



ADDIS ABABA UNIVERSITY SCHOOL OF COMMERCE

PHARMACEUTICAL SUPPLY CHAIN RISK MANAGEMENT
THE CASE OF PHARMACEUTICAL FUND AND SUPPLY AGENCY

*A Thesis Submitted to Addis Ababa University, school of Commerce Department of
Logistics and Supply Chain Management for the Partial Fulfillment of the Requirements
for Masters of Art Degree in Logistics and Supply Chain Management.*

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SCHOOLOF COMMECE

**DEPARTMENTOF LOGISTICS AND SUPPLY CHAIN
MANAGEMENT**

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PHARMACEUTICAL FUND AND SUPPLY AGENCY**

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Statement of Certification

This is to certify that Bisrat Mengistu has carried out his research work on the topic entitled: “Pharmaceutical Supply Chain Risk Management the Case of Pharmaceutical Fund and Supply Agency” is his original work and is suitable for submission for the award of Masters of Art Degree in Logistics and Supply chain management.

Advisor: Dr. Worku Mekonnen (PhD)

Date & Signature

Statement of Declaration

I, Bisrat Mengistu, declare that this Master's research "Pharmaceutical Supply Chain Risk Management the Case of Pharmaceutical Fund and Supply Agency" is submitted in partial fulfilment of the requirements for the degree of Master's 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.

Declared by:

Bisrat Mengistu

Date & Signature

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Acronyms and Abbreviations

AHP-Analytical Hierarchy Process

AIDS- Acquired Immune Deficiency Syndrome

ET- Event Tree

ETA- Event Tree Analysis

FMEA- Failure Mode Effect Analysis

FTA- Fault tree analysis

GS- General Service

HCMI- Health Commodity Management Information System

HIV- Human Immune deficiency Virus

HR- Human Resource

IGS- Interim Group Secession

IPLS- Integrated Pharmaceutical Logistics System

IT- information technology

JIT- Just In Time

LMIS- Logistic Information Management Systems

MDG- Millennium Development Goal

MIS- management information science

MoH-Ministry of Health

PFSA- Pharmaceutical Fund and Supply Agency

PHARMID –Pharmaceutical and Medical Supplies Import and Whole Sale Enterprise

PSC- Pharmaceutical Supply Chain

RDF- Revolving Drug Fund

RPN- Risk priority number

RSV-Risk score values

SC- Supply Chain

SCM- Supply Chain Management

SCOR- Supply Chain Operation Reference

SCRM- Supply Chain Risk Management

SCR-Supply Chain Risk

SD- Standard Deviation

SD-Standard deviation

SPSS- Statistical Package for the Social Sciences

USA- United States of America

WHO- World Health Organization

Abstract

Supply chain risk management is the systemic identification, assessment, and mitigation of potential disruption in logistics network with the objective to reduce their negative impact on the logistics network performance. Whilst risk has always been present in the process of reconciling supply with demand there are a number of factors that have emerged in last decades which have increased the level of risk. Increased demand for just in time deliveries, the trend to outsourcing, ever changing customer demand, a reduction in supplier base are some to mention. Any risk affecting the pharmaceutical supply chain not only waste resources but also threaten patients' life by hindering access to medicines. The pharmaceutical fund and supply agency was established back in 2007 in order to introduce efficiency in the supply chain of pharmaceuticals and medical supplies management system as well as to address issues of drug availability and affordability. Observed problems in the supply chain operation of the agency such as frequent shortage and stock out of medicines, and purchase of poor quality pharmaceutical initiate to conduct this study. The study is conducted with the objectives of identifying main supply chain risks faced by pharmaceutical fund and supply agency, access the extent to which supply chain risk management is practised by pharmaceutical fund and supply agency, and determine the barriers in adopting Supply chain risk management. A case study research approach was chosen as the research strategy for investigating the research questions. The research is a quantitative descriptive type which originates from the prevailing descriptive qualities of both a case study approach and the research's conceptual frame work. The findings of the study showed weak risk identification, a higher supplier risk, a weak implementation of supply chain risk management, and a number of barriers in adopting supply chain risk management. Factors like; supplier geographical distance, inadequate technology, poor communication across a supply chain, and lack of supply chain management knowledge stated as frequently occurring barriers. The paper recommends the Agency to adopt a better risk identification technique since risk identification is a key and first step in implementing supply chain risk management. Moreover a much better work should be done in handling supplier's risk since it is found to be the primary risk factor in the pharmaceutical supply chain of the Agency, barriers in adopting a better supply chain risk management like supplier geographical distance can be addressed by making use of better communication technologies as well as building the capacity of local pharmaceutical manufacturers.

Key words *Disruption, risk, supply chain risk management, and threat.*

CHAPTER ONE

1. INTRODUCTION

The World Health Organization (WHO) estimates about one-third of the world's population lack access to essential medicine, mostly in Asia and Africa. For this, availability and affordability of essential medicines is taken as one of the Millennium Development Goal (MDG) in developing countries (who.int). Access to medicine is one of the elements of the right to health which is outlined in article twelve of the international covenant on economic, social and cultural rights which has been ratified by approximately 150 countries including Ethiopia. Kaufmann, Thiel, and Becker (2005) stated pharmaceutical supply chain (PSC) should provide medicines in the right quantity, with the acceptable quality, to the right place and customers, at the right time and with optimum cost to be consistent with health system's objectives and also it should make benefits for its stockholders.

1.1 Background of the study

Any risk affecting the PSC not only wastes the resources but also threaten the patients' life by hindering access to medicines (Schneider and Wilson 2010). But the use of the term 'risk' can be confusing because it is perceived as a multidimensional construct. On one hand, it is used to refer to uncertain internal or external (environmental) variables that reduce outcome predictability. In this sense, 'risk' actually refers to a source of risk and uncertainty, such as 'political risks' and 'market risks' or from a supply chain views 'the volatility of customer demand'. On the other hand, the term risk is also used when referring to the consequences of risks, i.e. to the potential outcome indicators. In this sense, the terms 'operational risks', 'human risks' or 'risks to customer service levels' are consequences of risk becoming events (Kilubi and Dietrich, 2015).

According to Liz Breen (2008) risk can be defined as the probability of unwanted outcome happening or the probability and magnitude of a loss, disaster, or other undesirable event. More elaborately it can be stated as the chance, in quantitative terms, of a defined hazard occurring. It therefore combines a probabilistic measure of the occurrence of the primary event(s) with a measure of the consequences of that/those event(s). Management can be defined as the planning, organizing, coordinating, controlling, and directing of resources toward a defined objective.

By combining the definitions given above and various definitions developed by others supply chain management (SCM) can be defined as the management of material, information, and financial flows through a network of organizations (i.e., suppliers, manufacturers, logistics providers, wholesalers/distributors, retailers) that aims to produce and deliver products or services for the consumers. It includes the coordination and collaboration of processes and activities across different functions such as marketing, sales, production, product design, procurement, logistics, finance, and information technology within the network of organizations (Ritchie and Brindley, 2007a; Shah,2004).

Supply Chain Risk Management (SCRM) is the systematic identification, assessment, and mitigation of potential disruptions in logistics networks with the objective to reduce their negative impact on the logistics network's performance (Norman and Jansson, 2004). SCRM is also defined as to collaborate with partners in a supply chain, apply risk management process tools to deal with risks and uncertainties caused by or impacting on logistics related activities or resources (Norrman and Lindroth, 2002). Piyush *et al.* (2011) stated SCRM emerged as a natural extension of SCM with the prime objective of identifying the potential sources of risks and suggesting suitable action plans to mitigate them. Hence the focus of SCRM is to understand, and try to avoid, the devastating ripple effects that disasters or even minor business disruptions can have in a supply chain. SCRM is a crucial and indivisible part of SCM to achieve mentioned objectives of any given firm and risk management has now become an integral part of every aspect of business operations (Norman and Jansson, 2004).

Any glitch within the supply chain can cause delays and even disruption to the supply chain (Buzacott, 1971). Most recent incidents, such as the Arab Spring protests, the Sendai earthquake, and the Thailand floods in 2011 have shown how such disruptions can severely affect even the most stable supply chain. According to Tang, (2006a) the increasing numbers of research studies on supply chain disruptions resulting from economic and political instability, volatile market dynamics, natural disasters or human actions, have shown that risk issues are becoming the new norm in supply chain (SC) operations. Occurrence of several well-documented incidents, both natural and manmade such as (e.g. Tsunami 2004, Hurricane Katrina 2005, Taiwan earthquakes 1999, 2009, and 2010 Iceland volcano 2010, the nuclear disaster in Fukushima 2011, or Hurricane Sandy in 2012), terrorist attacks (e.g. New York, 2001; Madrid, 2004; London, 2005; Jakarta, 2009) and diseases (e.g. foot- and mouth disease 2001 in the UK; SARS-pandemic 2003/2004; Avian influenza, 2005; Swine influenza

2009), make interest in supply chain risk (SCR) issues to steadily grow (Wagner and Neshat, 2012).

Whilst risk has always been present in the process of reconciling supply with demand, there are a number of factors that have emerged in the last decade or so which might be considered to have increased the level of risk (Kut and Zheng, 2003). These include; a focus on efficiency rather than effectiveness, the globalization of supply chains, focused factories and centralized distribution, the trend to outsourcing, Low Cost Country (LCC) sourcing, ever-changing customer demand, expanding product variety, shorter product life cycles and compressed time-to-market, fast and heavy ramp-up of demand early in product life cycles, capacity limitation of key components, and a reduction of the supplier base (Jüttner, 2003 and Norman and Jansson, 2004). Moreover increased demand for just-in-time (JIT) deliveries, reduced inventory buffers, and e-business play a significant role in repeated and unexpected disruption in a supply chain (Fawcett *et al*, 2011; Irene and Haasis, 2015).

Additionally the demands of the business environment and the progression of emerging markets are leading to the development of dynamic and complex SC networks which hinder visibility and consequently reduce ones control over the process (Irene and Haasis, 2015). What's more is service supply chain should be managed differently from manufacturing supply chain, because they are characterized by intangibility, and heterogeneity in consumption (Liz Breen, 2008).

