	Quantitative	Supply chain configuration, Innovation performance,	IJPE	Thailand	Ambidexterity	Firm level	CI, SI, II
Yu et al. (2017)	Marketing, Integration	Manufacturing	Quantitative	Capability, Supply chain performance, IT, Capabilities coordination,	IJPR	China	Resource-Based-View (RBV)	Firm level	CI, SI, II
Rosenzweig et al. (2003)	Integration, Performance	Manufacturing (consumer product manufacturers)	Quantitative (survey)	Competitive capabilities ,Coordination / alignment	JOM	Global (vision in manufacturing)		Firm level	CI, SI, II
Kim (2009)	Integration, Performance	Manufacturing	Quantitative (survey)	Competitive capabilities, Coordination / alignment	IJPE	Korea and Japan	RBV, Resource dependency	Firm level	CI, SI, II
Flynn et al. (2010)	Integration, Performance	Manufacturing	Quantitative (survey)	Coordination, Aligning, Configuration	JOM	China	Contingency, configuration	Firm level	CI, SI, II
Wong et al. (2017)	National culture, Integration, Performance	Manufacturing	Quantitative (survey)	National culture, Moderation, Capabilities,	IJPE	International Manufacturing Strategy Survey	Contingency, RBV	Firm level	CI, SI, II

				Collectivism, Partnership		(IMSS) (2013) (22 countries)			
Song et al. (2017)	Sustainability, Integration	Manufacturing (food, textile, pharmaceuticals etc)	Quantitative (survey)	Firm size, Green external integration, Firm performance, Moderating effects.	Sustainability	China	Contingency, RBV	Firm level	CI, SI, II
Yu et al. (2013)	Integration, Financial performance	Manufacturing	Quantitative (survey)	External integration, Supply chain performance,	IJPE	China	Organisational learning	Firm level	CI, SI, II
Vanpoucke et al. (2017)	Integration, Performance	Manufacturing	Quantitative (survey, International Manufacturing Strategy Survey)	Information exchange, Operational Integration	International Journal of Operations and Production Management	Global (International Manufacturing Strategy Survey was used)		Firm level	CI, SI
Li et al. (2016)	Green sustainability, Integration, Performance	Manufacturing (fashion)	Quantitative (database of Thomson Reuters Knowledge)	Green sustainability, Integration	Journal of Cleaner Production			Firm level	SI, II
Zhao et al. (2015)	Integration, Performance	Manufacturing	Quantitative (survey)	Performance, Supplier, customer and internal integration	Industrial Marketing Management	China	RBV, Transaction cost economics	Firm level	CI, SI, II
Danese and Romano (2011)	Partnership, Integration, Performance	Manufacturing	Quantitative (Used 2007 High Performance Manufacturing (HPM) data)	Performance, Supplier, customer and internal integration, Interaction effects	Supply Chain Management: An International Journal			Firm level	CI, SI

Schoenherr and Swink (2012)	Arcs of integration, Performance	Manufacturing, distribution and retail firms (multi country)	Quantitative (survey, from SCM professionals)	Arcs of integration, performance	JOM	Multi country /Multi Industry (Review)	RBV, Information processing theory, Relational view theory	Firm level	CI, SI, II
Van der Vaart and van Donk (2008)	Survey-based integration, Performance measurement	Multi-Industry	Literature review (2000-2008 SCM, OM/OR Journals)	Survey-based integration, Performance measurement	IJPE	Multi country /Multi Industry (Review)	N/A	Firm level	CI, SI, II
Alfalla-Luque et al. (2013)	Performance and performance measurement , Integration	Multi-Industry	Literature review	Dimensions, Variables of SCI, Performance	Production planning and Control: The Management of Operations	Multi country /Multi Industry (Review)	N/A	Firm level	CI, SI, II
Lee et al. (2007)	Information technology, Integration, Performance	Manufacturing (those that use SCI as a key topmost strategic tool)	Quantitative (survey)	Supply chain partners reliability, Performance, Cost containment, Supplier and customer integration	Supply Chain Management: An International Journal	USA		Firm level	CI, SI, II
Naslund and Hulthen (2012)	Integration, Performance	Multi-Industry	Literature review		Benchmarking ; An internal Journal	Multi country /Multi Industry (Review)	N/A	Firm level	CI, SI, II
Wagner et al. (2012)	Supply chain fit, Performance, Operations strategy	Multi-Industry	Quantitative (survey)	Supply chain fit, Performance, Uncertainty, Supply and demand, Responsiveness, Efficiency	JOM	USA and Europe	Product-process matrix	Firm level	CI, SI, II

