The Influence of Supply Chain Risk Management Practices on Supply Chain Performance: The Case of Selected Pharmaceutical Manufacturing Firms in Ethiopia.

By

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Advisor

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Declaration

I, the undersigned, declare that this Master's thesis entitled "The influence Supply Chain Risk Management Practices on Supply Chain Performance: In the case of selected pharmaceutical manufacturing firms in Ethiopia" is submitted in partial fulfilment of the requirements for the degree of Masters of Arts in Logistics and Supply Management at the School of Commerce, Addis Ababa University. The thesis is my original work and has not been presented for a degree in any other university and all sources of materials used for the thesis have been duly acknowledged.

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Certification

This is to certify that Neguse Sime W/Melak has carried out this research work on the topic entitled "The Influence of Supply Chain Risk Management Practice on Supply Chain Performance: The case of Selected Pharmaceutical Manufacturing Firms" under my supervision. This work is original in nature and it can be submitted for the partial fulfillment of the requirements for the award of the degree of Masters of Arts in Logistics and Supply Chain Management.

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Tariku Jebena (PhD.)

Date _____

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Acronyms and Abbreviations

GMP	Good Manufacturing Practices
MOH	Ministry of Health
MoI	Ministry of Industry
SC	Supply Chain
SCM	Supply Chain Management
SCRM	Supply Chain Risk Management
UNIDO	United Nation Industrial Development Organization
SCOR	Supply Chain Operations Reference
SPSS	Statistical Package for the Social Sciences

Abstract

The study is sought to explore the influence of supply chain risk management practices adopted by the pharmaceutical manufacturing firms (East African Pharmaceuticals PLC, Cadila Pharmaceuticals Ethiopia PLC and Julphar Pharmaceuticals) on supply chain performance. The population included all supply chain, marketing employees and plant managers of the three firms. The research data was collected through a structured questionnaire with two open ended and all the rest closed ended supported by semi-structured interview questions. The questionnaire was administered by a five-point Likert scale method. The collected data was analyzed using both descriptive and inferential statistics by SPSS 23 to find out the influence of SCRM practices on supply chain performance of those firms. The study found out that the pharmaceutical manufacturing firms were using SCRM practices: supply chain flexibility, supply chain collaboration, supply base rationalization, supply chain control and supply chain avoidance in varying extent. Among the five SCRM practices, SC Collaboration was practiced highly followed by SC Avoidance and SC Control practices respectively while SC Flexibility and Supply Base Rationalization were least practiced. The major finding of the study indicated that among SCRM practices, SC Flexibility, SC Collaboration and SC Control have significantly affected the supply chain performance of the manufacturing firms. The study recommended that, firms should have contingency planning in response to demand fluctuation, develop SCRM procedure manual. Finally, firms should have proactive SCRM strategies which mitigate the supply chain disruptions rather than dealing with all risks simply by supply chain management.

Key words: Supply Chain Risk Management Practice, Supply chain performance

CHAPTER ONE

INTRODUCTION

This chapter consists of the back ground of the study, statement of the problem, objectives of the study, research questions, significance of the study, scope of the study, limitation of the study, definition of terms and organization of the paper.

1.1. Background of the study

The improved growth conditions in industrialized economies in 2016-2017 continue to have a positive impact on global manufacturing. As a result, world manufacturing output maintained an impressive growth rate of 4.2 per cent in the first quarter of 2018 (UNIDO 2018). In Ethiopia, the wider industrial sector and manufacturing within it, grew much faster after 2005. Thus, the annual rate of growth of industrial output doubled to nearly 20 percent by 2015-17. Although Ethiopia has emerged as one of Africa's fastest-growing economies, its manufacturing sector is still far from being an engine of growth and economic transformation with only 6.4 percent of GDP by 2017 (Oqubay, 2018).

The complexity of business transactions, technological advances, globalization, speed of product cycles and the overall pace of change have increased uncertainty, fragility, vulnerability and disruptions facing organization. For these reasons, supply chain risk management is becoming an integral part of risk management in most organizations (Fred, 2017).

Risk management as an integral part of supply chain management, has now become a part of every dimension of business operations. Most businesses are not well prepared to manage the rising risk levels, caused by more global and complex supply chains that are increasing suppliers' disruptions, logistics delays, product recalls and safety issue (Mahendran *et al*., 2011).

A great variety of risks exist, which can have significant effects on the short term and long term performance of supply chains. In addition to internal risks which are controllable to some extent, the ever-increasing external risks continue to expose today's supply chains to

completely new challenges like socio-political disruptions, security problems, terrorism, counterfeiting etc, (Dani, 2009). According to Mahendran *et al*. (2011), risk management can help organizations safeguard the quality and supply of product to customers and ultimately the end user. It is about anticipating hazards and controlling risk through an ongoing process of risk awareness, reduction and/or acceptance and review. He also added on the uniqueness of pharmaceutical industry in some senses that as it has a fiducial responsibility in management and production function.

The objectives of pharmaceutical industry are to manufacture products with the highest quality, safety and efficacy, at the lowest possible cost and to achieve these goals, the industry has to focus on eradicating risks in every step of the supply chain process (Haresh, 2011). The growth and development of the Ethiopian pharmaceutical manufacturing sector is based on the 'value chain' approach, which is a spectrum of progress from the exclusive import of finished pharmaceutical products to a research-based pharmaceutical industry (MoH and MoI, 2015).

Pharmaceutical industry is one of the priority manufacturing sectors in Ethiopia, expected to contribute for the economic transformation of industry led economy. The Government took several steps to incentivize development of the local pharmaceutical industry during the past five years, with an observable positive impact. GTP-I has played an important role, including laying the groundwork for the development of the Ethiopian pharmaceutical industry. There is now a trend for new foreign and local investments in the sector, resulting in new business ventures. Parallel investments in expanding effective health coverage have improved health indices and have resulted in growing demand for health commodities (MoH and MoI, 2015).

There are approximately 200 importers of pharmaceutical products and medical consumables in Ethiopia. The local industry comprises 22 pharmaceutical and medical suppliers and manufacturers, with nine involved directly in the manufacture of pharmaceutical products. Most of the manufacturers operate below their capacities and supply only about 20% of the local market (MoH and MoI, 2015). According to Gebre-Mariam *et al.* (2016), four out of the nine direct pharmaceutical manufacturers, achieved

GMP (Good Manufacturing Practice) certificate from the pharmaceutical inspection convention and pharmaceutical inspection co-operation scheme (PIC/S).

Pharmaceutical supply chains are subject to a wide range of risks that may disrupt the continuous supply of medicines. The disruptions are not only causing disturbance and increased costs, but can also aggravate the patients' health status by hindering access to medicines. Confronted with much greater economic, social and political instabilities, pharmaceutical supply chains in the developing countries are exposed to even higher levels of uncertainties and vulnerabilities (Hesham, 2015).

In this study an attempt has been made to examine the influence of supply chain risk management practices on supply chain performance of selected pharmaceutical manufacturing firms.

1.2 Statement of the problem

According to Andreas (2014), supply chain risk management has become one of the highest priority issues for companies operating in the global markets. Building capacity to meet customer's demand and preserving the financial bottom line hinge on effective preparation and mitigation efforts are the main issues in the supply chain management process. Risks in pharmaceutical supply chain are associated with product discontinuity, product shortages, poor performance, patient safety/dispensing errors and technological errors (causing stock shortages in pharmacies) to name but a few, all of which incur through disruption to the system.

Supply continuity is the single biggest business driver. It has been assessed that disruptions can exert a tremendous impact on companies' overall performance of supply chain operations, if there are not suitable mechanisms or tools able to prevent or smooth their negative effects, as many real cases have showed in the past few years (Sheffie, 2005).

In the context of the Ethiopian pharmaceutical industry, government has put in place incentives earmarked for investors into the pharmaceutical space that includes: tax-free loans on up to 70% of greenfield investments and 60% for expansion projects, reduced land lease rates, 100% custom duty exemption on the import of capital goods and certain production inputs. In addition, five-year income tax exemption for exporters (exporting >50% of output) and suppliers to exporters (supplying >75% of output into exporters' value

chain) and ‘one-stop-shop’ for government services and technical assistance had been granted. Despite all such incentives, the pharmaceutical manufacturing firms are not efficient in their performance.

Most of the manufacturers operate below their capacities and supply only about 20% of the local market. In 2014, local pharmaceutical companies supplied products to the value of US$ 44.2 million. Local manufacturers have limited product portfolios and are thought to be able to supply only 90 of the more than 380 products on the national essential medicines list. The annual private pharmaceutical market in Ethiopia is estimated to be worth US$ 100 million. In 2014, the Ethiopian industry exported pharmaceutical products worth almost US$ 2 million, which was far below the GTP-I target of US$ 20 million (MoH and MoI, 2015).

Among other things, it is possible to associate this low performance of firms with supply chain risks which causes disruptions in the supply chain. There is a need therefore, for the firms to clearly identify the risks involved in supply chain and all the uncertainties in delivering value to customers and supply chain managers should come up with robust mitigation strategies to increase supply chain efficiencies and effectiveness.

With respect to supply chain risk management, to the best of knowledge of the researcher, only few researches were done on SCRM on different organizations. Among others, Bisrat (2016) conducted a research on pharmaceutical supply chain risk management, based on the perspectives of PFSA (Pharmaceutical Fund and Supply Agency) with objectives of identifying main supply chain risks, assessing supply chain risk management implemented and identifying barriers in adopting the supply chain risk management in the said company. His findings showed that there is weak risk identification, higher supply risk, a weak implementation of SCRM and a number of barriers in adopting SCRM-factors like supplier geographic distance, inadequate technology, poor communication across supply chain, lack of SCRM knowledge stated as frequently occurring barriers. He suggested remedies like adopting better risk identification techniques as key and first step to implement SCRM.

Samuel (2017) studied assessment of supply chain risks and supply chain risk management practices on Ethio-Telecom with major objective to assess supply chain risks affecting Ethio telecom and the SCRM practices adopted by the company. In his findings risks faced

by the company were demand and supply side risks, risks associated with changes in regulations, infrastructure and catastrophic risks. In addition to the supply chain risks the SCRM practices adopted by the company are practiced in varying extent. Contingency plans and supplier related practices-building long term collaborative relationship with key suppliers and using back up suppliers were practiced in lesser extent. Finally, he concluded that improvement of supply chain risk management practices should be in place.

Despite SCRM practice is vital for the company, in Ethiopian context, enough researches have not been conducted as such to mitigate supply chain risks which disrupts the smooth performance of firms especially manufacturing firms. It was therefore, the purpose of this study to find out the influence of SCRM practices on supply chain performance of pharmaceutical manufacturing firms.

1.3. Objective of the study

1.3.1. General objective

The general objective of the study is to assess the influence of supply chain risk management practices on supply chain performance of selected pharmaceutical manufacturing firms in Ethiopia based on perspectives of employees.

1.3.2. Specific objectives

The specific objectives of the study are:

- To assess the supply chain risk management practices of selected pharmaceutical manufacturing firms in Ethiopia.
- To examine the influence of supply chain risk management practice on the supply chain performance of selected pharmaceutical manufacturing firms in Ethiopia.