The risks in supply chains arise mainly due to (I) Operational fluctuations such as variability in supply, demand uncertainties, and price variability Juttner, (2005); Christopher and Lee,(2004) (ii) Natural events such as earthquakes, cyclones, epidemics and (iii) Manmade crises such as terrorist attacks, unethical business practices and economic recessions (Kleindorfer and Saad, 2005). The supply chain involves every stage from planning and procurement to the final delivery of products and any organization within a supply chain performs activities of sourcing, making and delivery while each of these activities are prone to disruption. It is better to have a closer look at each of these activities to better understand sources of risk.

a. Source

Sourcing involves the acquisition of physical products or services. Source of risk from activities of sourcing consists: single sourcing risk, sourcing flexibility risk, supplier

selection/outsourcing risk, risks arising from product quality, supplier capacity limitation, and currency fluctuation risk (Johnson, 2001).

b. Make

Making is a process that is done internally in order to convert sourced goods in to outputs that are in accordance with the demand of the customer or it is processing an input data to deliverable output in case of service industry. The major issues in this segment involve: product and process design risk, production capacity risk, and operational disruption risk (Johnson, 2001).

c. Deliver

This is a process of delivering processed goods and service towards a customer upon a request or anticipating of demand. According to Ding *et al.* (2007) and Sodhi (2005) demand uncertainties are still the major problem discussed in SCRM. The major issues in this category include: demand volatility, seasonality, balance of unmet demand, and excess inventory (Zsidisin *et al.* 2000).

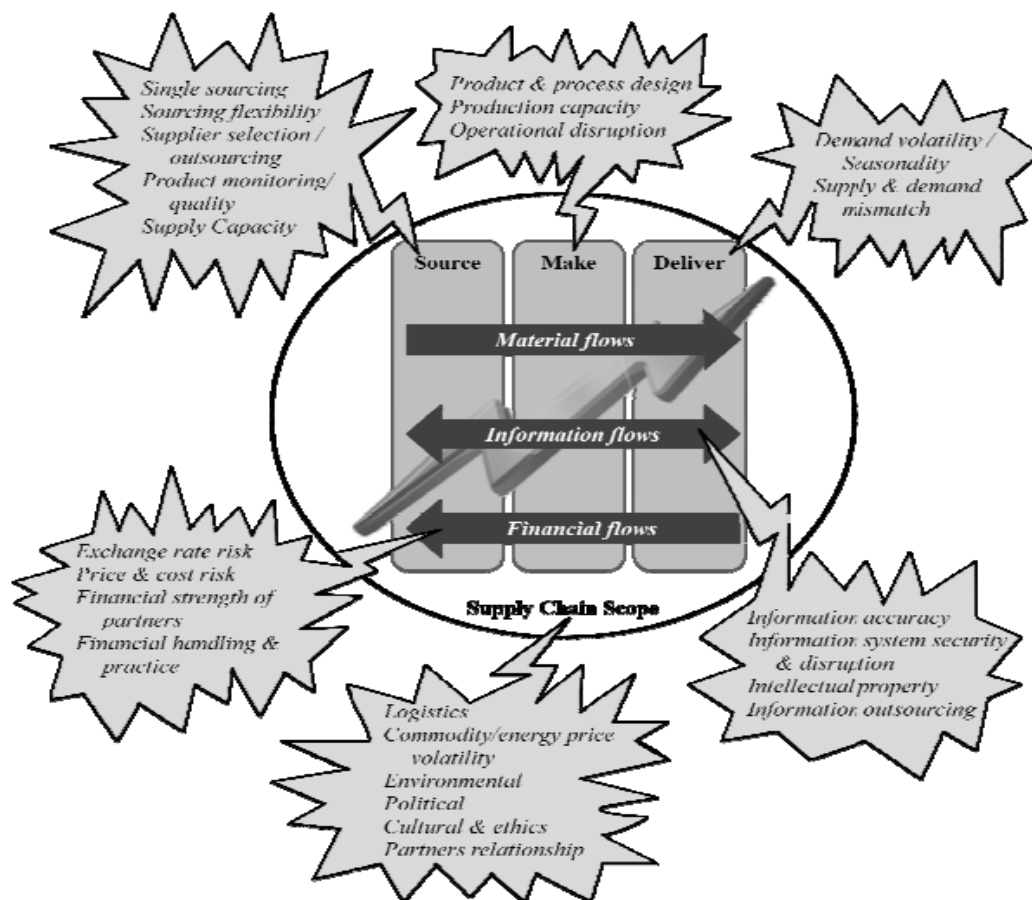


Fig.1 source of risk in a supply chain

Source (S. Nurmaya Musa, 2012)

1.2 The Pharmaceutical Fund and supply agency (PFSA)

To address issues of drug availability and affordability, the government of Ethiopia supported the creation of revolving drug funds (RDF) as part of the new health care financing strategy back in 1998. These funds aim to increase resources at facility-level through the sale of medicines with a mark-up, thereby generating additional funds for the procurement of new drugs and quality improvements. The strategy aims to enhance affordable and sustainable supply of medicines to the public, improve overall quality of services provided, and promote sustainability of health services. This approach is also in line with a body of work arguing that charging for services and drugs can improve the efficiency of the system, improve availability and affordability of medicines and result in increased health utilization and particularly improve procurement of drugs though there are arguments that states charging for health services deter use.

In order to introduce efficiency in the supply chain of pharmaceuticals and medical supplies management system, the former Pharmaceutical and Medical Supplies Import & Wholesaler Enterprise (PHARMID) has been transformed into PFSA with several measures taken to strengthen the capacity of the new agency. PFSA was established back in 2007 with proclamation 553/2007 as an autonomous federal organ having its own legal personality. It is established by the government of Ethiopia upon the understanding of health as the pillar of securing proper life and productivity of the people and pharmaceuticals share a vital role in the health service, pharmaceutical expenditure is much significant as compared to other health service budget, a necessity to supply quality assured essential pharmaceuticals at affordable price in a sustainable manner to the public, appropriateness of designing a system of mobilizing funds to different sources to insure uninterrupted and sustainable supply of pharmaceuticals to all health facilities and service the public in equitable manner (Federal Negarit Gazette, 2007).

PFSA has stated its vision and mission as “to see the public access quality pharmaceuticals with honourable service” and "avail affordable and quality pharmaceuticals sustainably to all public health facilities by using revolving drug fund" respectively. The agency is established with the sole objectives of supplying quality assured and affordable pharmaceuticals, medical supplies, and medical instruments to the public, to play complementary role in developmental efforts for health service expansions and strengthening by ensuring enhanced and sustainable supply of pharmaceuticals, and to create enabling condition for the accumulation of the Fund

in revolving and cost recovery process thereby ensuring the realization of its objectives. PFSA has financial sources from net income generated from the supply of pharmaceuticals pursuant to the proclamation, resources allocated from the government in kind or in cash, and grants in kind or in cash from donor agencies.

The agency is vested with power and duties that ranges from implementing effective and efficient procurement and distribution system of pharmaceuticals and medical supplies to providing proper storage for the item and collecting service charge pursuant to the directives of the board. Regarding modalities of procurement of pharmaceuticals and payment of service fees the proclamation states that the agency shall without prejudice to the general government procurement principles have its own procurement manual. Moreover public health institution shall place orders to the agency for the supply of essential pharmaceuticals and the agency shall in case of failure to supply the pharmaceuticals advice the institution of the best alternatives and the institution shall be responsible to effect payment in cash to the agency accordingly (Federal Negarit Gazette, 2007).

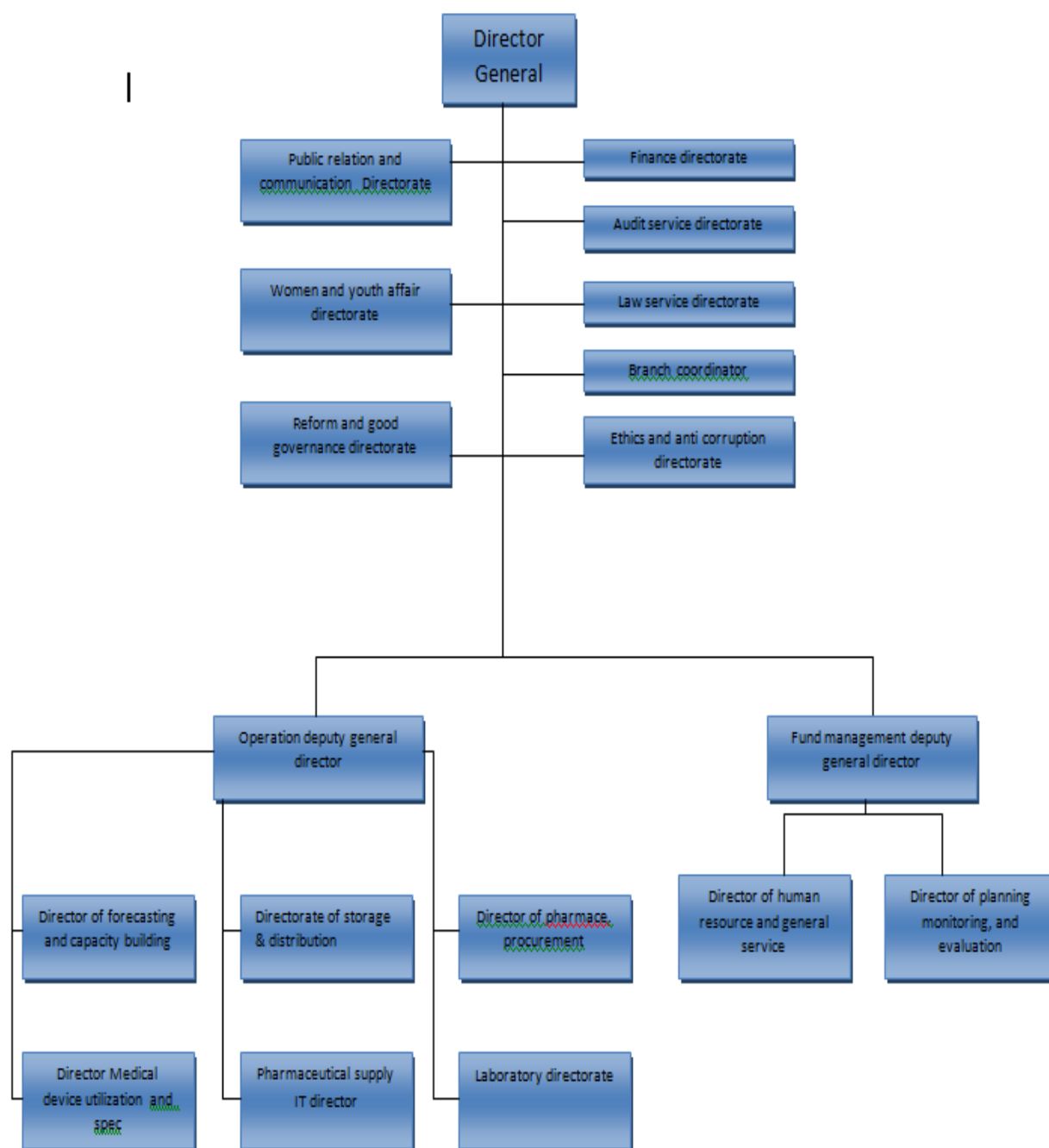


Fig. 2 PFSA organizational structure

Source: HR Directorate of PFSA

1.3 Statement of the problem

Accessing affordable essential medicines is an important factor to address patients' satisfaction and increase their health seeking behavior. According to WHO most leading causes of death such as malaria, infectious diseases, and Human Immunodeficiency Virus/Acquired immunity deficiency syndrome (HIV/AIDS) can only be prevented or treated effectively by having appropriate medicines consistently available.