Fynes et al. (2004)	Integration quality, Performance	Manufacturing (Electronics)	Quantitative (survey)	Integration quality, Uncertainty,	Journal of Purchasing & Supply Management	Ireland	Contingency theory	Firm level	CI, SI, II
Zhao et al. (2011)	Relationship commitment integration, Ownership	Manufacturing	Quantitative (survey)	Relationship commitment, Internal and external integration, Ownership, Collectivism culture and Individualistic culture	JOM	China	Contingency theory	Firm level	CI, SI, II
Wong et al. (2011)	Sustainability , Integration	Manufacturing (Automotive)	Quantitative (survey)	Environmental uncertainty, Supply chain integration, Performance	JOM	Thailand	Contingency theory, Organisational information processing theories, Resource dependency theory	Firm level	CI, SI, II
Liu et al. (2016)	Information technology, Integration, Performance	Manufacturing	Quantitative (survey)	IT competence, Supply chain integration, Resource orchestration theory	JOM	China	Contingency and Configuration theory	Firm level	CI, SI, II
Cao and Zhang (2011)	Sustainability Collaboration Performance	Manufacturing (Multi-Industry)	Quantitative (survey)	Supply chain collaboration, Performance, Information sharing	JOM	USA	Transaction cost economies, RBV, Relational view	Firm level	CI, SI
Gligor et al. (2015)	Sustainability (uncertainty), Collaboration	Multi-Industry (Manufacturing, retail,	Quantitative (Survey, used archival data	Supply chain agility, Environmental	JOM	USA	RBV	Firm level (Senior	CI, SI,

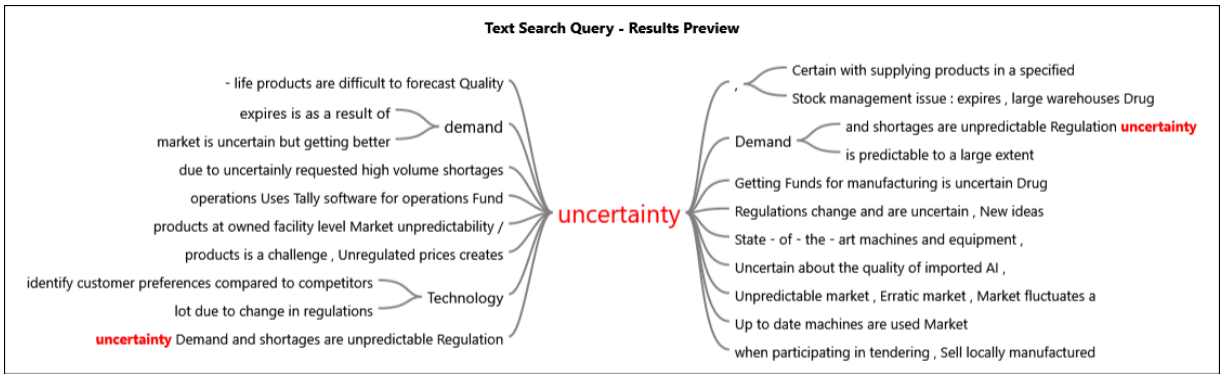
	, Performance	transport service providers)	from the compustat database)	uncertainty, Performance				level manager s only)	
Swink et al. (2007)		Manufacturing	Quantitative (survey)		JOM			Firm level	CI, SI, II
Williams et al. (2013)	Integration, Performance, Informtion visibility	Multi-Industry	Quantitative (survey)	Information processing capabilities, Globalisation, Responsivenes, Leverage, Internal integration	JOM	Global survey of supply chain progress and research methods	Organizationa l information processing theory	Firm level	CI, SI, II
Wiengarten et al. (2014)	Integration, Performance, Informtion visibility, Global competition	Manufacturing	Quantitative (survey)	Moderation, Logistical capabilities, External integration,	JOM	International Manufacturing Strategy Survey (IMSS) (2009) (19 countries, Asia, North America, Europe)	RBV, Contingency	Firm level	CI, SI