1.4. Research questions

The study was initiated to seek answers to the following basic questions:

- How do pharmaceutical manufacturing firms in Ethiopia manage supply chain risks?
- What are the influences of supply chain risk management practices on supply chain performance of selected pharmaceutical manufacturing firms in Ethiopia?

1.5. Significance of the study

The findings of this study will provide more knowledge for researchers and academicians who may be interested in studying the relationship between SCRM practices and supply chain performance. The findings of the study can also enable logistics and supply chain employees of pharmaceutical manufacturers and suppliers to evaluate their role towards the performance of their supply chains. Other service providers and institutions outside the sector will also benefit from the findings of this study since it will shed more light on the relationship that exists between SCRM practices and supply chain Performance.

1.6. Scope of the study

This research is delimited to only pharmaceutical manufacturing firms and did not include those engaged in producing medical supplies such as syringes, absorbent cottons, lab equipment and the like. Among 22 major pharmaceutical manufacturing firms in Ethiopia, this research deals with those three firms certified by GMP (Good Manufacturing Practice), located in and around Addis Ababa which are East African Pharmaceuticals PLC, Cadila Pharmaceuticals Ethiopia PLC and Julphar Pharmaceuticals Manufacturing Ethiopia PLC with the assumption that those companies have better SCRM practices. Regarding performance of the manufacturing firms, this research is limited only to supply chain performance of the firms in terms of cost, quality, delivery and customer service rather than productivity and capacity. Time scope of the study is from March-May 2019.

1.7. Limitation of the study

Access to documents of the selected manufacturing firms was difficult since, as a culture, many people are not willing to provide information by the excuse of confidential information. The study mainly depended on the data provided by the respondents. This means that the accuracy of the data provided depended on the information provided.

Since the study covered only three GMP certified companies among all pharmaceutical industries in Ethiopia it is difficult to generalize the findings of the study to all manufacturing firms engaged in the pharmaceutical industry. Moreover, the variables (SCRM practices) considered in this study may not be enough to conclude that only those

variables are affecting the supply chain performance as different SCRM practices might be applied to ensure its effect on performance.

1.8. Operational definitions of terms and concepts

Delivery- It is one of the key attributes of performance according to SCOR model. It measures the supplier's ability to predictably complete processes as promised. It is measured by perfect order fulfillment and demonstrates the degree to which a supplier is able to serve its customers within the promised delivery time. Firms should meet delivery deadlines accurately, timely and in full (Gligor & Holcomb 2012).

Quality- Level refers to how the orders are executed, the reliability of the service performance including the quality of the shipment and the quality of the delivery (Chopra *et al.* 2007).

Supply Base Rationalization: involves supplier management practices such as supplier rationalization, supplier contract and establishing long term relationships with suppliers (Christopher & lee, 2005; Sheffi, 2006; Musa & Tang, 2012).

SC Avoidance: is the process of avoiding an activity, any chance of loss is eliminated. Risk avoidance may also be seen as the elimination of hazards, activities and exposures that can negatively affect an organization's asset (Khan & Burnes, 2007).

SC Collaboration: is the agreement between or among supply chain actors to integrate their resources for mutual benefits. Firms need to develop routines and practices that lead to collaboration among partners (Choprat *et al*., 2007; Blackhurst, Dunn & Craighead, 2011). Collaboration involves information sharing, information technology and supply chain visibility.

SC Control: is the process of taking proactive steps to reduce the identified risks where possible and putting procedures, rules or policies in place to minimize the residual risk to reduce the severity of such a loss (Son & Orchard, 2012)

SC Flexibility: is the ability of firms to be more innovative, dynamic and responsive to changes and challenges (Gligor & Holcomb, 2012; Tang & Tomlin, 2009). The flexibility strategy includes contingency planning, postponement and agility.

Supply Chain Performance- the entire chains ability to meet end-customer needs through product availability and responsive, on-time delivery (Fisher1997).

Supply Chain Risk: The APICS Dictionary, 14th Edition, defines supply chain risk as "the variety of possible events and their outcomes that could have a negative effect on the flow of goods, services, funds or information resulting in some level of quantitative loss for the supply chain" (Blackstone, 2013). On the other hand, Supply Chain Risk Leadership Council defined supply chain risk as the likelihood and consequence of events at any point in the end-to-end supply chain, from sources of raw material to end use of customers (SCRLC,2011).

Supply Chain Risk Management Practices- In this study, SCRM practices are practices that Pharmaceutical manufacturing firms use to reduce or control supply chain risks. These practices are supply chain flexibility, supply chain collaboration, supply chain supply base rationalization, supply chain control and supply chain avoidance (Skipper & Hanna 2009; Gligor & Holcomb 2012; Lockamy, 2014).

1.9. Organization of the study

Generally, the paper is organized in to five chapters. The first chapter provided an introduction to his research dealing with back ground of the study, the research problem, research questions, research objectives, scope and significance of the study. The second chapter discusses the related literature review about the subject matter. In chapter three the research methodologies were presented. Chapter four presents results and discussion of the study and finally, chapter five presents the summary of major findings, conclusion and forwarded suggestions.

CHAPTER TWO

RELATED LITERATURE REVIEW

2.1. Introduction

In this chapter both theoretical and empirical literature were discussed. Literatures specific to the concepts or ideas of supply chain risk management practices and supply chain performance were covered. The relevant conceptual issues, theoretical, empirical literatures related to the topic of the study were reviewed and based on the literature reviewed, the selected conceptual framework were also presented in the chapter.

2.2 Theoretical Literature Review

2.2.1 Contingency Theory

According to Kihyun (2011), contingency theory has two underneath assumptions: first, there is no one best way to organize the appropriate form depends on the kind of task or environment one is dealing with and secondly management must be concerned with achieving alignments and good fit. The extent to which firms perceive and react correctly to all forms of unexpected supply chain risks dictates the ability to adopt and implement practices that reduce the effects of harmful events (Grotsch and Schleper, 2013). Contingency theory perspective has been adopted in supply chain management studies (Kihyun, 2011; Bufferman, Germain and Lyer, 2018). Postponement and contingency planning are addressed as flexible risk management practices. According to skipper and Hanna (2009), contingency planning is a special type of planning that provides firms with blue print for managing risk related to unknown occurrence. Contingency planning is important to achieving flexibility. Contingency planning includes increasing production at alternative locations, temporarily switching transportation and shifting customer demand to alternative product (Tang and Tomlin, 2009).

2.2.2 Supply Chain Risk Management Practices

According to Haresh (2011), Pharmaceutical supply chain potentially faces different types of risks and in response supply chain tend to have plans in place that can mitigate these risks. Further, he broadly classified Pharmaceutical risks as supply related (Imports,

inferior quality of supply, non-availability of resources, natural disasters, man-made disasters, selection of suppliers), cost related, production related, demand related and miscellaneous related risks.

Supply chain risk management evolved from the disciplines of risk management and the later supply chain management, which has been an important research area for more than two decades. Its primary purpose is to identify potential sources of risk and provide appropriate suggestions for mitigating them (Singhal, Agarwal and Mittal, 2011). Supply chain risk management (SCRM) is a set of approaches and practices for the effective integration of suppliers, manufacturers, distributors, retailers, and consumers, with the purpose of improving the long-term performance of first the whole supply chain and then the individual companies. SCRM is a formal process that involves identifying potential losses and their probability and importance (Sunjka and Sklar-Chik, 2012).

In recent years, supply chain disruptions have impacted the performance of companies. The case of Ericsson is well known in this domain. Due to a fire at a Phillips semiconductor plant in 2000, the production was disrupted, which eventually led to Ericsson's $400 million loss (Chopra and Sodhi, 2004). The earthquake, tsunami, and the subsequent nuclear crisis that occurred in Japan in 2011 caused Toyota's production to drop by 40,000 vehicles, costing $72 million in profits per day (Pettit *et al*., 2013). The catastrophic Thailand flooding of October 2011 affected the supply chains of computer manufacturers dependent on hard disks, and also disrupted the supply chains of Japanese automotive companies with plants in Thailand (Chopra and Sodhi, 2014). According to Chopra and Sodhi (2014), in order to control and mitigate the negative effects caused by such risks, a significant amount of work in the area of supply chain risk management (SCRM) is undertaken in both academia and practitioner circles.

- Supply Chain Flexibility

According to Liu *et al.* (2010) firms that achieve higher level so flexibility and agility significantly outperform their less flexible counterparts. Flexible firms are more innovative, dynamic and responsive to changes and challenges (Gligor & Holcomb, 2012; Tang &Tomlin, 2009). Nembhard *et al*. (2005) noted that a manufacturing firm can have the flexibility to select different suppliers, plant locations, and market regions.

Dynamic capabilities are defined as the firm's potential to systematically solve problems, formed by its propensity to sense opportunities and threats, to make timely and market oriented decisions, and to change its resource base (Barreto, 2010)

Agility- Agility is mostly understood as the ability of a supply chain to rapidly respond to change by adapting its initial stable configuration (Christopher, Peck and Towil 2006; Bernade & Hanna, 2009). Agile paradigm favors high availability and responsiveness to changes in product mix and volume (Christopher *et al.*,2006) being fast (Liu, Lin & Hayes, 2010). According to Bernade *et al*. (2009) agility comprises of all kind of changes. Nag, Hana and Yao (2013) viewed agility as comprising of two main factors: responding to changes in proper ways and due time, and exploiting changes and taking advantages of changes as opportunities to survive and prosper in a competitive environment. Liu *et al.* (2010) regarded the main capabilities of an agile production system as the ease with which the system can change between products, and the ability to introduce new products without investments.

Postponement- is the ability to delay the actual commitment of resources and activities to maintain flexibility and delay incurring costs (Li, Lin, Wang & Yan, 2006). According to Choi Narasimhan and Kim (2012), there are three categorizes of postponement: time postponement, form postponement, and place postponement. Time postponement refers to the movement of goods from manufacturing plants only after customer orders are received (Bessant, 2008). Form postponement refers to determining the form and function of products which includes labeling, packaging, assembly, and manufacturing (Choi *et al*. 2012).

The extent of form postponement depends on demand customization, component costs, product life cycle, and product modularity (Choi & Krause, 2006).

Place postponement refers to positioning upstream inventories in the manufacturing process. Tang (2006) has argued that postponement is a robust demand management strategy that leads to supply chain efficiency and supply resilience. He added that postponement is an effective strategy in enhancing supply chain efficiency when facing uncertain demands for diverse products.

Contingency planning- According to Skipper and Hanna (2009), contingency planning is a special type of planning that provides firms with a blue print for managing risk related to unknown occurrence. Contingency planning is significant to achieving flexibility (Ponomarov, 2012). Contingency planning includes increasing production at alternative location, temporarily switching transportation, and shifting customer demand to alternative products (Tang & Tomlin, 2009). The contingency plan must be specific in terms of time and complete response to risks. The process of planning includes risks assessment, risk evaluation and management, relationship management, first response, security, operations, stability, subsequent stage of response, and performance evaluation (Skipper &Hanna, 2009). Sheffi (2006) has suggested that contingency planning should describe and define the roles, procedures, duties, and responsibilities of key players in firms to significantly reduce unexpected disruptions.