In Ethiopia the Pharmaceutical Fund and Supply Agency (PFSA) is established back in 2007 with proclamation 553/2007 as an autonomous federal organ having its own legal personality with a mission of addressing issues of drug availability and affordability in the health sector (Federal Negarit Gazeta, 2007). But there are noticed risks in the core supply chain activities of the agency. These risk factors which normally exist in the process of reconciling demand with supply frequently seen posing a problem in the operational activities of PFSA. Supply risk commonly noticed in the operations of PFSA in the form of shortage and unavailability of medicines and medical supplies in governmental health facilities which ought to be primarily supplied by PFSA and the unavailability last even for months and those medicines in shortage are meant to patients with critical health condition. Purchase of poor quality pharmaceuticals is also the other problem a very recent example being the purchase and disposal of two million dollar worth aid money substandard condoms from an Indian supplier HLL Life Care Ltd. Internal risks which are exhibited in the form of over stock and expiration of medication in warehouses and poor distribution system which lacks agility also pose a significant risk in the efficiency of the firm operation in case of emergency conditions. More importantly all this incompetence are happening while PFSA is operating in a relatively non turbulent market which normally enable companies to operate with a flawed strategy or structure and still achieve an average performance while a turbulent environment take such firms to a complete chaos and consequently a significant risk to the health care system (Smeltzer and Siferd, 1998; Sislian, 2000; Meixell and Gargeya, 2005).

Absence of a dedicated risk management department in the organizational structure of PFSA is also the other problem noted since SCRM is concerned with the systematic identification, assessment, and mitigation of potential disruption in logistics networks with the objective to reduce their negative impact on the logistics networks performance. (Norman and Jansson, 2004). It is the above mentioned situations that led the researcher to ask a question about what SCRM looks like at PFSA.

1.4 Objective of the Research

1.4.1 General Objectives

The general objective of this research is to assess the pharmaceutical supply chain risk management practise of PFSA.

1.4.2 Specific Objectives

- Identify the main supply chain risks faced by PFSA
- To assess current SCRM practises employed by PFSA
- Identify the barriers in adopting SCRM practises by PFSA

1.5 Research question

In order to achieve the research objective the following research questions are proposed.

RQ1) what are the different types of potential risks in PFSA?

RQ2) what possible mitigation strategies are adopted to manage these risks?

RQ3) what are the barriers in adopting a better SCRM practise in PFSA?

1.6 Significance of the study

This study apart from its contribution to developments in the academics subject area it also increase awareness about the ever presence of risks and the need for designing a proactive supply chain risk management strategy. Its contribution can also extend to other non pharmaceutical supply chains sectors in the country. It can also serve as a springboard for other researchers who would like to conduct further research in the area of SCRM in other governmental or private companies. Additionally, the finding of the study contributes to the existing literature in area of SCRM.

1.7 Scope of the study

As stated in the problem of the statement and cited by other authors PFSA faced a number of problems that compromise its efficiency. But this research paper will focus on unpredictable supply chain risks of various frequency, and severity that will pose a disruption in normal operational activities of the Agency from head office perspective. The study doesn't aim to investigate risks at branch level for two main reasons. The first is by assuming risk problems to be similar with that of the central hub except presences of supplementary problems in connection with distribution from the central hub while the second being scarcity of resources

financial, time, and personnel) to carry out the study at every branches. Furthermore the study does not aim to examine the detailed outbound logistics activities (distribution system throughout the country) of PFSA which limits achieving a comprehensive understanding of supply chain risks that the Agency might face.

1.8 Limitation of the study

Since today's supply chains are too complex and interconnected in order to better understand the firm's position a larger network has to be studied and not just from a single firm perspective. Therefore a firm's risk exposure in a given supply chain is a function of not only a particular firm's capabilities but also the supplier network that provides input to the enterprise i.e. both foreign and local pharmaceutical manufacture (Modi and Mabert, 2007). This perspective also to some extent limits the contribution of the study for final decision making as well as generalization to other non pharmaceutical supply chain. Finally the research takes a descriptive approach in assessing status of SCRM and do not tried to examine how these risk affect SCRM at PFSA.

1.9 Operational definitions

Supply chain risk management- the systematic identification, assessment and mitigation of potential disruptions in logistics networks with the objective to reduce their negative impact on the logistics network's performance

Risk- it is the probability of unwanted outcome happening or the probability and magnitude of a loss, disaster, or other undesirable events.

Threat- negative event that can cause a risk to become a loss expressed as an aggregate of risk, and the likelihood of occurrence of the event

Disruption- major breakdown in the production or distribution nodes that comprise in a supply chain

The agency- Pharmaceutical Fund and Supply Agency

1.10 Organization of the Study

The study is organized into five chapters. Chapter one is the introductory chapter that covers the background of the study, statement of the problem, objectives of the study, scope of the study & significance of the study. It introduces and focuses upon giving the reader an overview of the study's development.

The second chapter presents, a review of related literature. It covers both theoretical and empirical back grounds, as well as the theoretical framework of trends in SCRM.

Chapter three presents in detail a discussion and explanation of the research methodology. It will begin with a discussion of the research design, population of the study, sampling techniques, sample size, data collection instruments, the data collection procedures and ends with data analysis approach.

Chapter four presents the results of the research and the discussion upon the findings. It begins with data analysis on the general information of the research participant and proceeds to the findings from questionnaire and discussion of the findings from a view point of the research question. Chapter five finally presents the conclusion and recommendations of the research.

CHAPTER TWO

2. RELATED LITERATURE REVIEW

Introduction

This literature review covers subject matters pertaining to SCRM that raise issues, both theoretical and empirical that has been discussed in the past studies. The information covered in the literature review was obtained mostly from published articles, books, both governmental and nongovernmental websites, Newspapers, proclamations, and conference papers.

2.1 Theoretical literature review

Though the subject risk is not a new concept it is gaining more focus from the beginning of the twenty one century onwards in literatures of supply chain management (Smallman 1996; Khan *et al* 2007). Due to repeated occurrence of events that lead to supply chain disruption which consequently disrupt the operation of one or more supply chain member a number of authors acknowledged that more and more papers focusing on SCRM are being published indicating the growing importance of SCRM (Zsidisin *et al* 2006; Melo *et al* 2006).

Temporal trends in the field of SCRM take a pattern of risk definitions and investigation for focal firm perspectives usually influenced by financial risk analysis with papers written in the period of 1996-2000 while papers that published during 2001-2005 focused on consideration of global risk issues, investigation of operational parameters such as inventory policies, demand and supply, capacity planning and those paper that published from 2006 and onwards became more interested in examining and explaining cross country relationship issues, issues related to information sharing and security, focus on brand image and comprehensive supply chain risk management program, agility and resilience, issues with the advent of globalization and repeated occurrence of natural and manmade disaster (Melo *et al*. 2006).

2.1.1 Sources of Supply Chain Risks

A number of authors have contributed to the development of the subject while considering risk from different perspective. Chopra and Sodhi (2004) classifies the causes of risk in to nine risk categories which include disruptions, delays, systems, forecast, intellectual property, procurement, receivables, inventory, and capacity. Some classify supply chain risk as organizational risk (inventory risk, operational risk, quality risk, and management risk), network risk (supply risk, supplier default, and demand risk) and environmental risk (events

driven by external forces). Risks internal to the supply chain involve those risks that lie within the boundaries of the supply chain parties and ranges from labor strike, production disruption to communication failure. Environmental risk sources comprise any uncertainties arising from the supply chain-environment interaction (Social, political, natural, and industrial or market risk). These may be the result of accidents (e.g. fire), socio-political actions (e.g. fuel protests or terrorist attacks) or acts of God (e.g. extreme weather or earthquakes) (Normann and Jansson, 2004; Abhijeet *et al.* 2012). Whatever damage which caused by suboptimal interaction between the organizations along the chain is attributable to the third risk category network-related risk sources and there are three different types of network- related risk sources: lack of ownership, chaos and inertia (Christopher and Lee, 2004). In this sense, environmental and organizational uncertainties are risk sources ‘to’ the various links in the supply chain and network-related uncertainties are risk sources ‘of’ the various links (Das and Teng, 1998).

Other classifications include based on probability and impact, Hallikas *et al.* (2004) operational and disruption risk, Tang, (2006a) capacity limitation, technological incompatibility, supply disruption, and currency fluctuation Berger and Zeng, (2006) as well as strategic, and operational risk (Fawcett *et al.* 2011). Yet other authors choose to focus on the concept of risk application, Cousins, (2004); Fraser and Henery, (2012); Harland *et al.* (2003) sources of risks Smallman, (1996), risk assessment, Frostdick (1997); Blackhurst *et al.* (2008) risk mitigation Christopher and Lee (2004), risk modeling Faisal (2006), flexibility Tang and Tomlin (2008), risk management Fawcett *et al.* (2011); Manuj and Mentzer (2008); Savage *et al.* (2006), and associated economic repercussions Papadakis (2006).

Risk events were also studied with core supply chain activities (source, make, and deliver) and investigated with common business practices. Supply risks are associated with procurement and are considered to be threats to supply assurance. Supply risk relates to potential or actual disturbances to the flow of product or information emanating within the network, upstream of the focal company. Therefore, it is risk associated with a company's suppliers, or supplier's suppliers being unable to deliver the materials the company needs to effectively meet its production requirements/demand forecasts. It adversely affects inward flow of any type of resource to enable operations to take place; also termed as ‘input risk’. These risk sources include; possibility of improper supplier selection, uncertainty in supply lead time, supply system design (number of suppliers (single/multiple sourcing)), location of suppliers (local/global sourcing) and supplier’s agility, flexibility, delivery reliability,

infrastructural strength, coordination and information sharing (Smeltzer and Siferd, 1998; Faizal and Palaniappan, 2012).

Demand risk relates to potential or actual disturbances to flow of product, information, and cash, emanating from within the network, between the focal company and the market. This demand risk can be a failure on either the high or low side to accurately accommodate the level of demand. It encompasses uncertainties in both product volume and mix which includes; loss of major accounts, volatility of demand, and concentration of customer base (Ding *et al*, 2007; Sodhi, 2005)

The other source of risk is process risk. Processes are the sequences of value-adding and managerial activities undertaken by the company. Process risk relates to disruptions to these processes. It affects a firm's internal ability to produce and supply goods/services, which results from the consequences of a breakdown in a core operating, manufacturing or processing capability. It includes; manufacturing yield variability, lengthy set-up times and inflexible processes, equipment reliability, limited capacity/bottlenecks, and outsourcing key business processes (Johnson, 2001).