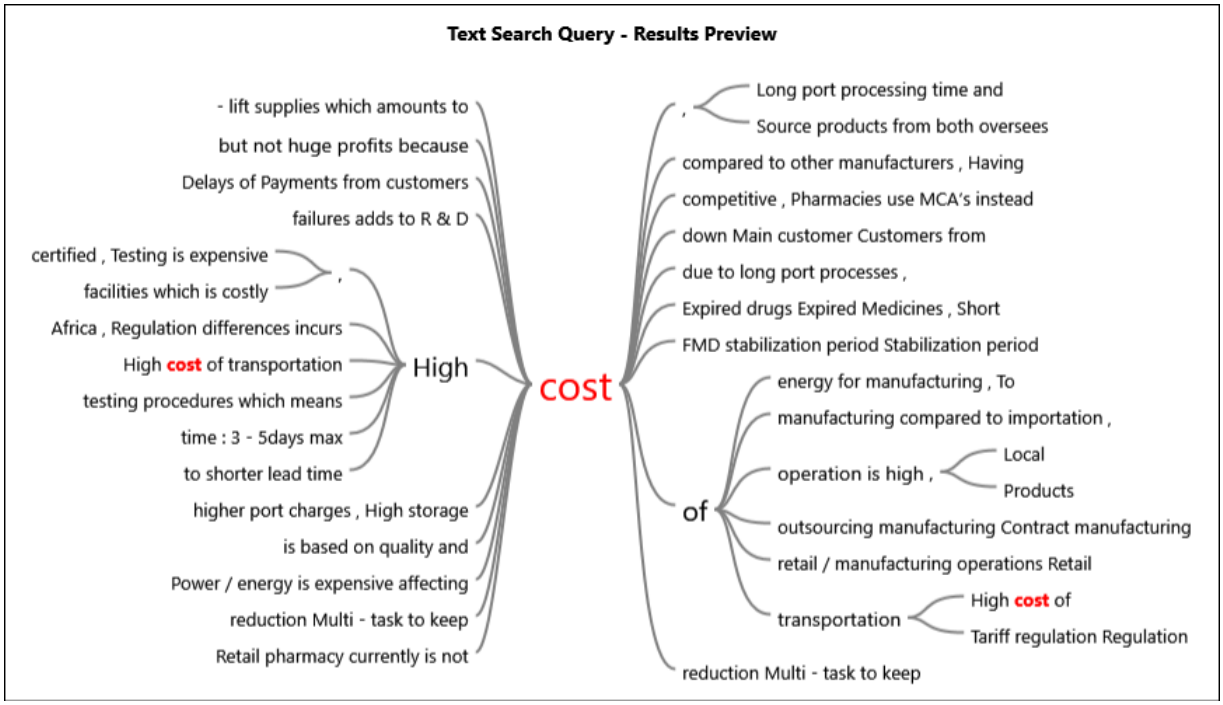
Note: Dimension; CI- customer Integration, SI- supplier integration, II- internal integration.
JOM: Journal of Operations Management
IJPE: International Journal of Production Economics
IJPR: International Journal of Production Research
IJOPM: International Journal of Operations and Production Management