- Supply Chain Collaboration

Supply chain relations are based on integration, coordination and collaboration across the supply chain from the customer to the suppliers (Swink, 2006). According to Chopera *et al.* (2007), collaboration is the agreement between or among supply chain actors to integrate their resources for mutual benefits. According to Musa, Wei and Tang (2012), firms need to develop routines and practices that lead to collaboration among partners. The main pillars of a collaborative relationship are trust, transparency and faith (Chopera *et al.* 2007).

According to Sodhi and Tang (2012) a supply chain is fully coordinated when all decision is aligned to accomplish common objectives. Lack of coordination will result in distortion of demand, (bullwhip effect) increase manufacturing cost, inventory cost, replenishment lead time, transportation cost, labor cost, decrease inefficiency, profit information distortion (Paik & Bagchi, 2007). The collaborative supply chain has therefore become crucial in reducing supply chain risks (Tang 2006). Arshinder and Deshmukh (2007) argued that sharing of information between supply chain members helps to substitute information with inventory and lead time, reduces the supply chain costs, reduces the demand variability, enhances responsiveness and improve the service level. There is a positive relationship between collaboration and performance (Breuer, Siestrup, Haasis &

Wildebrand, 2013). Collaboration with suppliers and customers when responding to risk as well as redesigning products and processes gives firms some advantages through increased information flow, reduced uncertainty, improved quality and increased profitability (Sheffi & Rice 2005; Richie & Brindley, 2007).

Information sharing-Mitchell and Nault (2007) have argued that synchronized business processes such as material, information and financial flows improve supply chain performance; thus, leading to business growth. For this reason, collaboration supply chain relies on the desire to share information and collaborative management. Effective information sharing among partners is a key determinant in reducing internal and external risk in the supply chain environment (Christopher, Mena, Khan& Yurt, 2012; Tang, 2006).

Supply chain visibility-Visibility within the supply chain refers to knowing where inventory is at any moment from the producer to the final destination (Christopher *et al.*, 2012). Supply chain visibility is also actionable information that can help support customer and be applied to myriad points along the supply chain -from supplier to service provider to end customer to remove redundancies and improve processes to give a firm a competitive advantage (Musa *et al*., 2012). According to Li Lin, Wang and Yan (2006) supply chain visibility has the following advantages: it shows you real time order, inventory and shipment information, systematically monitors perishables and reduces inventory loss from expired goods, reduces cost associated with expedited delivery, lower inventory levels and safety stocks, improves customer services, while raising productivity of customer service representatives and achieves faster time to market for new product (Musa *et al*. 2012).

- Supply Base Rationalization

Supply management is widely acknowledged as strategic for companies, because they contribute to build and to maintain competitive advantage (Hsu, Kannan, Leong &Tan 2006; Chopra *et al.*,2007). Supply management has become more critical because there is an increasing dependence on supplier. The dependence makes companies highly exposed to supply risks. According to Tang (2006) supply management should have a positive impact on the mitigation of the supply chain risks. Many researchers have posited several supply base strategies that can be used to reduce supply chain risks. These include an

extended usage of flexible contract agreements, inspection to qualify supplier and may be even combined with make and buy strategies to split production across different factories (Sheffie, 2006), selecting dual rather than single sourcing (Wieland, 2013), building trust in relationships (Srinivasan, Mukherjee & Gaur, 2011) managing risk in a proactive manner and finding a balance and alignment between benefits gained from and costs of risk management (Paik & Bagchi, 2007), risk sharing through sourcing relationships(Hsu *et al.* 2006) by establishing a closer relationship with single source suppliers and instituting less closer relationships with a number of different suppliers in order to spread risks (Sheffi & Rice, 2005), and determining a number of technological methods to discover, recover and redesign the supply chain (Blackhurst *et al* 2011).

Supplier diversification- The access to a wider supply base enables firms to inject in supply chains additional production lines and quickly shift volumes and production in case of a disruption (Sheffi, 2006; Tomlin, 2006). By diversifying the portfolio of suppliers, risks spread across multiple players, therefore decreasing the impact any single player can have on the supply stream (Maunj & Mentzer, 2008b). Adding another supplier decreases the expected return, but in turn lowers the risk variance and deviation from the mean (Musa & Tang, 2012).

Suppliers selection- Strategy becomes one of the most important practices in supply chain risk mitigation (Hsu *et al*., 2006). Suppliers election is done after the firm has decided on either single sourcing or multiple sourcing. Suppliers selection should be based not only on the price of the acquisition, but also on a wider range of criteria such as quality, organizational parameters and capabilities with a view to reducing supply chain risk (Micheli, Cagno & Zorzini, 2008). Suppliers selection based on quality, pricing, delivery and performance of product have significant relationship with four elements of customer satisfaction- product quality, product variety, delivery service and competitive pricing- and firm performance (Ponomarov, 2012).

Buyer-supplier Partnership- Chopera *et al.* (2007) referred to trust, mutuality, information exchange, openness and communication as important ingredients in buyer-supplier partnership. Chopera *et al.* (2010) claimed that buyer-supplier relationships were becoming more popular in supply chain because of their ability to reduce uncertainty. According to

Zailani and Rajagopal (2005) long run collaborative relationships with key supplier contribute to firm's financial performance. Micheli *et al*. (2008) have said that suppliers are vital to the success of a firm, in terms of their reliability in availability and on the competitive edge of the final product, impact the level of risk. Supplier selection, diversification, supplier partnership and interaction contract agreement, are some of the strategies used to manage supply chain risks.

- Supply Chain Control

The ability to learn from past disruptions to develop better preparedness for future events is important to supply chain risk management (Ponomarov & Holcomb, 2009). Therefore, leading companies provide training to employees, suppliers and customers supply network risks to raise awareness and reinforce the importance of supply chain resilience (Blackhurst *et al*., 2011; Schoenherr *et al*., 2014). Besides learning (i.e knowledge creation) from experience and establishing standard practices within the supply chain, knowledge and understanding of supply chain structures both physical and information-are important elements of supply chain risk management (Choi *et al*., 2012)

Supply chain risk control is the process of taking proactive steps to reduce the identified risks where possible and putting procedures, rules or policies in place to minimize the residual risk or to reduce the severity of such a loss (Son & Orchard, 2012). Effective supply chain risk management requires supporting infrastructure which is executive led (Lockamy, 2014). It has been viewed that companies have been implementing different strategies and philosophies to control inventory, to eliminate waste, bring continuous improvement, to improve forecasting and improved efficiency and responsiveness (Christopher, Peck & Towill, 2006).

Inventory Management- the inventory management includes determination of the order quantity, the timing of order, reorder point and the replenishment of inventory. Inventory management and control are crucial to supply chain risk control strategies because mismanagement of inventory threatens a firm's viability (Juttner & Maklan, 2011). They added that too much inventory consumes physical space, creates a financial burden, and increases the possibility of damage, spoilage and loss. Besides, excessive inventory frequently compensates for sloppy and inefficient management, poor forecasting,

haphazard scheduling, and inadequate attention to process and procedures.

Khan, Christopher and Burners (2008) concluded that companies with very high inventory ratio have more possibilities to be bad financial performers, Strategic inventory reserves could be used to militate against supply chain risks (Vilko, Ritala & Edelmann, 2014). The effect of supply chain risks is decreased by forecast accuracy, thus it might increase the cost of inventory or stock. In order to mitigate the risks, the firms can use pool or aggregate demand forecasting (Musa & Tang, 2012).

Improved efficiency and responsiveness – the responsiveness of supply chain describes how quickly it responds to customer (Li *et al*., 2008; Christopher *et al.,* 2006), and being able to reconfigure the supply chain (Bernards & Hanna, 2009). Responsive supply chain ensures delivery on time, cost reduction and accurate forecasting of data (Mehrjerdi, 2009).

Continuous improvement – the main objectives for the operational cycle are to analyze reduce and control (ARC) high priority risks through individual risk management projects (Cranfield, 2011). Even after a successful risk management activity, continuous monitoring is necessary to control the risk, and analyze the effectiveness of the applied mitigation strategy and adjust measures if necessary at each step of the supply risk management process based on lessons learned (Matook *et al*., 2009)

- Supply Chain Avoidance

Risk avoidance is the most effective risk management strategy in that by avoiding an activity, any chance of loss is eliminated (Khan & Bunes, 2007). According to Christopher and Holweg (2011) supply chain operating in all types of environments attempt to avoid risks within the constraints of acceptable retunes such as revenue and profit targets. Manuj and Mentzer (2008) suggested that avoidance takes the form of exiting through divestment of specialized assets, delay of entry into a market or market segment, or participating only in low uncertainty markets. This type of strategy is geared toward driving overall probabilities associated with risk events of a decision to zero by ensuring that the risk does not exist (Tang & Tomlin, 2008; Manuj & Mentzer, 2008).

2.2.3. Supply Chain Performance and Measurement

Supply chain performance is defined as the entire chain's ability to meet end-customer needs through product availability and responsive, on-time delivery (Fisher, 1997). Supply chain performance entails both functional lines and company boundaries. Improving supply chain performance is a continuous process that requires both an analytical performance measurement system and a mechanism to initiate steps for realizing key performance indicators (KPI) goals (Gunasekaran and McGaughey, 2004).

Supply chain performance measurement is the process of qualifying the efficiency and effectiveness of supply chain (Wong & Wong, 2018). Kilgore, M (2003) and Radjou N (2002) suggest that much of the supply chain management efforts in the recent past have focused on increasing the efficiency (lowering costs) of supply chain operations, and less on increasing the robustness and reliability of supply chains. This could partly be because unlike efficiency, it is much harder to place a value on robustness and reliability. Disruptions are an indication that firms supply chain is not reliable and robust.

Supply chain performance measurement includes multiple dimensions including financial and non-financial metrics describing costs, capacity, lead times and service levels (Bigliardi and Bottani, 2014). According to Chopra *et al*. (2007) supply chain management could be measured at various management or operation levels. Strategic level measures influence top manager decision and very often reflects investigation of broad based polices and level of adherence to organization goals. The tactical level deals with resource allocation and measuring performance against targets to be met in order to achieve results specified at the strategic level while at the operation level, metrics are relevant for day to day business. The metrics of a firm’s operation performance are based on: cost; quality; flexibility & delivery.

Recent studies of supply chain management have suggested that these priorities can be categorized in to two fundamental dimensions: efficiency and responsiveness (Chopra *et al.* 2007). The term efficiency refers to the ability of a supply chain to compete on costs. It is usually best suited to serve markets with predictable demands and for which the products have a long-life cycle. The term responsiveness refers to the ability of supply chain to respond quickly to market movements. In designing a responsive supply chain, the

emphasis will be on fast deliveries (Chopra *et al.,* 2007). Based on operational priorities this study adopted four metrics; cost; quality, delivery and customer service levels as proposed by researchers (Wong and Wong, 2008; Bigliardi & Bottani, 2014).