Control risk can also be a source of risk. Controls are the assumptions, rules, systems and procedures that govern how an organization exerts control over the processes. In terms of the supply chain they may be order quantities, batch sizes, safety stock policies etc. Control risk is therefore the risk arising from the application or misapplication of these rules. It includes inappropriate rules that distort demand poor visibility along the pipeline lack of collaborative planning and forecasts bullwhip effects due to multiple echelons (Iwan *et al*, 2009).

2.1.2 The SCRM Process

Apart from discussing different source of risk and classification of risk a number of authors have also discussed steps or processes in SCRM (Faizal and Palaniappan, 2012). Accordingly SCRM process classified into two broad categories: risk assessment and risk control. Risk assessment is used to analyze the degree of risk associated with each hazard. The goal of risk assessment is to indicate which areas and activities in the value chain are most susceptible to hazards. It balances the probability of demand, the likelihood of reliable supply, the most effective allocation of resources, the probability of success of new product introductions, market conditions, and the opportunity costs of alternative decision paths.

Performing such assessments will involve clarifying the nature of the risk, understanding conditions that may lead to the event, knowing how frequently such events have happened or can be expected to happen, and the potential impact of such events.

Risk assessment is typically made up of two measures: Likelihood and Impact. Likelihood measures the probability that the event will occur. The exact probability may be difficult to determine unless there is historical data that can be used to find the frequency of the event occurring. Alternatively an organization can use a subjective likelihood, or degree of belief, based on the opinions of experts. A time horizon is necessary to define the probability in a useful way (e.g., the likelihood that an event will occur in the next year or 50 years). Impact measures the consequences on the organization if the event occurs. It can be measured directly, for example in terms of dollars. It can also be measured on a scale, for example from zero to one with zero being very little negative consequence and one being a very bad consequence. Methods for measuring impact include “what-if” simulations, financial models, and opinions of teams of experts. Impact may also be measured in terms of other Supply Chain Operation Reference (SCOR) metrics besides financials. A summary risk score then can be calculated for each risk by multiplying the impact times the probability to get an expected value of the risk. Then risks can be ranked by risk score (Faizal and Palaniappan, 2012).

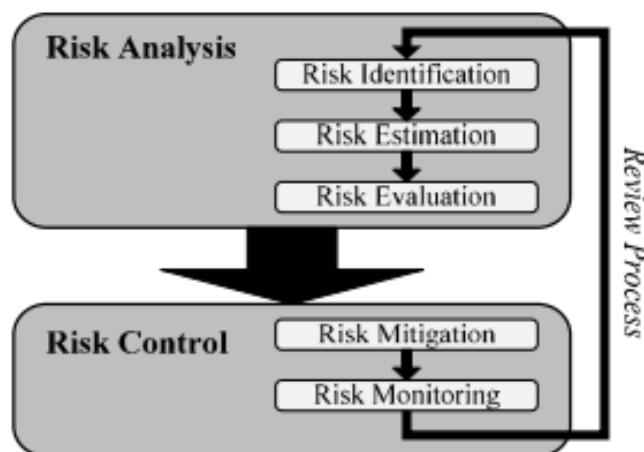
There are a number of tools used in assessment of a risk; Failure Mode Effect Analysis (FMEA) is used to prioritize the risk using Risk Priority Number (RPN), which can be calculated from probability of occurrence, severity and detection of risk and also using Risk Score Values (RSV) in which severity and occurrence of risk is calculated. The other method is Fault Tree Analysis (FTA) this is a graphical technique that provides a systematic description of the combinations of possible occurrences in a system, which can result in an undesirable outcome. This method can combine hardware failures and human failures. The most serious outcome is selected as the “Top Event”. A fault tree is then constructed by relating the sequence of events, which individually or in combination, could lead to the top event. FTA is both a design and a diagnostic tool. As a design tool FTA is used to compare alternative design solutions and the resulting top event probability. As a diagnostic tool FTA is used to investigate scenarios that may have led to the top event (Ritchie *et al*, 2008).

Event tree analysis (ETA) is also a risk assessment tool for identifying and evaluating the sequence of events in a potential accident scenario following the occurrence of an initiating event. ETA utilizes a visual logic tree structure known as an Event Tree (ET). The objective of ETA is to determine whether the initiating event will develop into a serious mishap or if the event is sufficiently controlled by the safety systems and procedures implemented in the system design. An ETA can result in many different possible outcomes from a single initiating event, and it provides the capability to obtain a probability for each outcome (Ritchie *et al*, 2008).

Activities under risk assessment include risk identification, risk estimation and risk evaluation. Risk identification is regarded as a key aspect of SCRM. It involves generating a list of potential events that could hamper the supply chain performance. Risk identification enables an organization to be proactive in managing risks which makes it efficient and cost effective. Inputs for identification of risk can be obtained from past experience or industry research. Tools for risk identification include cause and effect diagram which trace back the cause for an effect, and a Gant chart which is a bar chart showing the precedence and timing of activities. A Gant chart enable in identifying a critical path i.e. the most critical organization and processes that would be in trouble if a disruption is experienced (Zsidisin *et al*, 2004).

On the other hand the risk control category consists of risk control and risk mitigation. Multiple source of supply; strategic agreement or partnership with supplier; collaborative, planning, forecasting, and replenishment, and joint product design and delivery are listed as strategic risk mitigation methods (Faizal and Palaniappan, 2012).

Fig.3 SCRM process



Source (S. Nurmaya Musa, 2012)

2.1.3 Approaches in managing SCR

This section discusses two selected management theories (contingency management theory and agency theory) in relation to their applicability in the management of SCR.

2.1.3.1 Contingency management theory

This theory emphasizes the importance of situational influences on the management of organizations and questions the existence of a single, best way to manage or organize a firm. According to this theory, appropriate strategies are contextual and structured, based on the characteristics of the situation. Superior firm performance is achieved when strategy appropriately matches up with environmental contexts. Studies consistently indicate that, in supply chain contexts, mismatches between strategic approaches and environmental characteristics are associated with inferior organizational performance (Zsidisin *et al* 2000; Woojung *et al*, 2015). Contingency theory is an appropriate lens for investigating mitigation choices for supply chain risk as there is no one right approach for managing and preventing supply chain risk (Chopra and Sodhi, 2004).

Confronted by a wide variety of potential supply chain-related risks, managers may focus on applying one primary supply chain risk mitigation strategy assuming that the selected approach effectively alleviates all supply chain risks. However, such an approach is inconsistent with the key tenets of contingency theory, which suggests that there is no single approach for most effectively controlling all kinds of supply chain risks (Woojung *et al*, 2015). Rather, given that supply chain risk can be sparked by multiple different sources or contexts, this paper proposes that a firm's supply chain risk mitigation strategies should be tailored to accommodate the particular characteristics of risk contexts.

Well-established existing SCRM research identifies the probability (or likelihood) and the severity (loss, impact, or seriousness) associated with risk occurrence as the two primary characteristics for risk assessment (Zsidisin *et al*, 2004). Evaluating risk contexts (i.e. risk probability and severity) is important for assessing appropriate supply chain risk mitigation strategy because, as posited by contingency theory, risk contexts can determine appropriate approaches for mitigation. For example, the optimal approach for mitigating a high-severity/low-probability risk like the 2011 earthquake in Japan may be very different from the optimal approach for mitigating the effect of recurrent low-severity/high-probability risks like transportation breakdowns or late deliveries (Woojung *et al*, 2015). Therefore, consistent with contingency theory, the conceptual framework of this paper proposes that the particular

situation or nature of the potential supply chain risk is critical when selecting an appropriate mitigation strategy.

2.1.3.2 Agency theory

From a management perspective, the evolution of agency theory can be dated to the 1960s and 1970s. Eisenhardt (1989) states that agency theory is relevant for the situations wherein one party (the principal) delegates authority – in terms of control and decision-making about certain tasks – to another party (the agent). When the agent is acting for the principal it resembles behaviours such as performing for the benefit of the principal or acting as the principal's representative or employee. It is found important to include the agency theory within the conceptual frame work of this research since PFSA work with other partners by subcontracting some of its duties in order to deliver an end to end solution to its customers.

Influential contributions made by different scholars have substantially improved our understanding of how agency theory informs economic relations (Mitnick, 1975; Ross, 1979). Previously application of agency theory in with different discipline such as economics and finance Sappington (1991), information systems Mahaney and Lederer (2003), and management Eisenhardt (1998) have been studied by different scholars. More recently, (SCM) scholars have shown growing interest in using agency theory to understand how participants within the SC manage risks, align incentives and forge relationships (Norrman, 2008).

Essentially, Ketchen *et al* (2007a) hypothesize that agency theory provides a mechanism that may be used to explain how players (both independently and as a collective) within the SC respond to transaction cost dilemmas where rational and non-rational behaviour occurs. Stock (1997) put forwarded that agency theory may also assist managers in understanding SC behaviour by focusing attention on the following issues. The development of inter- and intra-organisational relationships; the maintenance of complex relationships between suppliers and customers (e.g. vendors and third-party logistics providers); the dynamics of risk sharing, capital outlay, power and conflict between channel intermediaries; and identifying the costs and benefits of SC integration.

2.2 Empirical literature review

Globally abundant amount of article could be found which focuses on risk factors and management in the pharmaceutical sector; among them some review studies in supply chain risk management with focus on counterfeit, Jakson *et al.* (2012); Deus (2006); Goldhammer and Lassman (2006) supply chain logistics Bishara (2006), quality assurance Deus (2006), and enterprise risk management (Rogachev, 2008). In Ethiopian context an article that is focused on PSC risk management could not be found as to my knowledge.

Melo *et al.* (2006) stated that about 56% of the related papers focus on supply risks. Analysis of the literature focusing on supply risks shows that information sharing and coordination issues have been paid the highest attention (44%) followed by the supply system design issues (36%). The downstream issues also make a significant contribution (44%), which shows that market uncertainties, demand fluctuations and associated risk issues are also well addressed by researchers.

A major incident that is quoted in a number of articles dealing with SCRM is a supply disruption faced by Ericsson on 18 March 2000 (Nurmaya, 2012; Faizal and Palaniappan, 2012; Iwan *et al.* 2009). Since it is a classic example of how seemingly minor disruption can cause great consequence it is worth to narrate the incident briefly.