Appendix B: Additional qualitative models from Nvivo 12

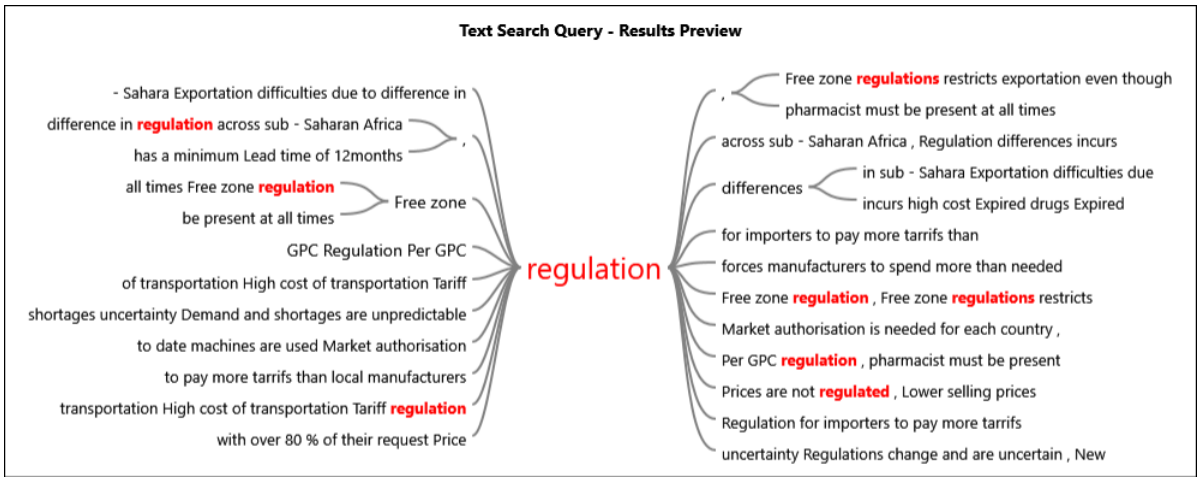
The explanation for figures in Appendix B: the figures give a descriptive idea of what the key terms in the transcript were specifically referring to. Thus, it shows in a verbatim form, numerous examples of sentences in the transcript having the *keyword (e.g. uncertainty)* mentioned just to give a general description of what the keyword was specifically explaining. The keywords used for the search in Nvivo are highlighted in red and showed in the middle of each figure.

Figure B: **Examples of text search (with the stemmed word) using key variables identified from the interview transcription**






Text Search Query - Results Preview
in collapsing retail pharmacies and shares profit
products are expensive because of the quality
temperature controlled , Storage facilities are well controlled
well known locally Pharma operation models VMI
what sells us not what we import
,
bill customers and for forecast Quality RX
environmental practices is not a requirement , Good
shelf - life products are difficult to
used to bill customers and for
forecast
get contaminated during mode of transport Product
India , Local customers use brand to assure
is expensive Competitive advantage Brand name and
quality identification , Products from Europe perceived
when all necessary process is followed ,
more
packaging , and delivery is the hallmark Quality
Proper disposal is costly and time consuming
Quality , packaging , and delivery is the hallmark
quality Drug sourcing Sourcing is based on
Quality Identification Brand name is used for
our products are expensive because of
to forecast Quality uncertainty Uncertain about
the
quality
packaging , and delivery is the hallmark Quality
Quality is expensive , Sometimes air - lift supplies
,
cost , Source products from both oversees
and
ethics is a requirement Cheap price
Contamination is likely to occur due to
Drug sourcing Sourcing is based on quality
, Products from Europe perceived more quality
Identification
Brand name is used for quality
achieved when all necessary process is
is
expensive , Sometimes air - lift supplies which
our competitive advantage , What we manufacture
issues are mostly associated with coaching products ,
of imported AI , Excipients sometimes get contaminated
product work effectively compared to similar products ,
Quality issues are mostly associated with coaching
: invests in collapsing retail pharmacies and
and PBM VMI Operation model VMI :
RX
is also to own all products
Quality RX : invests in collapsing retail
to hat of china o India , Local
uncertainty Uncertain about the quality of imported