2.3 Empirical Literature Review

2.3.1 Pharmaceutical Risk Management Practices

Hesham, M. (2015) did a study on SCRM at Pharco pharmaceuticals, a pharmaceuticals manufacturing in Egypt. He found out that external risks were perceived to be more significant than internal risks. The research also revealed that there was no clear strategy developed by the company to mitigate most of its supply chain risks.

Agorzie *et al*. (2017) did a study on supply chain risk factors assessment in the Nigerian pharmaceutical industry. The study examined their impact level and measured their criticality to prioritize those risk factors. The study revealed that pharmaceutical firms in Nigeria are better equipped to manage & mitigate risk factors in their supply chain.

Aleksandra, A. (2017), in his research on Proactive Supply Chain Risk Management Approach – The Case of Serbia, applying analytic hierarchy process model, he ended up with a result that pharmaceutical firms in India and China are increasingly outsourcing their supply chain operations in response to risks like high cost of R&D, inefficient utilization of labor, capital and technology resources which allows firms to focus on their core competencies.

Brako *et, al*. (2016) studied on Investigating the Risks in the Pharmaceutical Supply Chain in Ghana. With respect to the risks associated with the Pharmaceutical Supply Chain, the study revealed that Drug Shortages, Pilfering and Expiration of Drugs are the risks associated with Pharmaceutical Supply Chain. They point to the fact that Pharmaceutical companies face the problem of inventory management. The inventory management problem confirms the assertion made by Mahender (2005) that inventory management also poses risk in pharmaceutical supply chain. However Counterfeit or fake drugs was not considered by the respondents as among the risks associated with pharmaceutical Products. Thus 59% disagreed that Pharmaceutical companies face the risk of fake or counterfeit drugs in their business.

The study revealed the major reasons the respondents attributed to the risks associated with the pharmaceutical supply chain and they include difficulty in obtaining raw materials, unethical attitude of pharmacists and chemical sellers, low income of consumers, poor inventory management and reverse logistics not being encouraged in the pharmaceutical industry in Ghana.

2.3.2 Pharmaceutical Supply Chain Performances

Adane, A. (2017) studied measuring supply chain performance in Ethiopian pharmaceutical industry using BSC model with the objectives of measuring supply chain performance from 4 BSC perspectives. From his findings, internal business, learning and growth and customer perspectives found to be significantly influencing the supply chain performance. In general, the study revealed that supply chain performance is practiced moderately.

2.3.3 The relevance of pharmaceutical SCRM in supply chain performance

Amemba, C.S. (2013), studied the effect of implementing risk management strategies on supply chain performance. A case of Kenya medical supplies agency. The study revealed that the level of implementation of Risk Management was medium and that risk identification, risk analysis and evaluation and risk control and monitoring strategies that was implemented in the agency supply affected the performance to a great extent. The study recommended that the agency should implement risk management strategies proactively at the planning stage of the supply chain and to ensure that there was a joint participation with all supply chain partners in the strategy implementation.

2.3.4. Supply chain risk management practices and firm performances

Erick, O. (2014), conducted a research on supply chain risk management practices and disruption control in power supply Kenya with one of the objectives to determine the relationship between the SCRM practices and disruption control in the electric power sector in Kenya. He found out that power sector firms have implemented the SCRM practices albeit to a varying extent. Supply contingency planning by way of having in place a backup supply in the critical yet disruption prone categories. Finally, the study affirmed that there exists a statistically significant relationship between loss of critical stock and SCRM practices adopted by the organization.

The study therefore recommended that all the power sector firms should endeavor to

appreciate their supply chain risks and determine all the robust supply chain risk management practices that can be embedded in to the day to day supply chain operations to ensure proactive control of disruptions or to minimize the effect of any incident disruption.

Fred, O. (2017), Influence of SCRM Strategies on Performance of Food and Beverage Manufacturing Firms in Kenya. The study established that SCRM strategies have influence on performance of food and beverage manufacturing firms in Kenya. The study concluded that the most important SCRM strategies on the performance of those firms are the supply chain avoidance strategies followed by supply chain control, supply chain flexibility and supply base rationalization respectively. Supply chain collaboration strategy had the least influence on the performance of the firms. Finally, the study recommended that firms should support supply chain risk management with dedicated employees, resources, investments and best practices to ensure that firms supply chain efforts satisfy customers in the most productive, cost-effective way possible.

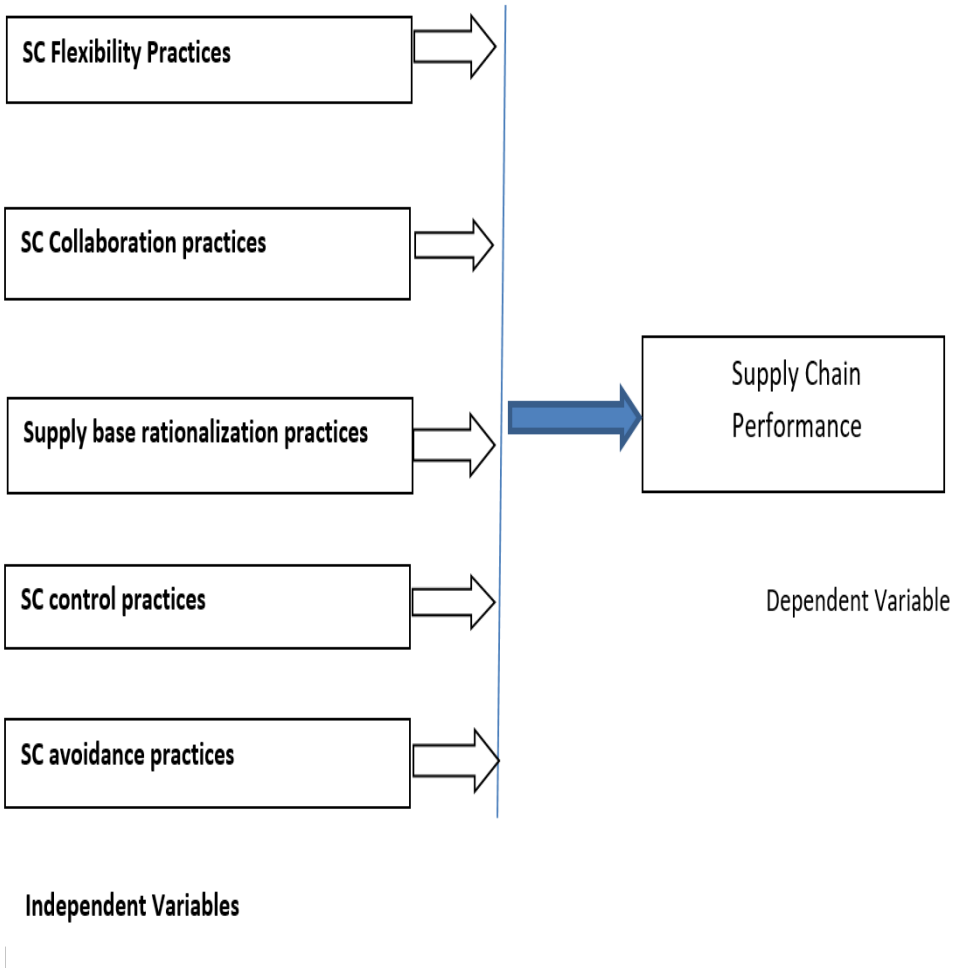
2.4 Research Gap

Most of the researches conducted are related to SCRM practices and organizational performance. However, they are different in some aspects with this study like the type of practices to mitigate the supply chain risks. Most of the researches were conducted in the context of other countries. Therefore, this research will address the influence of the SCRM practices on supply chain performance of pharmaceutical manufacturing firms in Ethiopian context.

2.5 Conceptual Framework

Yosef (2009) defined conceptual framework as a network, or a plane of interlinked concepts that together provide a comprehensive understanding of a phenomenon or phenomena. The concepts that constitute the conceptual framework support one another, articulate their respective phenomena, and establish a framework-specific philosophy. The variables of this study comprised one dependent variable (Supply Chain Performance) and five independent variables (SC flexibility, SC collaboration, Supply base rationalization, SC control and SC avoidance)

Figure 2. 1 Conceptual Framework of the Study



Source: The conceptual Framework of the study adopted from Fred (2017) and Wong and Wong (2008).

CHAPTER THREE

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

3.1. Introduction

This chapter presents the research methodology that was used for the study: description of the study area, the choice of particular research approach and design, population, source and type of data, measurement and instrument, data collection procedure, ethical consideration, data analysis techniques and finally validity and reliability test will be present

3.2 Description of study area

The study areas are focused on three pharmaceutical firms which are found in Addis Ababa and around in Addis Ababa, Gelan Town. Therefore, the study is bounded and conducted in Addis Ababa City and around Addis Ababa. List of these three companies are East African Pharmaceuticals PLC and Julphar Pharmaceuticals Manufacturing Ethiopia PLC (Location of both factories and head office of the two companies is Bole Sub city, Jackros area) and the third company is Cadila Pharmaceuticals Ethiopia PLC is found in Gelan nearby Addis Ababa where the staffs are both in Galan and Addis Ababa.

3.3 Research Approach

Mixed research approach (qualitative and quantitative) has been used in this study. Creswell (2005) asserted that quantitative research is a type of research in which the researcher decides what to study, asks specific, narrow questions, collects numeric (numbered) data from participants, analyzes these numbers using statistics, and conducts the inquiry in an unbiased and objective manner. In addition to that, the quantitative method was used to make it easy for conversion of information obtained into statistical models for general analyses to be made and the research questions to be answered based on the statistical models. Qualitative approach, on the other hand was used to analyze data obtained from interview and open ended questions to substantiate the result obtained from the quantitative approach.

3.4 Research Design

A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure and to address the objective. “Studies that establish casual relationships between variables may be termed as explanatory research, the emphasis here is on studying a situation or a problem to explain the relationships between variables” (Saunders et al., 2008 P: 140). Since this thesis is about the study of the influence of supply chain risk management practice on supply chain performance, explanatory research design was undertaken for this study. In the explanatory survey design, independent and dependent variables can be measured at the same point in time by using single questionnaire.

3.5. Unit of Analysis

The unit of analysis is the major entity that is being analyzed in the study. Therefore, the unit of analysis used in this survey is all the employees of the three manufacturing firms that are member of Supply chain, marketing departments and plant managers of those firms who are involved in the supply chain operation. The employees’ perception towards the SCRM practices and supply chain performance were collected using survey questionnaire and interview and then analysis has been made on the collected information.

3.6 Population of the Study

Population of the study were employees of the three manufacturing firms under the study (East African Pharmaceuticals PLC, Cadila Pharmaceuticals Ethiopia PLC and Julphar Pharmaceuticals Manufacturing Ethiopia PLC) who have interaction with supply chain process which are Marketing, Supply chain and Plant managers of the three firms. The total number of employees in these departments accounted 77. Since the numbers of respondents in those departments are manageable, a census method was applied. In addition to the questionnaires Semi-structured interview was conducted with the plant managers of the two companies and supply chain manager of one company which is useful to triangulate the findings.