A major accident from an Ericsson perspective was a fire on 18 March 2000 in a very small production cell (small as a conference room for ten people) at a sub-supplier's plant in Albuquerque, New Mexico United States of America (USA). The ten-minute fire was an effect of a lightning bolt hitting an electric line in New Mexico, causing power fluctuations throughout the state. The problem was that when the power was out, there was no spare diesel motor to supply the fans with power, so the fans stopped. From a plant perspective, the resulting fire was almost negligible, and when the fire brigade arrived it was sent home as the fire already was out. But for Ericsson, the impact was huge. In the spring of 2001, when the annual report from Ericsson was announced, a major loss of about \$400 million was indicated, primarily due to gaps in the supply of radio-frequency chips from this supplier. The reason was that the fire occurred in one of the plant's "clean rooms", where absolutely no dust is tolerated. Due to the fire, and especially the smoke and sprinkler water, it took almost three weeks until the production was up and running. After six months, the yield was only 50 percent, and it would take years to get new equipment delivered and installed. As this plant was Ericsson's only source for this chip, Ericsson was not able to sell and deliver one of its

key consumer products during its booming “market window”. The company lost many months of mobile phone production, and the accident finally had a great impact on Ericsson’s decision to withdraw from the mobile phone terminal business in contrast the other telecom giant Nokia’s profit rose by 42% that year (Norrman and Lindroth, 2002).

In a review of empirical literature it is also worthy to have a look in to research and data synthesis methods that were followed by authors. Data synthesis of research methods used for decision-making in SCRM field can be broadly classified as qualitative and quantitative methods. From a review of past literatures it is evident that the preferred methodology has been qualitative (Abhijeet *et al*, 2012). Qualitative research methods could further divided based on research approaches as empirical study, conceptual theory and literature survey. Similarly, quantitative research methods were divided into mathematical modeling, statistics and probabilistic theory and simulation for detailed thematic analysis.

Empirical study employs case study, industrial survey, and structured / informal interview and focus group methodologies for analyzing information gained by means of observation or secondary data study. Use of Interviews (Questionnaires) and focus group study is a common qualitative methodology in the study of SCRM and repeatedly employed by a number of authors to study SC disruption, the severity of supply chain disruptions and providing mitigation strategies for the disruption (Lewis, 2003; Jiang *et al*, 2007; Autry and Bobbitt, 2008; Perry, 2007).

Quantitative research methods are broadly classified into mathematical modeling, simulation and statistical testing for detailed thematic analysis (Abhijeet *et al*, 2012). Mathematical modeling can be linear programming Lai *et al*. (2009), Analytical Hierarchy Process (AHP) Levary (2008); Gaudenzi and Borghesi (2006), though Melo *et al* (2006) argue about the subjectivity involved in AHP. Other mathematical modeling methods include stochastic modeling Goh *et al* (2007) and scenario planning (Norrman and Lindroth, 2002).

In general underlying complexities and impractical assumptions limit the utility of mathematical modeling. Moreover, in some cases the explicit relationships between decision variables are difficult to model. In such situations, simulation techniques provide an alternative approach to analyzing the supply chains by constructing an artificial environment within which the dynamic behavior of the risks can be assessed (Melo *et al*, 2006).

Simulation methods are also widely used in evaluating and modeling supply chain risks (Zsidisin *et al*, 2004). Several types of simulation modeling namely, agent based simulation Datta *et al* (2007), Monte Carlo simulation Wagner and Neshat (2010), and discrete-event simulation Manuj and Mentzer (2009) are used in the literature of SCRM.

The simulation models also have certain limitations, such as the models can only be run with previously defined conditions and there are limited capabilities to design the system parameter itself (Swaminathan *et al*. (1998); Hung and Ryu, 2008). To overcome these shortcomings, multi-agent approaches, supported by advanced computational methods, have been introduced. In these approaches the problem is modeled as agent elements (supplier, manufacturer, distributor etc), control elements (inventory control, scheduling, logistics and transportation etc) and their interaction protocols. These approaches are better than individual programs as they combine the various autonomous agents/programs in one platform (Melo *et al*, 2006). Statistics and Probability testing approach is also the other quantitative technique used in study that aid in SCRM hypothesis testing with the help of linear regression model Hung and Ryu, 2008).

So far this paper covers what is discussed in related previous literatures about SCRM. Temporal trends in the field of SCRM that shows the progress how previous literature used to address issues of SCRM, approaches in considering risk issue from different perspectives, employed methods in classification of risks, steps in the process of SCRM, management theories recommended for implementation during SCRM have been discussed. Moreover in the empirical literature part related literature that have a focus on PSC which conducted with a focus on one particular PSC such as counterfeiting, and quality assurance are discussed. Apart from this the case of Ericsson single supplier policy failure which is considered as a classic example in the literatures of SCRM have been discussed in detail in order to achieve the awareness of how seemingly minor disruption in a SC result in critical consequences. Though the presence of all these research articles in the field of SCRM the author of this research couldn't come across any research paper that has a focus on PSC risk issues in Ethiopia. It is this gap that leads me to conduct PSC risk management research on the country's single and only state owned provider of pharmaceuticals; PFSA. Implication of this research can also be further emphasized since any risk affecting the PSC not only wastes the resources but also threaten the patients' life by hindering access to medicines (Schneider and Wilson 2010).

2.3 Conceptual framework

Conceptual framework guides the flow of a research and visualizes the interaction of factors and their relationship across a path. Supply chain because of its very nature comprised of a number of stakeholder and risks in a supply chain can also originated from these various stakeholders along its length. The approaches in managing these risks should also take in to consideration the need to act contextually and acknowledging the roles of both the upstream and downstream parties beyond the internal situation of a given company. Since the supply chain involves every activity from planning and procurement to the final delivery of products and service each activity within this chain is vulnerable to disruption. Apart from this risks in supply chains categorized as operational risks (those risk factors that happen during reconciling demand with supply), and environmental (natural and manmade events that cause disruptions) (Juttner, 2005; Christopher and Lee, 2004). A risk classification method recommended by SCRLC (2011) and adopted by this research grouped risks into two major categories as either internal or external risks. The paper further classified external risks in to end-to-end, supplier and distribution risks.

End-to-end risks, accidents, sabotage, terrorism, political uncertainty, labor unavailability, market challenges, lawsuits, technological trends, theft and adulteration, regulatory approval, currency fluctuation, external regulation, and quality assurance.

Supplier risks include physical and regulatory, production problems, financial losses and premiums, management and upstream supply risks.

Distribution risks include infrastructure unavailability, lack of capacity, labor unavailability, cargo damage or theft, warehouse inadequacies, IT system inadequacies or failure, long, multi-party supply pipelines, and demand uncertainties.

Environmental risk includes natural disasters, terrorism and war, regulatory changes, tax, duties and quotas and strikes (Khan, 2010).

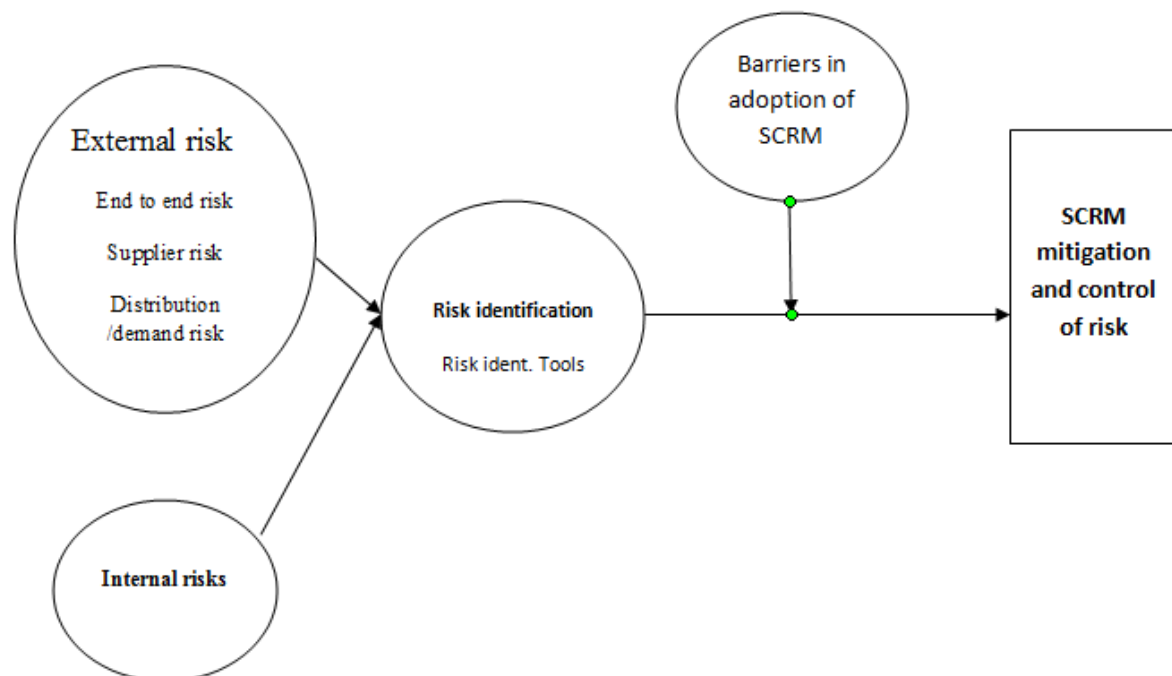
Internal risks include operational, political uncertainty, demand variability, personnel availability, design uncertainty, planning failures, financial uncertainty, facility unavailability, testing unavailability, enterprise underperformance, and supplier relationship management.

The SCRM process as discussed in previous pages is composed of defined steps. These steps are broadly classified as risk analysis and risk control. The former step consists of risk identification, risk estimation, and risk evaluation while the latter step includes risk mitigation and risk monitoring (S. Nurmaya Musa, 2012). The conceptual framework of this research comprehends risk identification methods and their frequency of use in the Agency, tools used in SCRM, as well as potential barriers in the implementation of SCRM at PFSA.

SCRM tools these are tools that can be utilized in the processes of SCRM to aid in advance planning and facilitation of flow of finance, goods, and information.

Barriers in adopting supply chain risk management these are factors both internal and external that hampers the implementation of SCRM (Christopher & Lee, 2001). Concerns about increased costs, poor communication across supply chain, inadequate technology, lack of management support, supplier geographical distance, and lack of supply chain management knowledge are listed in this study as a potential barrier that could hinder the implementation of SCRM mitigation strategy.

Fig. 4 SCRM a conceptual frame work



Source: Self Developed

As long as different risks of variable source, probability of occurrence, and magnitude of consequences are present in order to reduce the negative outcome of these risks on the logistics performance of the network a SCRM should be part of the given organization management strategy and it is also an element of the conceptual frame work of this research. In this conceptual frame work SCRM commence with identifying existing risks of various sources as well as rating their relative treat to the operations of the Agency, followed by identifying used SCRM tools employed for identifying these risk, and identifying potential barriers which hinders implementation and progression of SCRM. Therefore the conceptual frame work of this research takes factors described as sources of risk, risk identification method, tools in identifying risks, and potential barriers in implementing SCRM as deciding factors in controlling the SCR mitigation capability of PFSA.