Text Search Query - Results Preview
- Sahara Exportation difficulties due to difference in
difference in regulation across sub - Saharan Africa
has a minimum Lead time of 12months
,
all times Free zone regulation
be present at all times
Free zone
GPC Regulation Per GPC
of transportation High cost of transportation Tariff
shortages uncertainty Demand and shortages are unpredictable
to date machines are used Market authorisation
to pay more tarrifs than local manufacturers
transportation High cost of transportation Tariff regulation
with over 80 % of their request Price
regulation
Free zone regulations restricts exportation even though
,
pharmacist must be present at all times
across sub - Saharan Africa , Regulation differences incurs
in sub - Sahara Exportation difficulties due
differences
incurs high cost Expired drugs Expired
for importers to pay more tarrifs than
forces manufacturers to spend more than needed
Free zone regulation , Free zone regulations restricts
Market authorisation is needed for each country ,
Per GPC regulation , pharmacist must be present
Prices are not regulated , Lower selling prices
Regulation for importers to pay more tarrifs
uncertainty Regulations change and are uncertain , New

Appendix C: Survey questionnaire

QUESTIONNAIRE FOR ALL PHARMACEUTICAL PLAYERS

Topic: Understanding the supply chain integration - supply chain sustainability relationship: a study of the UK and Ghana pharmaceutical industry

Section A: Background information

Gender:

- Male
- Female
- Prefer not to say
- Others

Highest level of education achieved:

- Bachelor's degree
- Master's degree
- PhD
- Others

Level of Job Title / Position:

- Top-level management
- Middle-level management
- Low-level management
- Other

Which of the following best classifies your company:

- Raw material supplier only
- Manufacturing only
- Manufacturing and Distribution
- Manufacturing, Distribution and Retail
- Wholesale only
- Wholesale and Distribution
- Wholesale, Distribution and Retail
- Distribution only
- Retail only

How long you have worked at present organisation:

- Under 1 year
- 1 - 5years
- 6 - 10years
- 11 - 15years
- 16 years and above

Number of employees

- 1 – 250 *(UK companies)*
- 251 and above *(UK companies)*
- 1 – 30 *(Ghana companies)*
- 31 and above *(Ghana companies)*

Annual turnover

- Less than £25m
- More than £25m

Firm Ownership

- State owned
- Private owned
- Public owned

Section B

1. Supply Chain Integration

In this sub-section we assess the extent to which a manufacturer collaborates with its supply chain partners and manages processes within their organization and with other organizations.

Please indicate the extent of integration or information sharing between your organization and your major supplier in the following areas (1 = not at all; 7 = extensive).

Share information to our major suppliers through information technologies
Have a high degree of strategic partnership with suppliers
Have a high degree of joint planning to obtain rapid response ordering process (inbound) with suppliers
Our suppliers provide information to us in the production and procurement processes
Our suppliers are involved in our product development processes

Please indicate the degree of integration in the following areas (1 = not at all; 7 = extensive).

Please Note:
1. For manufacturing companies: plant in this section means a manufacturing site
2. For wholesalers and distributors: plant in this section means a warehouse/distribution centre
3. For retailers: plant in this section means a retail store

Have a high level of responsiveness within our plant to meet other department's needs
Have an integrated system across functional areas under plant control
Within our plant, we emphasize on information flows among purchasing, inventory management, sales, and distribution departments
Within our plant, we emphasize on physical flows among production, packing, warehousing, and transportation departments
The utilization of periodic interdepartmental meetings among internal functions

Please indicate the extent of integration or information sharing between your organization and your major customer in the following areas (1 = not at all; 7 = extensive).

Have a high level of information sharing with major customers about market information
Share information to major customers through information technologies
Have a high degree of joint planning and forecasting with major customers to anticipate demand visibility
Our customers provide information to us in the procurement and production processes
Our customers are involved in our product development processes

2. Supply Chain Sustainability

Here we assess the management of social, environmental and economic activities and the encouragement of good practices among workers and throughout the lifecycle of goods and services

Please indicate the degree to which you agree to the following statements concerning your company's performance with respect to your major customer (1 = strongly disagree; 7 = strongly agree).