3.7 Data sources, types and collection procedures

The required data for the study was collected from primary and secondary sources. Primary data was collected from employees of the three manufacturing firms particularly from supply chain, marketing departments and plant managers of those firms. Self-administered questionnaire that consist of few open ended and more closed ended questions that was designed to collect responses from the employees and semi structured interview was conducted with the plant managers of the three firms. The study used desk review of secondary documents, like policy and strategy documents, research outputs and literatures on supply chain risk management in pharmaceutical firms, industry development documents of Ethiopia etc.

3.8 Measurement and Instrument

The type of survey used for this study was most close ended questionnaire and few open-ended ones. The use of close-ended questions on the questionnaire allows for uniformity of responses to questions. Besides, this type of structured research instruments is less costly and less time consuming than other measuring instruments. On the other hand, concerning the span of time used to conduct the survey, a cross-sectional survey type has been employed for the study. The defining feature of a cross-sectional study is that it can compare different population groups at a single point in time using a single questionnaire. Therefore, the use of cross-sectional survey allows study to compare many different variables at the same time. A questionnaire for the study was designed for the purpose of drawing out relevant information on the study under title "The Influence of Supply Chain Risk Management Practices on Supply Chain Performance: The Case of selected Pharmaceutical Manufacturing Firms in Ethiopia".

3.9 Methods of Data Analysis

Descriptive statistics was applied to address the first objective. The analysis of the data has been done using SPSS Version 23. Frequencies and percentages were used to analyze respondents' demographic data. Mean and standard deviation were used for the assessment of the responses of the employees of the organization. To address the second objective, inferential statistics specifically, a multiple regression model was employed in determining

the influence of independent variables (supply chain risk management practices) on the dependent variable (supply chain performance) of the selected pharmaceutical manufacturing firms. The independent variables (Supply chain risk management practices) are: SC Flexibility, SC Collaboration, supply base rationalization, SC control, SC avoidance while the dependent variable is supply chain performance.

3.10 Reliability and Validity Instruments

3.10.1 Validity Test

Malhotra (2010) mentioned about three type of validity in his study; content validity, predictive validity, and construct validity. To ascertain the degree to which the data collection instruments measure what it is supposed to measure, this study addressed content validity through the review of literature and adopting instruments used in previous researches conducted by Fred (2017), Wong and Wong (2008).

3.10.2 Reliability Test

Reliability analysis is concerned with the internal consistency of the research instrument. Reliability refers to the extent to which data collection techniques or analysis procedures yield consistent findings (Saunders et al. 2009). Cronbach's Alpha is the most commonly used measure of internal consistency/reliability when the study has Likert questions in questionnaires that form a scale and wish to determine if the scale is reliable.

3.11. Ethical Issues

The researcher disclosed to the respondents that the study was purely meant to satisfy an academic requirement and not for any other reason. Respondents were told not write their names in the questionnaires and confidentiality was ensured. The information was analyzed and used for the purpose of the study only.

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSIONS

4.1. Introduction

In the previous sections, all possible explanatory variables were identified and selected based on the literatures and conceptual framework. Under this section bivariate analysis is conducted to examine the relationship of each of selected explanatory variables and supply chain performance. The result of correlation analysis indicates that there is strong association between explanatory variables and supply chain performance. However, bivariate association between two variables doesn't necessarily show a significant relationship between all explanatory variables and supply chain performance because in real life more than one explanatory variables influence the outcome variables. Therefore, it is important to carry out multivariate regression to incorporate more than one explanatory variables.

This chapter presents the data analysis and the research findings. The findings of this research on the effect of supply chain risk management practices on supply chain performance of the three pharmaceutical manufacturing firms, is tabulated and analyzed using descriptive and regression analysis statistical tool. The result of the analysis is based on the data collected by use of the questionnaire and interview.

4.2. Response Rate

A total of 77 questionnaires were distributed to the selected respondents of the three pharmaceutical manufacturing firms, out of which 71 questionnaires were collected, that make 92% response rate.

Table 4. 1:Response rate of firms in terms of work unit of each firm

Firms	Number of questionnaires collected from each work unit			Number of questionnaire collected
	Supply Chain	Marketing	Plant Managers	
EAST Africa	9	12	1	22
Cadilla	12	12	1	25
Julphar	10	13	1	24

Source: Survey Data,2019

In order to reduce the possible errors in the data administration, immediately after the collection of the data, the researcher has cleaned the outliers, missing values and discrepancies. Finally, 68 complete respondents' data was used for the survey analysis using SPSS 23

4.3 *Reliability Test*

Reliability analysis is concerned with the internal consistency of the research instrument. Reliability refers to the extent to which data collection techniques or analysis procedures yield consistent findings (Saunders *et al*. 2009). Cronbach's Alpha is the most commonly used measure of internal consistency/reliability when the study has Likert questions in questionnaires that form a scale and wish to determine if the scale is reliable. Therefore, in the study the questionnaire have been distributed to a sample of 13 respondents which more than 15% of the population for the pilot test and the result of reliability is presented below.

Table 4. 2: Reliability Test

Construct	Variables	Number of Items	Cronbach's Alpha
SCM Practices	SC flexibility practice	5	0.835
	SC collaboration practice	5	0.851
	Supply base rationalization practice	5	0.813
	SC control practice	5	0.750
	SC avoidance practice	5	0.797
Supply chain performance		4	0.741
All Variables		29	0.917

All values of the Cronbach's alpha for SCRM practices and supply chain performance measure shows more than 0.7, which is supported by literature (Hair *et al*.,2010). Therefore, we can conclude that the data collection instruments were acceptable and reliable.

4.4 Demographic Profile of the Respondents

Socio-demographic information of the respondents, are presented in the form of tables and frequencies for the analysis. The profile of respondents in the selected pharmaceutical firms are summarized in to three parts in this study, the first one is about the respondents' educational qualification, the second one is about years worked in the organization and the third one is about their gender distribution.

As it can be seen the educational background of the respondents from the below table, 30 respondents (44%) have bachelor degree,13 respondents (19%) have master's degree, In general, 60% of the respondents have 1st and 2nd degree and the majority of the respondents indeed possess the required educational level that qualify them for their top and middle level posts and they are in a better position to understand the subject matter of the study in providing relevant and reliable information needed for the study.

Level of work experience of the respondents is important on the area of the study for the surveys' success. The result of the study showed out of 68 respondents, 25 respondents (36.8%) fall at a work experience bracket of 1 to 5 years, 16 respondents (23.5%) fall at

the work experience bracket of 6 to 10 years, 17 respondents (25%) fall at the work experience bracket of 11 to 15 years and the remaining 10 respondents (14.7%) fall at the work experience bracket of more than 15 years. This implies the fact that most of the respondents have sufficient knowledge and experience about their firm and subject matter of the study.

The study sought to establish the gender of respondents and the following below table showed information gathered from respondents. The majority of the respondents were male (60.3%) compared to female (39.7%). The result shows that there is slight gender disparity in management of the pharmaceutical firms.

Table 4. 3: Demographic Profile

Demographic Characteristics		Frequency	Total
Gender	Male	41	68
	Female	27	
Educational Qualification	Bachelor's Degree	30	68
	Master's Degree	13	
	College Certificate	10	
	Diploma	15	
Experience	1-5	25	68
	6-10	16	
	11-15	17	
	>15	10	

Source: Survey data 2019

4.5 Supply Chain risk management practices of pharmaceutical manufacturing firms in Ethiopia.

4.5.1 SCRM Practices

The supply chain risk management practices used in the analysis are: Supply Chain flexibility, Supply Chain Collaboration, Supply base rationalization, Supply chain control and supply chain avoidance. To address different points under each main category of supply chain risk management practices and supply chain performance, different questions were asked and then it is aggregated in to one variable under each dimension. The table 4.4 below shows the aggregated response result for each variable.

Table 4. 4: Descriptive Characteristics of the Grouped Variables

Statistics						
	Supply chain flexibility	Supply chain collaboration	Supply base Rationalization	Supply chain control	Supply chain avoidance	Supply chain performance
Mean	3.46	4.05	3.52	3.54	3.86	3.74
Standard Deviation	.81144	.68207	.43329	.60925	.47811	.72519

Source: Survey Data, 2019

The output data of the 68 respondents shows, the mean score is greater than 3 (the average value). Of the five independent variables, supply chain collaboration practice has the highest mean score (4.05) which is followed by 3.86 mean score for supply chain avoidance practice. However, supply chain flexibility and supply base rationalization has the lowest mean score, which are 3.46 and 3.51 respectively. The mean score of the dependent variable (Supply chain performance of the company) is also above 3. This implies that in the pharmaceutical manufacturing firms, SCRM practices and supply chain performance of the company showed above average performance.

- SC Flexibility

In order to assess supply chain flexibility practices of the firms, the selected employees were requested to respond five questions. The result of the analysis shows that all the five-

mean score of the variables of supply chain flexibility practices are greater than the average value, varying from 3.2 to 3.62 (Annex 4).

The overall finding shows all those lists of practices are managed well and the firms have good supply chain flexibility and it influences supply chain performance. The research findings agree with those of Gligor and Holcomb (2012) that found out that firms that achieve higher levels of flexibility and agility significantly outperform their less flexible counterparts. Flexible firms are more innovative, dynamic and responsive to changes and challenges. Hence, flexibility positively impacts its ability to enhance comparative performance relative to leading industry competitors. This study concludes that supply chain flexibility practice has positive influence on supply chain performance of the three pharmaceutical manufacturing firms.

- SC Collaboration

Supply chain Collaboration practices has influence on supply chain performance. Highest respondents varying from 93% to 66% agree on supply chain collaboration practices of the pharmaceutical firms and all the mean value of the supply chain collaboration practice variables are greater than the average value ranging from 3.65 to 4.53 (Annex 5).

The findings support Wieland and Wallenburg (2012) who found that communicative and collaborative relationships have a positive effect on supply chain resilience. It is also found that improved resilience, obtained by investing in agility and robustness, enhances a supply chain's customer value. Similarly, Srinivasan *et al*. (2011) stated that building trust in relationship contribute to reduction of supply chain related risks. Hence there will be a positive relationship between supply chain collaborative risk management practice and supply chain performance of the pharmaceutical firms. The findings from the interview also confirms that supply chain collaboration is the one most practiced supply chain risk management in all the three firms.

- Supply Base Rationalization

The mean score of all supply base rationalization practices except Sourcing from a few local suppliers only to minimize risks have mean score value greater than the average value

(Annex 6). Sourcing from suppliers who have been evaluated and selected to reduce supply risks had the highest mean score of 4.31 as 85% of the respondents agree on the practice. Sourcing from a few local and foreign suppliers has influence supply chain practices as this practice had the highest score of 3.74 as 29% strongly agree and 41% agree. When respondents were requested whether sourcing from multiple foreign suppliers to minimize losses had influence on supply chain performance, 51% of the respondents agree,16% had neutral response, while 32% disagreed. However, sourcing from a few local suppliers only to minimize risks had the lowest mean score of 2.66 as 60 % of the respondents disagree. Therefore, all supply base rationalization practices except sourcing from a few local suppliers only to minimize risks have influence on supply chain performance.