CHAPTER THREE

3. RESEARCH DESIGN AND METHODOLOGY

Introduction

A research design, as defined by Kothari (2004) 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. In fact, it is the conceptual structure within which research is conducted; it constitutes the blueprint for the collection, measurement and analysis of data. Research design stands for advance planning of the methods to be adopted for collecting the relevant data and the techniques to be used in their analysis, keeping in view the objective of the research and availability of staff, time and money. Data are empirical evidence or information that should be gathered carefully by following certain rules or procedures. The data can be quantitative (i.e. expressed in numbers) or qualitative (i.e. expressed in words, pictures, objects).

Quantitative research involves data collection procedures that result primarily in numerical data which is then analyzed by statistical methods whereas qualitative research involves data collection procedures that result primarily in open-ended, non-numerical data which is then analyzed primarily by non-statistical methods. The survey method can be used for three types of research, namely descriptive (which focuses on the determination of the frequency with which an event occurs and how variables are related/associated in a particular context), exploratory (which emphasizes on the discovery of ideas and insights), and explanatory (concerned with determining the impact and cause and effect relationships among variables), (Bhattacharjee, 2012; Adams, *et al*, 2007).

3.1 Study area

Since the paper aims to study PSC risk management at PFSA the study is conducted at PFSA head office located at Guillele Addis Ababa, Ethiopia. The rationale behind the selection of the study area is because of all the staffs that manages the key activities of the agency with an elaborated knowledge regarding the overall activities of the agency can be accessed altogether. Moreover the researcher believed that managers and staffs at the head office are more intellectual and experienced than those who work at the branch level which enables them to better understand and respond to the research questionnaires better. Beside circumstances at the head office level are reflections of that of the branches.

3.2 Research design

A case study research approach is chosen as the research strategy for investigating the research questions. The research is a quantitative descriptive type which originates from the prevailing descriptive qualities of both a case study approach and the research's theoretical frame work.

3.3 Research participant

Participants of the study are selected based on their relevance to the subject of the research. From the sixteen directorates of PFSA six main directorates that have more ties with PSC are included in the study. The selected directorates are branch coordination directorate, forecasting and capacity building directorate, pharmaceutical and medical supplies procurement directorate, Pharmaceutical and medical supplies storage and distribution directorate, planning, monitoring, and evaluation directorate, and medical device utilization and specification preparation directorate. The other ten directorates namely Women and youth affair directorate, reform and good governance directorate, public relation and communication directorate, ethics and anti-corruption directorate, law service directorate, audit service directorate, pharmaceutical supply management and Information Technology (IT) directorate, HR and GS directorate, laboratory directorate, and finance directorate. These directorates are excluded from the study because the researcher believed that it could be challenging for them to respond to the entire questionnaire provide on the survey because of the irrelevance with their main tasks.

3.4 Study population

The entire personnel in each selected directorate is listed and all members of the staff excluding support staff like secretaries, cashiers, dispatch officers, daily labourer, stock clerks, janitors, get men, and IT technicians are taken as study population. The number of study population become eighty (one from branch coordination directorate, three from planning monitoring and evaluation directorate, fifteen from pharmaceutical and medical equipment procurement directorate, five from medical device utilization and specification preparation directorate, twenty from forecasting and capacity building directorate, thirty six from medicine and medical equipment storage and distribution directorate). Since the total number of the study population become less than hundred a census approach is used in order to achieve a desirable precision.

3.5 Method of data collection, sources and research instrument

The objective of data-collection is to get a good overall picture of how a process performs. Though there are several methods of collecting primary data, particularly in surveys based and descriptive researches. Some of the most important ones are: observation method, interview method, questionnaires, schedules, and other methods (Hair *et al*, 2002). However, for this paper a case study is followed since it is advantageous for the collection of significant amount of primary data in an economic and efficient manner, common in business research, it is particularly useful for the analysis of organisations, and it typically allows for better understanding of particular phenomena in a defined setting.

Questionnaires are used as a research instrument for the collection of a primary data. Questionnaires are a formalized set of questions involving one or more measurement scales designed to collect specified primary data. Often they are the only feasible way to reach a number of reviewers large enough to allow statistically analysis of the results. The questionnaire is developed in order to gain vital information on risk identification, currently employed SCRM practises, and barriers in adopting supply chain risk management practises at the Agency. Adapted questionnaire from Kenneth (2015) is used which is a structured, close ended type, prepared in English and divided in to four parts (Appendix 2). Part A consisted of general information, Part B sought to identify the main supply chain risks confronted by PFSA, part C determined supply chain risks management practices employed by PFSA while part D determine the barriers to adoption of supply chain risk management practices. The questionnaires are composed of a rating scale type of question to identify the main supply chain risks faced by PFSA, establish SCRM practises employed by PFSA and determine the barriers in adopting SCRM practises by PFSA. One question in part C also provides an open ended type of alternative to let the respondent their say if they can't find their choice from the given potential SCRM tools.

3.6 Data quality assurance

In compliance to (Wilkinson and Birmingham, 2003), before final administrating the instruments the questionnaires were piloted and tested for validity in order to spot mistakes and ambiguous questions so that to make necessary amendments. Test of reliability Cronbach's Alpha was conducted on the research questionnaires in order to ascertain the internal consistency of the research instrument. Acceptable level of Cronbach alpha of above 0.80 is used as a reasonable test of scale reliability.

3.7 Method of data analysis and presentation

After questionnaires are distributed and collected back, analysis of data continued. The collected data was processed using Statistical Package for Social Sciences (SPSS) 16.0. Descriptive statistics and frequency table was used to interpret the responses of the participants. To review the internal consistency of the scale items, Cronbach coefficients (alpha) was computed. Accordingly, the summarized data was interpreted vis-à-vis the raised research questions and the objective of the research to arrive at a meaningful conclusion and recommendations are forwarded.

3.8 Instrument validity

In an attempt to ensure content validity as recommended by Kothari (2004) the questionnaire was developed on the basis of a thorough review of the existing literature concerning the area of inquiry. Furthermore, apart from the initial attempt to strongly ground the adaption of the questionnaire on the extant literature, it was subjected to pre-test to further ensure its content validity as suggested by Chen *et al.* (2004). Therefore six experienced experts from various directorate of PFSA were made to critically review the items in the questionnaire for possible ambiguity, lack of clarity, appropriateness, and whether or not it sufficiently address the objectives. Comments were taken as an input to make the questionnaire more clear, unambiguous, and comprehensive.

3.9 Ethical consideration

With a written cooperation letter from the School of commerce (Annex 2) respondents were approached and informed about the intent of the research. Furthermore the participant was informed that their response will be kept confidential and will be used for academic purpose only, both verbally and written on the first page of the questionnaire. All the participants are made to participate in the survey only with their full consent and their identity stayed anonyms.

CHAPTER FOUR

4. RESULTS, DISCUSSION AND INTERPRETATION

Introduction

This chapter presents the findings of the survey and discussions based on the results. The first section deals with the general information of the research participant while the second part presents answers to the research objectives; what are the different types of risks or potential risks in PFSA, how does a risk event affects supply chain operations of PFSA, what possible mitigation strategies are adopted to manage these risks, and what are the barriers in adopting a better SCRM practise in PFSA. From the eighty PFSA staffs approached and taken the questionnaires three participants (3.75%) fail to show up during two days of the questionnaire collection and a further five respondents (6.25%) questionnaire rejected because of uncompleted responses making the final effective respondents seventy two in number.

4.1 General information

The general information of this study consist of the respondents' gender, highest academic qualification, duration of time the respondent worked in PFSA, and the directorate in which he/she belongs to. From the seventy two respondent who completed the questionnaire eight respondents (11.1%) were female while the rest sixty four (88.9%) were male. Regarding the highest academic qualification achieved eight respondents (11.1%) are diploma holder, fifty four (75%) have a bachelor degree, and ten (13.9%) of the respondents have a master degree.

The participants were also asked for how long they have worked at PFSA. The result show nine (12.5%) of the respondent worked here for less than a year, fifteen (20.8%) between 1-2 years, thirty one (43.1%) between 3-5 years, and seventeen (23.6%) for more than five years.

Table 1 Cronbach's Alpha

	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
Risk identification	.801	.808	38
Employed SCRM practises	.893	.890	28
Capability to mitigate key SCR	.890	.887	22

Source: own study

4.2 Methods employed in identifying risks and main SCR faced by PFSA

As discussed in the literature review risk identification is regarded as a key aspect of SCRM which enables an organization to be proactive in managing risks in turn making it efficient and cost effective. Risk identification mainly deals with generating a list of potential events that could potentially hamper the supply chain performance. In this research methods in identifying risk events are listed and participant asked to rate to what extent they used the listed methods in identifying risks. A choice is given for each risk identification method from very “great extent” (5) to “not at all” (1).the result is presented on table 2.

Table 2: Methods employed in identifying risk by PFSA.

	Risk estimation		Previous risk assessment		Developing risk register		Brainstorming session		survey	
	Freq	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Not at all (1)	4	5.6%	5	6.9	12	16.7	9	12.5	19	26.4
Small extent (2)	30	41.7%	34	47.2	39	54.2	40	55.6	35	48.6
Moderate extent (3)	33	45.8%	29	40.3	18	25.0	19	26.4	15	20.8
Great extent (4)	4	5.6%	4	5.6	3	4.2	4	5.6	3	4.2
Very great extent (5)	1	1.4%%	0	0	0	0	0	0	0	0

	N	Mean	SD. Deviation
Risk estimation	72	2.56	.748
Previous risk assessment	72	2.44	.710
Brainstorming session	72	2.25	.746
Developing risk register	72	2.17	.751
Surveys	72	2.03	.804
Valid N (list wise)	72		

Source: own study

From the findings it can be seen that PFSA is using the listed risk identification methods small to moderate extent with risk estimation better employed with a mean of 2.56 and standard deviation (SD) 0.748 followed by, previous risk assessment mean 2.44 and SD 0.710, brain storming session 2.25 mean and 0.746 SD, developing a risk register mean 2.17 and SD 0.751, and surveys mean 2.03 and SD 0.804.

The implication of the finding is PFSA is using risk estimation and previous risk assessment better than the other methods even though these two methods are also used from small to moderate extent. More importantly it is shown that the Agency is even much weaker in using the methods of risk register and conducting surveys which are more formal, reliable, and proactive methods of risk identification (Faizal and Palaniappan, 2012).

The other question raised is how a risk event affects supply chain operations of PFSA which is the severity of threats posed on the SC of PFSA by listed potential risks. The potential risks are subdivided in to five subcategories namely; external end to end supply chain risk (SCR), external supplier risk, external distribution risk, environmental disruption risk, and internal agency's risk. Each subdivision of SCR consists of a list of potential risks which participant asked to rate it from "no treat" (1) to "highest treat" (5). The results are presented on table 3.