Our company can quickly modify products to meet our major customer's requirements.
Our company can quickly introduce new products into the market.
Our company can quickly respond to changes in market demand.
Our company has an outstanding on-time delivery record to our major customer.
The lead time for fulfilling customers' orders (the time which elapses between the receipt of customer's order and the delivery of the goods) is short.
Our company provides a high level of customer service to our major customer.

Please evaluate your company's performance in the following areas relative to your primary/ major competitors (1 = much worse; 7 = much better).

Growth in sales
Return on sales
Growth in profit
Growth in market share
Return on investment (ROI)

Please evaluate your company's performance in the following areas relative to your primary/ major competitors (1 = much worse; 7 = much better).

Improvement in overall stakeholder welfare or betterment
Improvement in community health and safety
Reduction in environmental impacts and risks to general public
Improvement in occupational health and safety of employees
Improved awareness and protection of the claims and rights of people in community served
Employees receive periodic training

Please evaluate your company's performance in the following areas relative to your primary/ major competitors (1 = much worse; 7 = much better).

Reduction of waste water
Reduction of solid wastes
Reduction in air emission
Decrease in consumption for hazardous/harmful/toxic materials

Decrease in frequency for environmental accidents
Improve a company's environmental situation
Increase in energy saved due to conservation and efficiency improvements
Decrease in improper drug disposal
Decrease in improper solid/liquid wastes disposal

3. External Uncertainty

Here we assess the level to which firm's external environment is characterized by absence of pattern, unpredictability and unexpected change.

Please evaluate your company's performance in the following areas relative to your primary/ major competitors, customers and suppliers (Seven point Likert scale,1= extremely low; 7=extremely high)

Our customers often change their order over the month
Our supplier's performance is unpredictable
Competitors' actions regarding marketing promotions are unpredictable
Our plant uses core production technologies that often change
Process technologies employed in plants are complex
Core product technologies often change
Regulations often change
Product prices often change

4. Product Innovation

Here we assess the development of new products, changes in design of established products, or use of new materials or components in manufacture of established products.

Please indicate the degree to which you agree to the following statements concerning your company's performance with respect to your major customer (1 = strongly disagree; 7 = strongly agree).

Respond well to customer need for "new" product features
Develop unique product features to our customer needs
Develop new product features into the market quickly
Develop new product features to our customers
Change product offered to meet customers' needs

5. Leadership style

Here we assess the manner and approach of how people are provided with direction, motivated and how plans are implemented.

Please evaluate your company's performance in the following areas relative to your primary/ major supervisor (seven-point Likert scale, 1 strongly disagree - 7 strongly agree)

My supervisor asks me to obey his/her instructions completely
My supervisor determined all decisions in the organization whether they are important or not
My supervisor always has the last say in the meeting
My supervisor always behaves in a commanding fashion in front of employees
My supervisor exercises strict discipline over subordinates

6. Resource Constraint

In this sub-section we assess the limitations on staffing, finance, equipment and other resources that are necessary to complete a project.

Please evaluate your company's performance in the following areas relative to your primary/ major competitors (Seven point Likert scale, 1= much worse – 7=much better)

Lack of qualified personnel
The firm has a satisfactory financial position currently
The firm is easy to access financial capital to support our market operations
The firm can secure the necessary funds if needed

7. Patient satisfaction

Here we assess the extent to which a patient is content with the pharmaceutical product and service which they received from their health care provider.

Please evaluate your company's performance in the following areas relative to your primary/ major competitors (seven-point Likert scale, 1=much worse to 7=much better)

Our customers are pleased with the products and services we provide for them
Our overall customer satisfaction levels increased
Our after-sales service satisfaction levels increased
Our customers stated expectations are exceeded
Customer standards are always met by our plant