These Findings are in line with those of Ponomarov (2012) that supplier rationalization based on quality, pricing, delivery and performance of product have significant relationship with four elements of customer satisfaction product quality, product variety, delivery service and competitive pricing- and firm performance. Musa and Tang (2012) also stated that supplier base rationalization narrow the domain and severity of risk to which an exchange is exposed, and thereby encourage cooperation and trust. Thus, the study concludes that supplier base rationalization risk strategies have positive influence on performance of pharmaceutical firms. Findings from the interview also shows "Sourcing from suppliers who have been evaluated and selected to reduce supply risks" is important practice in the firms as a regulatory requirement.

- SC Control

Supply chain control practices of the firms was assessed for the selected employees of the pharmaceutical manufacturing firms. The employees were requested to respond the following below five questions and the result of their response was summarized in the table (Annex 7).

The study found out whether regular monitoring of supply chain risks (demand, supply process and environment risks) influences supply chain performance. The variable had the highest mean score of 4.07 as 82% agree. Using improved forecasting techniques to reduce risks associated with the supply chain has mean score of 4.04 as 91% agree. Large number of the respondents were neutral for keeping extra inventory of strategic items (e.g raw

material, parts and finished goods) and on holding of underutilized capacity which serves as a cushion to any disruptions. Additionally, the mean value of holding of underutilized capacity which serve as a cushion to any disruption is below the average value.

Therefore, all supply chain control practices except "holding of underutilized capacity which serve as a cushion to any disruption" influence supply chain performance. The pharmaceutical firms need to work to improve holding of underutilized capacity which serve as a cushion to any disruption practice.

The research findings agree with Lockamy (2014) findings that companies have been implementing different strategies and philosophies to control inventory, to eliminate waste, bring Continuous improvement, to improve forecasting and improved efficiency and responsiveness. This study concluded that supply chain risk control practice has positive influence on performance of pharmaceutical firms.

- SC Avoidance

Highest respondents varying from 91% to 50% agree on supply chain avoidance practices of the pharmaceutical firms and all the mean score of the supply chain avoidance practices, which is between 4.28 and3.53 are greater than the average value (Annex 8).

The study findings agree with those of Christopher and Holweg (2011) who found out that supply chain operating in all types of environments attempt to avoid risks within the constraints of acceptable returns such as revenue and profit targets. Hence avoidance practice lead to better performance of supply chain. The study conclude that supply chain risk avoidance practices have positive relationship with performance of pharmaceutical manufacturing firms.

4.5.2 Supply Chain Performance

Respondents were asked whether the firms supply chain operations achieved the lowest possible costs. Seventy percent (70%) of the respondents agree while 25% disagree. On whether the firms had the ability to reduce time between order and delivery, 59% of the respondents agree while 25% disagreed. The study also revealed that supply chain strategy influenced the ability of firms to meet quoted or anticipated qualities consistently. Eighty eight percent (88%) agree. Finally, employees were asked whether supply chain

performance matches customers' expectation and the result indicated 59% agreed while 33% of respondents disagree (Annex 9).

4.6. Regression Analysis for the influence of Supply Chain Risk Management Practices on Supply Chain Performance

The researcher conducted a multiple regression analysis to test the relationship between the independent variables and dependent variable. This regression analysis is conducted to know by how much the independent variable explains the dependent variable. The model used to show this influence is:

$Y= \beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+ \varepsilon$

Where: Y= Supply chain performance of the firms

β_0= Constant (value of y when x1, x2, x3, x4 and x5=0)

β_1= Regression coefficient for supply chain flexibility practice(x1)

β_2= Regression coefficient for supply chain collaboration practice(x2)

β_3= Regression coefficient for supply base rationalization practice(x3)

β_4= Regression coefficient for supply chain control practice(x4)

β_5= Regression coefficient for supply chain avoidance practice (x5)

ε= error term

4.6.1 Multiple Linear Regression Assumptions

Before interpreting the regression analysis, all the assumptions of the multiple regressions should be fulfilled to get the reliable and dependent result of the analysis. Therefore, the researcher had tested pre-regression assumptions before going to answer the research questions.

- Multi Collinearity

A good regression model must not have a strong correlation among its independent variables or must not have a multicollinearity problem, therefore before making a regression analysis, it is important to test the multi collinearity test. The multi-collinearity test is a test to identify a strong correlation between two or more predictors in a regression

model. This assumption can be assessed by examining tolerance and the variance inflation factor(VIF). VIF values below 10 and tolerance statistics above 0.2 can safely conclude that there is no multi-collinearity within the data.

Table 4. 5: Multi-Collinearity Test

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	Supply chain control	.475	2.105
	Supply chain flexibility	.519	1.928
	Supply chain avoidance	.559	1.790
	Supply base Rationalization	.611	1.637

a. Dependent Variable: Supply chain collaboration

Source: Survey Data ,2019

Based on the output data on table above VIF (the coefficient of collinearity statistics) value is almost 2 and less than 2 and the tolerance is more than 0.2. Therefore, it can be concluded that there is no multi- collinearity in the regression model.

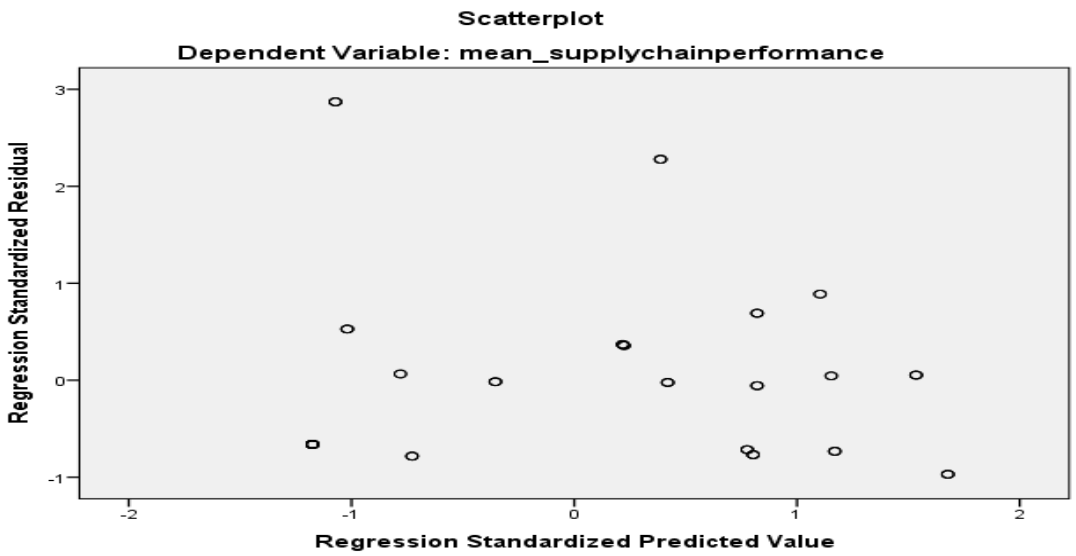
- Homoscedasticity

In homoscedasticity assumption, the variances of error terms are similar across the independent variables. At each level of the predictor variables, the variance of the residual terms should be constant. This means that the residuals at each level of the predictors should have the same variance(homoscedasticity); when the variances are very unequal, there is said to be heteroscedasticity (Field 2009). According to the statistical solution (2017), to test the linear relationship assumption, intellect's in the statistics, plot the standardized residuals verses the predicted yˆ values, which can show whether points are equally distributed across all values of the independent variables or not. Biased standard errors lead to biased inference, so results of hypothesis tests are possible wrong. For a basic analysis, we first plot *ZRESID(Y- axis) against *ZPRED(X-axis) on SPSS because this plot is useful to determine whether the assumptions of random errors and homoscedasticity have been met (Field 2009).

The graph of *ZRESID and *ZPRED should look like a random array of dots evenly dispersed around zero. If this graph funnels out, then the chances are that there is

heteroscedasticity in the data. If there is any sort of curve in this graph, then, the chances are that the data have broken the assumption of linearity (Field 2009).

Figure 4. 1 Scatter Plot Based on Residual



Source: Survey data,2019

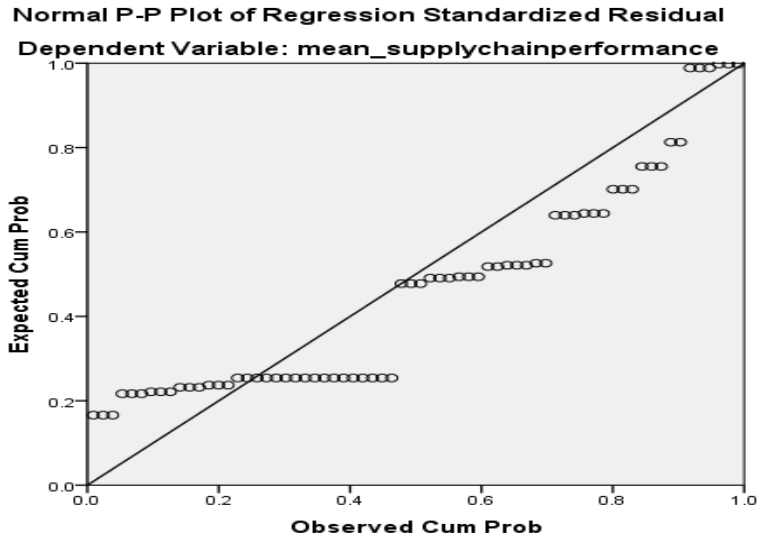
As can be seen in the scattered plot on fig 4.4 above, the residuals at each level of explanatory variables look like they are evenly dispersed and that the graph do not assume any type of shaped. Therefore, it is safe to say that this study has no heteroscedasticity problem.

- Normally Distributed Error Vs Normally Distributed Outcome Variables

The assumption of normally distributed error states that the residuals in the model are random, normally distributed variables with a mean of 0. This assumption simply means that the difference between the model and the observed data are most frequently zero or very close to zero and that differences much greater than zero happen only occasionally. In general, the normal distribution makes a straight diagonal line, and the plotted residuals are compared with the diagonal. If a distribution is normal, the residual line will closely follow the diagonal (Field, 2009). According to statistic solution (2017), multiple linear regression analysis requires that the error between observed and predicted values (i.e., the residuals of the regression) should be normally distributed. This assumption can be checked

by plotting residual values on a histogram with a fitted normal curve or by reviewing a Q-Q- plot. Normality can also be checked with a goodness of fit test (e.g, the Kolmogorov-Smirnov test), though this test must be conducted on the residuals themselves. When the data is not normally distributed, a non-linear transformation (e.g log-transformation) might correct this issue if one or more of the individual predictor variables are to blame, though this does not directly respond to the normality of residuals.

Figure 4. 2 P-P Plot of Standardized Regression Standardized Residual



Source: Survey Data 2019

Figure 4.5 Shows that the residuals have a sound normal distribution because the plotted residuals were around the diagonal straight line instead of making any other shape or curve.