Table 3: External end to end supply chain risk

	Quality assurance		Regulatory approval		Currency fluctuation		Taxes, custom, & other regulation		Theft and adulteration	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
No treat (1)	0	0	0	0	0	0	1	1.4	2	2.8
Low treat (2)	13	18.1	10	13.9	11	15.3	18	25.0	14	19.4
Moderate treat (3)	26	36.1	39	54.2	30	41.7	25	34.7	18	25.0
High treat (4)	31	43.1	20	27.8	24	33.3	21	29.2	34	47.2
Highest treat (5)	2	2.8	3	4.2	7	9.7	7	9.7	4	5.6

	N	Mean	Std. Deviation
currency fluctuation	72	3.37	.863
theft and adulteration	72	3.33	.949
quality assurance	72	3.31	.799
regulatory approval	72	3.22	.736
taxes, custom, and other regulation	72	3.21	.978
Valid N (list wise)	72		

Source: Own study

The findings indicate that all the listed end to end potential risk factor pose a significant treat (between moderate to high) to the supply chain activities of PFSA. Currency fluctuation, adulteration, and quality assurance risks pose a significant threat from the other risks with a mean and SD of 3.37 SD 0.863 and 3.31 SD 0.799 respectively. This also agrees with Goldhammer and lassman (2006); Jackson *et al.* (2012) as pharmaceutical counterfeiting is

one of the main threat in the PSC of even the developed countries. Currency fluctuation is also discussed as a major risk issue in SC Kleindorfer and Saad (2005) and its consequence could be even severe for the case of PFSA who majorly depends on imported of pharmaceutical to meet the health care demands of the country.

Table 4: External supply risk

	No treat (1)		Low treat (2)		Moderate treat (3)		High treat (4)		Highest treat (5)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Possibility of improper supplier selection only based on minimum price	2	2.8	14	19.4	22	30.6	30	41.7	4	5.6
Performance of supplier	0	0	8	11.1	25	34.7	35	48.6	4	5.6
Lead time	0	0	5	6.9	23	31.9	39	54.2	5	6.9
Cost escalation	2	2.8	5	6.9	26	36.1	35	48.6	4	5.6
Poor communication and coordination	2	2.8	6	8.3	36	50.0	27	37.5	1	1.4
Unavailability of item	1	1.4	9	12.5	15	20.8	40	55.6	7	9.7
Single supplier	1	1.4	8	11.1	22	30.6	21	29.2	20	27.8

	N	Mean	Std. Deviation
single supplier	72	3.71	1.041
Lead time	72	3.61	.723
unavailability of items	72	3.60	.883
performance of supplier	72	3.49	.769
cost escalation	72	3.47	.822
possibility of improper supplier selection	72	3.28	.938
poor communication and coordination	72	3.26	.750
Valid N (list wise)	72		

Source Own study

From the result it is shown that a supplier risk pose a much higher treat in PFSA supply chain. Potential risk factors like single supplier, lead time, and unavailability of item pose higher treat than the other potential risk factors listed in supplier's risk category. This finding also agree with Juttner (2005) that states supply risks poses a significant higher treat to the integrity of the given company supply chain as it is a risk associated with a company's

suppliers, or supplier's suppliers being unable to deliver the materials the company needed to effectively meet its demand forecasts.

Table 5: Distribution risks

	No treat (1)		Low treat (2)		Moderate treat (3)		High treat (4)		Highest treat (5)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Infrastructure unavailability	0	0	11	15.3	46	63.9	13	18.1	2	2.8
Cargo damage and theft	2	2.8	13	18.1	34	47.2	21	29.2	2	2.8
Warehouse inadequacies	1	1.4	16	22.2	29	40.3	20	27.8	6	8.3
Longer lead time	0	0	2	2.8	28	38.9	38	52.8	4	5.6
Communication barrier with branch	1	1.4	11	15.3	31	43.1	27	37.5	2	2.8
Unexpected rise in demand	0	0	3	4.2	25	34.7	39	54.2	5	6.9

	N	Mean	Std. Deviation
unexpected rise in demand	72	3.64	.678
longer lead time	72	3.61	.640
communication barrier with branch	72	3.25	.801
warehouse inadequacies	72	3.19	.929
cargo damage and theft	72	3.11	.832
infra structure unavailability	72	3.08	.666
Valid N (list wise)	72		

Source: own study

The findings indicate that all potential risk factors under the category of distribution risk pose more than high treat to the SC activities of PFSA. Unexpected rise in demand and longer lead time pose a higher threat to the supply chain relative to the other potential risk factors. The result also matches the findings on the previous page which states theft as a moderate extent risk in the end to end SCR. Unexpected rise in demand (moderate to great extent) with a mean of 3.64 and SD 0.678 is also justifiable as it is observed that stock out of medication is common classic example being stock out of Oral Rehydration Salt (ORS) during epidemics of cholera in the rainy season. On the other hand it is not unexpected if unexpected rise in demand pose a high treat to the PSC of PFSA as it is ill prepared for environmental disruption risk like natural catastrophe and manmade disaster.

Table 6: Environmental disruption risk

	Political risk		Natural catastrophe		Manmade disaster		Occurrence of epidemic	
	Freq	%	Freq	%	Freq	%	Freq	%
No treat (1)	12	16.7	11	15.3	2	2.8	0	0
Low treat (2)	33	45.8	34	47.2	33	45.8	9	12.5
Moderate treat (3)	17	23.6	21	29.2	25	34.7	27	37.5
High treat (4)	8	11.1	5	6.9	10	13.9	29	40.3
Highest treat (5)	2	2.8	1	1.4	2	2.8	7	9.7

	N	Mean	Std. Deviation
occurrence of epidemic	72	3.47	.839
manmade disaster	72	2.68	.853
political risk	72	2.37	.985
natural catastrophe	72	2.32	.869
Valid N (list wise)	72		

Source: own study

Environmental disruption risks are characterized by low probability of occurrence and a higher magnitude of disruption consequence (Norrman and Jansson, 2004; Abhijeet *et al*, 2012). Here from the research findings it is shown that environmental disruption risks like natural catastrophe, political risk, and manmade disaster perceived as a low treat by the respondents of this research with a mean of 2.32, 2.37, and 2.68. From the listed potential threats in the category of environmental disruption risk only occurrence of epidemic get a better attention from the respondent with a mean of 3.47, and SD of 0.839 and this is mostly from previous lessons of occurred epidemics. But the overall score of lower environmental disruption risk indicate that PFSA may be ill prepared to respond to a potentially occurring environmental disruption risk and also this is reflected as unexpected rise in demand pose a higher treat to PFSA with a mean of 3.64 and SD .678 as the findings under distribution risk indicates.

Table 7: Internal (agency's) risks

	No treat (1)		Low treat (2)		Moderate treat (3)		High treat (4)		Highest treat (5)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Obsolete and expired inventories	1	2.8	13	18.3	29	40.8	25	34.2	2	2.8
Lack of training and knowledge	2	2.8	17	23.6	33	45.8	17	23.6	3	4.2
Lack of adequate number of staff	1	1.4	14	19.4	36	50.0	17	23.6	4	5.6
Rapid staff turnover	0	0	5	6.9	37	51.4	24	33.3	6	8.3
Forecasting errors	0	0	9	12.5	32	44.4	29	40.3	2	2.8
Lack of funds	4	5.6	11	15.3	29	40.3	24	33.3	4	5.6
Strategic risk	1	1.4	13	18.1	24	33.3	28	38.9	6	8.3

	N	Mean	Std. Deviation
rapid staff turnover	72	3.43	.747
strategic risk	72	3.35	.922
forecasting error	72	3.33	.732
lack of funds	72	3.18	.954
obsolete and expired inventories	71	3.17	.862
lack of adequate number of staff	72	3.13	.838
lack of training and knowledge	72	3.03	.872
Valid N (list wise)	71		

Source: own study

Organizational or internal risk is a risk that stem from within the organization and these risks include inventory risk, operational risk, and management risk (Norrman and Jansson, 2004; Abhijeet *et al*, 2012). What is good about internal risks is they are controllable and ought to be eliminated or avoided since they are relatively under the control of the given organization but what is unique is a company voluntarily accepts some risks in order to gain a better return which make strategy risks quite different from preventable risk because of the nature that they are not inherently undesirable (Robert S. *et.al*. 2012). This research includes seven potential threats as potential internal risk factors. All the risk factors in this category are considered by the respondents as more than a moderate treat to PFSA. From the listed potential treats rapid staff turnover and forecasting error pose a higher treat with mean 3.43 SD 0.747, and mean 3.33 SD 0.732 respectively.

Table 7: Collective risks

	N	Mean	Std. Deviation
external supplier risk	72	3.36	.678
distribution risk	72	3.26	.712
Internal risk	72	3.25	.687
end to end supply chain risk	72	3.12	.604
Valid N (list wise)	72		

Source: own study

Threats posed by collective risks are aggregated together and made to be rated by the research participant the reason behind is to measure the response consistency of respondents by comparing mean of each category found at the collective risk table with the aggregate mean of each risk subcategory found in the previous tables. Here also supplier risk come first with a mean 3.36 and SD 0.678 distribution risk and internal risk come second and third by severity of threat at both collective risk measurement and the previous category risk measurement while the score of both distribution risk and internal risk at the collective risk measurement being mean 3.26 SD 0.712 and mean 3.25 SD 0.687 respectively.

4.3 Mitigation strategies adopted by PFSA in managing risks

Table 9: Extent of SCRM practise at PFSA

	Frequency	Percent	Mean	SD
Valid no extent (1)	4	5.6	2.33	.671
small extent (2)	44	61.1		
moderate extent (3)	20	27.8		
great extent (4)	4	5.6		
Total	72	100.0		

Source: own study

SCRM is defined as the systematic identification, assessment, and mitigation of potential disruptions in logistics networks with the objective to reduce their negative impact on the logistics network's performance (Norrman and Jansson, 2004). The question "to what extent does PFSA currently use SCRM practices" is put forwarded in order to get a general understanding of the extent to which PFSA follow SCRM practices. The findings show SCRM practiced at PFSA at a small extent with mean 2.33 and SD 0.671.

Table 10: Frequency of use of SCRM tools

	Never (1)		Rarely (2)		Sometimes (3)		Very often (4)		Always (5)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Sourcing tool	8	11.1	32	44.4	28	38.9	3	4.2	0	0
Inventory optimization tool	10	13	17	23.6	32	44.4	12	16.7	1	1.4
Sales tool	23	32.4	28	39.4	9	12.7	10	14.1	1	1.4
Operation planning tool	8	11.1	26	36.1	26	36.1	10	13.9	2	2.8
Master management data tool	12	16.7	28	38.9	21	29.2	10	13.9	1	1.4
Spend management analysis tool	19	26.4	28	38.9	19	26.4	6	8.3	0	0

	N	Mean	Std. Deviation
inventory optimization tool	72	2.68	.962
operation planning tool	72	2.61	.958
master data management tool	72	2.44	.977
sourcing tool	71	2.37	.741
spend management analysis tool	72	2.17	.919
sales tool	71	2.13	1.068
Valid N (list wise)	71		

Source: own study

In order to manage risks SCRM tools must be employed. These tools can be engaged in any or all stages of SCRM i.e. from risk identification to control. There are a number of risk management tools available which are applicable for different circumstances. Among these by the judgement of the researcher the listed six SCRM tools are included for participants to respond. More over participants were also provided with a blank space if they think they are using a risk management tool that is not included in the list. No respondent quoted a tool other than those in the list. From the listed SCRM tools the finding show that PFSA is using inventory optimization tool relatively better even though it is rarely with a score of mean 2.68 and SD 0.962. The finding also concur with the assumption which recommends use of inventory optimization tool for firms dealing with larger amount and assortment of stocks in order to manage gaps between consumption and on hand inventory. Factors like unpredictability of consumption demand due to demand rise and fall, and longer lead time, which scores a higher mean in the previous pages, could push for a higher safety stock that can make the use of inventory optimization tool indispensable.