- Correlation

The study used correlation analysis, superficially Pearson's correlation to measure the degree of association or relationship between different variables under consideration. As correlations, the measure of linear relationship between two variables with value ranging from -1 to 1, values that are closer to the absolute value of 1 indicates that there is a strong relationship between the variables being correlated whereas values closer to 0 indicates that there is little or no linear relationship. To describe the strength of the correlation, the researcher used Evan's (1996) guide for the absolute or r namely 0.00-0.19(very week),0.20-0.39(weak),0.40-0.59(Moderate),0.6-0.79(strong) and 0.80-1.00 (very strong).

The finding shows, all supply chain risk management practices are significant at the 0.01 level. Based on the output value of sig(2-tailed), in the selected pharmaceutical firms,

Table 4. 6: Correlation between the grouped SCRM Practices and SC Performance

Correlation

		Supply Chain Performance
SC Flexibility	Pearson Correlation	.856**
	Sig. (2-tailed)	.000
	N	68
SC Collaboration	Pearson Correlation	.599**
	Sig. (2-tailed)	.000
	N	68
Supply base Rationalization	Pearson Correlation	.571**
	Sig. (2-tailed)	.000
	N	68
SC Control	Pearson Correlation	.674**
	Sig. (2-tailed)	.000
	N	68
SC Avoidance	Pearson Correlation	.569**
	Sig. (2-tailed)	.000
	N	68

Source: Survey Data, 2019

- ✓ All independent variables, (flexibility, collaboration, supply base rationalization, control, avoidance) and supply chain performance have a statistically significant relationship, $p < .01$
- ✓ The direction of the relationship between independent and dependent variables are positive, that means these variables tend to increase together.
- ✓ The magnitude, or strength of the association is approximately strong since correlation coefficient(r) is between 0.5 and 0.8($.5<r<.8$)
- ✓ Since the value of correlation coefficient ($r<1$) for all bivariate correlation among independent variables, this indicates that there is no multicollinearity problem in the model.

4.6.2 Result of Regression Analysis

- Regression Analysis Model

The finding below shows, the adjusted R^2(coefficient of determination) explains 78.7% of the factor affecting supply chain performance of pharmaceutical manufacturing firms. Based on SPSS 23 generated data above, the adjusted R^2 explains 78.7% of the factor affecting supply chain performances as represented by the five independent variables that were studied. Therefore, a further research should be conducted to investigate the other 21.3% affecting supply chain performance in the pharmaceutical manufacturing firms.

Table 4. 7: Model Summary Table

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.896[a]	.803	.787	.33490

Source: Survey Data, 2019

- Analysis of ANOVA

The ANOVA table below establishes significance of the regression model from which an F- significance value of $p<0.01$. This implies that the regression model has a less than 0.01 likelihood (probability) of giving a wrong prediction. Hence the overall regression model is statistically significant, meaning that it is a suitable prediction model for explaining how supply chain risk management practices affects the supply chain performance of the firms.

Table 4. 8: ANOVA Table

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	28.281	5	5.656	50.431	.000[b]
	Residual	6.954	62	.112		
	Total	35.235	67			

a. Dependent Variable: supply chain performance

b. Predictors: (Constant), Supply chain avoidance, Supply base Rationalization, Supply chain flexibility, Supply chain control, Supply chain collaboration

- Coefficient of Regression

Table 4. 9: Coefficients Table

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.243	.396		.615	.541
	Supply chain flexibility	.728	.080	.814	9.065	.000
	Supply collaboration	-.331	.104	-.312	-3.198	.002
	Supply base Rationalization	.209	.124	.125	1.685	.097
	Supply chain control	.305	.103	.256	2.960	.004
	Supply chain avoidance	.129	.115	.085	1.127	.264

Source: Survey Data, 2019

The regression table indicates that Supply chain flexibility practice has a positive and significant influence on the of pharmaceutical firms, where t-statistic value was calculated to be 9.065 at p value <0.05. The value of the coefficient of supply chain flexibility was found to be .728 which means that, keeping other variables constant, a unit increase in supply chain flexibility practice causes 72.8% increase in supply chain performance of the firms.

The coefficient of supply chain control practice was .305, which means that keeping other variables constant, a unit increase in supply chain control practice causes 30.5% increase in supply chain performance of the firms. Supply chain control has positive and significant influence on the supply chain performance of pharmaceutical firms, where t-statistic value was calculated to be 2.960 at p value <0.05.

The coefficient of supply chain collaboration was -.331, which means that keeping other variables constant, a unit increase in supply chain collaboration causes 33.1% decrease in supply chain performance of the firms. Supply chain collaboration has a negative and significant influence on the supply chain performance on the pharmaceutical firms. However, this regression analysis result doesn't consent with descriptive analysis of the variables in the study, where supply chain collaboration has the highest mean among other

variables like flexibility, avoidance, control and supply base rationalization. In addition to this, this result is not consistent with the findings of the interview which proved supply chain collaboration is a critical practice in the pharmaceutical manufacturing firms.

However, the regression analysis result shows supply base rationalization and supply chain avoidance practice are not significant, with p value >0.05 for both variables.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATION

5.1. Introduction

The chapter covers five major sections of the study results and recommendations. These include the summary of the findings, conclusions of the study, recommendation, limitations and implication of future researches.

5.2 Summary of Major Findings

The study indeed established that all SCRM practices examined in the study were adopted by the firms but in a varying extent. The research adopted a kind of case study in an effort to establish the influence of SCRM practices on supply chain performance, the case of three pharmaceutical manufacturing firms in Ethiopia

- Of the five SCRM practices, supply chain collaboration practice has the highest mean score followed by supply chain avoidance and supply chain control practices respectively. Supply chain collaboration found to be highly practiced with highest mean score and which has been supported by the interview.
- Comparing the five SCRM practices, SC flexibility and Supply base rationalization practices found to be lower with mean score 3.46 and 5.52 respectively which are the least practiced activities.
- Supply chain performance of the companies is also more than moderate enough. This implies that in the pharmaceutical firms, supply chain risk management practices and supply chain performance of the company showed above average performance.
- Findings from the interview indicated that not all SCRM practices were viewed as SCRM but rather as SCM practices and there was no approved SCRM procedure manual in those firms.
- The findings of the survey also showed that the large proportion of the corresponding change in determining supply chain performance was the results of the change in SCRM practices of all the five predictor variables jointly.
- Based on regression analysis, the effect of supply chain flexibility and supply chain control among the five variables on supply chain performance were significant and

positive. The result of SC collaboration, the p-value showed significant while the beta coefficient was negative which implied reverse relationship. However, from the result of mean score, literatures and interview, it is the most important SCRM practice. The rest two variables supply base rationalization and supply chain avoidance are not significant according to the p-value of multiple regression.

- The findings from the interview revealed that supply chain risks in the pharmaceutical firms are mostly associated with the pharmaceutical firms are: foreign currency shortage, short shelf life of raw materials and products, stringent regulation on the specification of raw material, inspection, production process, selection of vendors.

5.3 Conclusions

- Based on descriptive statistics finding, on average the SCRM practices and supply chain performance of the three manufacturing firms had more than average level of implementation. However, due to inefficiencies of the SCRM practices the firms didn't reach at its optimal level.
- Supply chain flexibility had a more than the average mean score results. However, a practice 'delays final product assembly activities until customer orders have been received' had a weak mean score of 3.22 which needs attention.
- Supply base rationalization had a mean score of 3.52; however, the firms do not source from few local suppliers only to minimize risks which had mean score of 2.66 again needs due attention.
- More or less, the other SCRM practices-Supply chain collaboration, supply chain control and supply chain avoidance had relatively better mean score and there is no as such a very low mean score for the individual practices under each variable.
- Supply chain performance of the companies is also more than moderate enough. This implies that in the pharmaceutical firms, supply chain practices and supply chain performance of the company show above average performance.
- The study indicated that not all practices studied here are adopted with the view of managing supply chain risks but rather as supply management practices. The finding from the interview showed that among the SCRM practices, as regulatory

requirement from government bodies to comply with standards & specification, only supply chain collaboration and supply base rationalization are viewed as supply chain risk management practice.

- Based on regression analysis, the effect of supply chain flexibility and supply chain control among the five variables on supply chain performance were significant and positive. Supply chain collaboration which had the highest mean score, its importance to supply chain performance supported by many literatures and its practical implementation witnessed by the plant managers of the three firms during the interview, p-value showed significantly affecting supply chain performance, its beta coefficient was found to be negative which implied reverse relationship. The rest two variables supply base rationalization and supply chain avoidance are not significant according to the p-value of multiple regression.

5.4. Recommendations

The following recommendations can be drawn from the analysis and conclusions made.

- Contingency planning, postponement and agility must be in place to improve SC flexibility. Firms must have multiple approved vendor list and enhance their purchasing practice from local suppliers so that supply base rationalization will be optimized.
- Firms should work hard to reduce logistics cost through efficient operation & increase delivery time to make the supply chain performance more effective.
- Although more than 90% of the inputs are imported according to the interview, there are items which can be sourced locally. Therefore, a strategy to source locally could help to minimize supply chain risks; it implies that government in collaboration with firms shall design appropriate strategies.
- Firms should develop risk management procedure manual with respect to supply chain activities.
- Finally, a proactive SCRM strategy should be in place in response to enormous uncertainties and risks some of which are specific to the sector. These proactive strategies could be among others:
    - Contingency planning in response to demand fluctuation.

- Planning ways to mitigate foreign currency shortage risks like negotiating with national Bank of Ethiopia to get suppliers' credit, and engaging in export to generate foreign currency.
- keeping buffer stock of raw materials and spare parts once the foreign currency is available.
- Increase the number of approved vendor list to get advantage of price and flexibility.
- Collaborating with custom, arranging imported materials inspection at the factory to avoid delay at custom.
- Purchasing common items through government agency so that high cost of materials due to individual purchase will be minimized.

5.5. Limitations and Implication of Future Research.

While these results are valuable, it is not without limitations. The research didn't consider the response of very important members of the supply chain who are suppliers and customers and only considered supply chain performance as the only measurement. Although the quantitative research was supported by interview, responses from single respondents in the firms by no means could be free from response bias. Future studies using more contextual variables, additional dimensions which consider the very special nature of the sector and including all the pharmaceutical manufacturing firms in the study would be valuable to suggest a complete solution for all manufacturing firms in the pharmaceutical sector.

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Annex 1:Questionnaire of the Survey

ADDIS ABABA UNIVERSITY, SCHOOL OF COMMERCE

DEPARTMENT OF LOGISTICS AND SUPPLY CHAIN MANAGEMENT

MA PROGRAM

QUESTIONNAIRE

Dear Sir/ Madam

This questionnaire is designed to gather primary data from employees to conduct a thesis paper entitled ***"The Influence of Supply Chain Risk Management Practices on Supply Chain Performance: The Case of Selected Pharmaceutical Manufacturing Firms in Ethiopia"*** and is being carried out as a requirement for the partial fulfillment of MA in Logistics and supply chain management.

Kindly be assured that all the information you provide will be kept strictly confidential, will be used for academic purposes only and anonymity of your identity is guaranteed. In addition, all personal data shall be treated collectively rather than on personal bases.

The survey will take 20-25 minutes to complete but allow yourself enough time so that you don't have to rush. Please be responsible to answer honestly in order to get the most accurate result.

Should you require any further information, please feel free to contact the researcher Neguse Sime by the following address- negmikael@gmail.com, Mobile phone 0911220306.

With regards,

N.B:-

- It is not necessary to write your name
- For the closed ended questions, use (✓) mark for your choice in the given box.
- Make sure there are 7 pages including the introduction

Section A: Background Information

Nameof Organization…….

Department……

Designation……..

Tick on the appropriate box

1. Gender: Male ☐ Female ☐
2. Year of Experience :

   1-5 ☐ 6-10 ☐ 11-15 ☐ Over 15 ☐
3. Qualification Certificate:

   Bachelor's degree ☐ Master's degree ☐ College Certificate ☐

   Diploma ☐ PhD ☐

Other…….

Section B: Supply Chain Risk Management Practices

1. **Flexibility practice:** The ability to delay the actual commitment of resources and activities to maintain flexibility and delays incurring costs.

To what extent do the statements apply to your flexibility practices?

(1-Strongly Disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly Agree)

	Supply Chain Risk Management practices	5	4	3	2	1
F1	Delays final product assembly activities until the last possible position (or nearest to customers) in the supply chain.					

F2	Stores items at appropriate distribution points close to the customers in the supply chain.					
F3	Can re-arrange production process so that customization is possible.					
F4	Delays final product assembly activities until customer orders have been received.					
F5	Accommodate several customer service requirements.					

2. Collaboration Practice: Coordination and collaboration across the supply chain from customers to the suppliers.

To what extent do the statements apply to your supply chain collaboration practices?

(1-Strongly Disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly Agree)

	Supply Chain Risk Management practices	5	4	3	2	1
CO1	Exchange information that helps in the reduction of supply chain risks.					
CO2	Frequent and timely exchange of information about events or changes that may affect businesses.					
CO3	Collaboration with supply chain partners.					
CO4	Involvement of supply chain partners in the new product design development effort.					

CO5	Information technology is used to reduce supply chain risks.					

3. Supply Base Rationalization Practices:-Management of suppliers in a way that reduces supply chain risks.

To what extent do the statements apply to your Supply Base Rationalization practices?

(1-Strongly Disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly Agree)

	Supply Chain Risk Management practices	5	4	3	2	1
SBR1	Sourcing from multiple local suppliers to minimize the likelihood of supply chain risks.					
SBR2	Sourcing from multiple foreign suppliers to minimize the likelihood of supply chain risks					
SBR3	Sourcing from few local and foreign suppliers.					
SBR4	Sourcing from few local suppliers only to minimize risks.					
SBR5	Sourcing from suppliers who have been evaluated and selected to reduce supply risks.					

4. **Control Practice**: supply chain risk control is the process of taking proactive steps to reduce the identified risks where possible and putting procedures, rules and policies in place to minimize the residual risk or to reduce the severity of such a loss.

To what extent do the statements apply to your supply chain Control practices?

(1-Strongly Disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly Agree)

	Supply Chain Risk Management practices	5	4	3	2	1
C1	Holding buffer stock to mitigate the risk of stock-out.					
C2	Keeping extra inventory of strategic items (e.g Raw materials, parts and finished goods).					
C3	Holding of underutilized capacity which serves as cushion to any disruptions.					
C4	Using improved forecasting techniques to reduce risks associated with supply chain.					
C5	Regular monitoring of supply chain risks (Demand, Supply process and environmental risks).					

5. **Avoidance Practices**: this practice is geared toward driving over all probabilities associated with risk events of a decision to zero by ensuring that risk doesn't exist.

To what extent do the statements apply to your supply chain Avoidance practices?

(1-Strongly Disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly Agree)

	Supply Chain Risk Management practices	5	4	3	2	1
A1	Avoid geographical markets that deemed risky					
A2	Avoid some suppliers to minimize supply chain risks.					
A3	A delay getting in to certain markets until the uncertainty is reduced.					

A4	Audit supplier processes to minimize quality risk.					
A5	Information technology is used to minimize supply chain risks.					

- What are the major supply chain risk management practices of your pharmaceutical manufacturing firm?

  1……

  2……

  3……

  4……

  5……

  6……

Section C: Supply Chain Performance: A firm's supply chain performance is measured in terms of cost, quality, delivery relative to industry standards and customer service levels**.**

To what extent do the statements apply to your business operations performance?

(1-Strongly Disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly Agree)

	Supply Chain Performance Activities	5	4	3	2	1
SCP1	The ability to achieve the lowest possible cost of logistics through efficient operations, technology and/or scale economies.					
SCP2	The ability to reduce the time between order receipt and customer delivery to as close to zero possible.					
SCP3	The ability to meet anticipated quality on consistent bases.					

SCP4	The extent to which perceived supply chain performance matches customer expectations.					

- What are the major influences of supply chain risk management practices on the supply chain performance of your pharmaceutical manufacturing firm?

  1.……

  2.……

  3.……

  4.…….

  5……..

Thank you for your time!

Annex 2: Interview of the Survey

Addis Ababa University, School of Commerce

Department of Logistics and Supply Chain Management

MA Program

Interview

Company Name…….

Designation…….

Experience……

Question 1: What are the supply chain risks associated with your firm?

Question 2: What are the supply chain risk management practices your firm apply to mitigate your company supply chain risks?

Question 3: How is your company supply chain performance in terms cost, quality, delivery and customer service?

Thank you!

Annex 3: Registered output by Company and Product Type

	Tablets	Capsules	Syrups & Suspensions	IV Fluids	Vials	Oral Liquids & Powders	Ointments	Dermatological Preparation	Powders for Suspension	Ampoules	Empty Gelatin Capsules
Addis Pharmaceutical Factory (JV)	495,320,000	512,000,000	4,000,000 bottles	1,377,290 bags	1,600,000			110,000 tubes	1,000,000 bottles		
EPHARM (Full Ethioplan Investment)	371,010,000	171,540,000	2,130,000 bottles	256,320 bags	5,140,000	6,840,000	45,110,000			1,660,000	
CADILA Pharmaceuticals (JV)	202,800,000	85,800,000				749,000					
Julphar Pharmaceuticals (JV)	15,000,000					3,200,000					
Sino – Ethiop Associate Africa (JV)											1,090,000,000
East African Pharmaceuticals (JV)	57,200,000	29,000,000									
Fews Pharmaceuticals (Fully Ethioplan Investment)			5,640,000 bottles								
Pharmacure Pharmaceuticals (Fully Ethioplan Investment)				1,902,384 bags							
MedSol Pharmaceuticals (Fully Ethioplan Investment)				208,900 bags							
Total National Production	**1,141,330,000**	**798,340,000**	**11,770,000 bottles**	**3,744,894 bags**	**6,740,000**	**10,789,000**	**45,110,000**	**110,000 tubes**	**1,000,000 bottles**	**1,660,000**	**1,090,000,000**

Source: Addis Ababa chamber of commerce and Asoko Executive interviews, 2018

Annex 4: Descriptive Statistics on Supply Chain Flexibility Practice

Questions	Total	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	SD
Delays final product assembly activities until the last possible position (or nearest to customers) in the supply chain	68	24%	34%	13%	25%	4%	3.47	1.227
Stores items at appropriate distribution points close to the customers in the supply	68	21%	38%	3%	38%	0%	3.41	1.20
Can re-arrange production processes so that customization can be carried out later	68	29%	29%	13%	28%	0%	3.60	1.186
Delays final product assembly activities until customer orders have been received	68	21%	37%	0%	29%	13%	3.22	1.413
Accommodate several customer services requirements	68	13%	59%	12%	9%	7%	3.62	1.065
						Grand Mean	3.46	

Note: ‘a ‘implies as multiple mode exists

Annex 5: Descriptive Statistics on Supply Chain Collaboration Practice

Questions	Total	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	SD
Exchange of information that helps in the reducing supply chain risks	68	75%	18%	0%	0%	7%	4.53	1.072
Frequent and timely exchange of information about events or changes that may affect business	68	34%	57%	4%	0%	4%	4.16	0.874
Collaboration with supply chain partners	68	46%	22%	7%	25%	0%	3.88	1.24
Involvement of supply chain partners in the new product design development effort and marketing	68	31%	53%	9%	4%	3%	4.04	0.921
Information technology is used to reduce supply chain risks	68	41%	25%	0%	25%	9%	3.65	1.453
						Grand Mean	4.05	

Annex 6: Descriptive Statistics on Supply Base Rationalization

Questions	Total	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	SD
Sourcing from multiple local suppliers to minimize the likelihood of supply chain risks	68	18%	41%	9%	28%	4%	3.40	1.199
Sourcing from multiple foreign suppliers to minimize losses	68	29%	22%	16%	32%	0%	3.49	1.228
Sourcing from a few local and foreign suppliers	68	29%	41%	7%	18%	4%	3.74	1.192
Sourcing from a few local suppliers only to minimize risks	68	4%	22%	13%	56%	4%	2.66	1.016
Sourcing from suppliers who have been evaluated and selected to reduce supply risks	68	60%	25%	7%	0%	7%	4.31	1.123
						Grand Mean	3.52	

Annex 7:Descriptive Statistics on Supply Chain Control Practice

Questions	Total	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	mean	SD
Holding of buffer stock to mitigate the risk of stock-out	68	25%	26%	7%	38%	3%	3.32	1.298
Keeping extra inventory of strategic items (e.g., raw materials, parts and finished goods)	68	9%	34%	40%	13%	4%	3.29	0.963
Holding of underutilized capacity which serves as a cushion to any disruptions	68	4%	24%	38%	34%	0%	2.99	0.872
Using improved forecasting techniques to reduce risks associated with the supply chain	68	13%	78%	9%	0%	0%	4.04	0.471
Regular monitoring of supply chain risks (demand, supply process and environmental risks)	68	47%	35%	4%	4%	9%	4.07	1.226
						Grand Mean	3.54	

Annex 8: Descriptive Statistics on Supply Chain Avoidance Practice

Questions	Total	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	SD
Avoids geographical markets deemed risky	68	22%	38%	10%	29%	0%	3.53	1.139
Avoids some suppliers in order to minimize supply chain risks	68	25%	66%	0%	4%	4%	4.03	0.914
Delays getting into certain markets until the uncertainty is reduced.	68	9%	41%	25%	25%	0%	3.54	0.956
Audits both our processes and supplier processes to minimize quality risks	68	46%	41%	9%	4%	0%	4.28	0.808
Information technology is used to reduce supply chain risks	68	54%	24%	9%	9%	4%	4.15	1.175
						Grand Mean	3.90	

Annex 9:Descriptive Statistics on Supply Chain Performance

Questions	Total	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	SD
The ability to achieve the lowest possible cost of logistics through efficient operations, technology and/or scale economies	68	32%	38%	4%	25%	0%	3.78	1.157
The ability to reduce the time between order receipt and customer delivery to as close to zero as possible	68	24%	35%	16%	25%	0%	3.57	1.111
The ability to meet quoted or anticipated quality on a consistent basis	68	37%	51%	12%	0%	0%	4.25	0.655
The extent to which perceived matches customer expectations	68	13%	46%	7%	29%	4%	3.34	1.167
						Grand Mean	3.74	