Table 11: Practises employed in managing SCR

	Improve demand forecasting		Stream line processes		Creation of SCR register		Increase inventory level		Decentralize distribution	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Never (1)	2	2.8	2	2.8	6	8.3	1	1.4	2	2.8
Rarely (2)	13	18.1	26	36.1	31	43.1	8	11.1	1	1.4
Sometimes (3)	38	52.8	25	34.7	27	37.5	28	38.9	16	22.2
Very often (4)	13	18.1	16	22.2	6	8.3	31	43.1	41	56.9
always (5)	6	8.3	3	4.2	2	2.8	4	5.6	12	16.7

	N	Mean	Std. Deviation
Decentralize distribution	72	3.83	.822
Increase inventory level	72	3.40	.816
Improve demand forecasting	72	3.11	.897
Streamline process	72	2.89	.928
Creation of supply chain risk register	72	2.54	.871
Valid N (list wise)	72		

Source: own study

Managing SCR has different approaches and this section questioned the frequency of practised SCR managing mechanisms that can be executed by tuning internal processes and capabilities. From the list of activities listed under this section findings from the participant response indicate that decentralizing distribution and increasing inventory level employed frequently “very often” relative to the other mechanisms with a score of mean 3.83 SD 0.822 and mean 3.40 SD 0.816 respectively. This finding is also in line with the approaches of PFSA as it is constantly expanding its branch reaching seventeen branches currently. The distribution pattern at PFSA also shows similar as procured pharmaceuticals and medical equipments are transported to the central hub then distributed to the seventeen branches all over the country and all regional governmental health institutions are ought to be supplied by the respective branches. Increasing inventory level is also the other frequently followed practised approach as seen from the finding. This is also justifiable as risk mitigation since findings at the previous page shows` unexpected rise in demand mean 3.64 SD 0.678, longer lead time mean 3.61 SD 0.64, probability of occurrence of epidemic mean 3.47 SD 0.839 and a risk of single supplier mean 3.71 SD 1.041.

Table12: Methods employed to manage supplier's related risk

	Improve collaboration with supplier		Shift from single to multiple supplier base		Conduct risk audit of key supplier		Supplier development	
	Freq	%	Freq	%	Freq	%	Freq	%
Never (1)	1	1.4			4	5.6	13	18.1
Rarely (2)	12	16.7	8	11.1	32	44.4	21	29.2
Sometimes (3)	46	63.9	34	47.2	21	29.2	20	27.8
Very often (4)	9	12.5	26	36.1	14	19.4	16	22.2
always (5)	4	5.6	4	5.6	1	1.4	2	2.8

	N	Mean	Std. Deviation
shift from single to multiple supplier base	72	3.36	.756
improve collaboration with supplier	72	3.04	.759
conduct risk audits of key supplier	72	2.67	.904
supplier development	72	2.62	1.106
Valid N (list wise)	72		

Source: own study

As discussed before supply risk poses a significant higher treat to the overall smooth SC operation of a given organization and it is a more frequently happening and studied risk factor within a supply chain (Melo *et al*, 2006). Findings discussed in the previous page show a supply risk pose a relatively higher risk in the supply chain of PFSA with a treat score of mean of 3.36 SD 0.678 as a collective treat. Findings here show that PFSA use supplier strategies to manage supplier's related risk. Among the listed supplier management strategies a shift from single to multiple supplier is employed with a better frequency by PFSA with a score of mean 3.36 and SD 0.756. This approach taken by PFSA is justifiable and the finding match previous section finding which on supplier related risk section shows a treat by single supplier pose a relatively higher treat from other risk factors in the category of supply risk with mean of 3.71 and SD1.041. Other supplier managing strategies listed in this category employed with a lesser frequency. Supplier development scores the least frequency with a mean of 2.62 SD 1.106. PFSA initiative in taking affirmative action for procurement from domestic pharmaceutical manufacture defined in terms of advance partial payment for ordered pharmaceuticals and price priority for local manufacturer can define why the respondent dare to state supplier development practised by PFSA rarely.

Table 13: Strategic sourcing or advanced procurement practises

	Regular screening and monitoring of current supplier		Require critical suppliers to produce a detailed plan of disruption awareness		Include expected cost of disruption in the total cost of equation		Require supplier to provide timely information and visibility of material flow	
	Freq	%	Freq	%	Freq	%	Freq	%
Never (1)	3	4.2	11	15.3	7	9.7	11	15.3
Rarely (2)	29	40.3	22	30.6	20	27.8	19	26.4
Sometimes (3)	30	41.7	27	37.5	36	50.0	24	33.3
Very often (4)	7	9.7	11	15.3	6	8.3	15	20.8
always (5)	3	4.2	1	1.4	3	4.2	3	4.2

	N	Mean	Std. Deviation
require supplier for timely information and visibility of material flow	72	2.72	1.091
include expected cost of disruption in the total cost of equation	72	2.69	.914
regular screening and monitoring of current supplier	72	2.69	.866
require critical supplier to produce a plan of disruption awareness	72	2.57	.976
Valid N (list wise)	72		

Source: own study

Strategic sourcing can be stated as a systematic and fact based approach for optimizing an organization's supply base and improving the overall value proposition. It mostly focuses with getting the best value for money, recognizing total cost of ownership, and continuous visibility (Sislian and Satir, 2000). Findings from this section show listed strategic sourcing elements employed only "rarely" to "sometimes" by PFSA. This also shows that the Agency is not in a strategic relation with its suppliers as the relation between PFSA and its supplier should be stronger beyond a mere buying and selling encounter. Since strategic sourcing is a continuous process and it should be bounded with visibility and it is not about focusing only on cost, getting the cheapest product, focusing on beating up suppliers, and a onetime project decision (Sislian and Satir, 2000). More over preparing for disruption management and awareness only from self perspective is not enough and it is essential to require critical suppliers to produce a plan of disruption awareness since a disruption can occur not only internally but it could happen externally such as upon a critical supplier which consequently can pose a high treat from lack of that critical supply. The Philips fire incident which was a critical supplier to Ericsson and the consequential bankruptcy of Ericsson can be a good example (Musa, 2012; Iwan *et al*, 2009).

Table 14: Real-Time supply chain management practises employed at PFSA

	Conducting frequent meetings/tele conferences with critical supplier		Implement technologies to track containers in distribution channel		Conduct a detailed disruption incident report and analysis following a major disruption event		Create an exception event detection and early warning system	
	Freq	%	Freq	%	Freq	%	Freq	%
Never (1)	4	5.6	8	11.1	3	4.2	7	9.7
Rarely (2)	20	27.8	33	45.8	34	47.2	37	51.4
Sometimes (3)	46	63.9	21	29.2	28	38.9	20	27.8
Very often (4)	2	2.8	10	13.9	7	9.7	8	11.1
always (5)	0	0	0	0	0	0	0	0

	N	Mean	Std. Deviation
conducting frequent meeting with critical supplier	72	2.64	.635
conduct detailed disruption analysis following major disruption	72	2.54	.730
Implement techno. to track containers in distribution channel	72	2.46	.871
create an exception event detection and early warning system	72	2.40	.816
Valid N (list wise)	72		

Source: Own study

This section of the survey request the research participant about the frequency of real-time supply chain risk management practises followed by PFSA so far. The result shows none of the listed approaches are used often or always. Conducting frequent meeting with critical supplier is indicated by the respondents as it is employed with a relative better frequency with a mean of 2.64 and SD 0.635 the scores of the other methods is even lower; conducting detailed disruption analysis following major disruption mean 2.54 SD 0.730 implementing technology to track containers in disruption channel mean 2.46 SD 0.871, and creating an excellent event detection and early warning system mean 2.40 SD 0.816. A better score of conducting frequent meeting with critical supplier is also justifiable as PFSA frequently hold meetings with local pharmaceutical manufacture which aims at enhancing coordination between local pharmaceutical manufacturer and PFSA. Conducting detailed disruption analysis following major disruption is also justifiable as it discussed in the findings of risk identification as previous risk assessment is scored as the second most frequently risk identification method employed by the agency next to risk estimation.

Table 15: Real-Time base operation management practises employed at PFSA

	Improve visibility of inventory buffer in domestic distribution channel		Classify buffered materials for different levels of criticality		Training key employees		Developing real time supply chain configuration decision report	
	Freq	%	Freq	%	Freq	%	Freq	%
Never (1)	1	1.4	3	4.2	2	2.8	5	6.9
Rarely (2)	28	38.9	35	48.6	17	23.6	34	47.2
Sometimes (3)	37	51.4	22	30.6	35	48.6	20	27.8
Very often (4)	5	6.9	10	13.9	18	25.0	11	15.3
always (5)	1	1.4	2	2.8	0	0	2	2.8

	N	Mean	Std. Deviation
training key employees	72	2.96	.777
improve visibility of inventory buffer in a domestic dist. channel	72	2.68	.688
classify buffered materials for different levels of criticality	72	2.62	.879
developing real time supply chain configuration decision report	72	2.60	.929
Valid N (list wise)	72		

Source: Own study

Real time base operation management practises are those activities that are performed internally in order to achieve a real time (current, up to date, and right on the spot) control over SC ongoing processes. These real time base operation practises are done internally in order to be in equal pace with ongoing real time SCM practices that incorporate external stakeholders like suppliers and customers. Here the findings from the respondent shows training of key employees is practised with a better frequency with a mean of 2.96 SD 0.777 the other practises are performed less frequently; improving visibility of inventory buffer in domestic distribution channel mean 2.68 SD 0.688, classifying buffered materials for different levels of criticality mean 2.62 SD 0.879, developing a real time supply chain configuration decision report mean 2.6SD 0.929. A better score for training key employees, and improving visibility of inventory buffer in a domestic distribution channel could be a credit of currently implemented programmes like Health Commodity Management Information System (HCMI), which has two versions. The facility version is employed in managing inventory transaction and product report while the warehouse edition used for inventory management, warehouse management, and costing. The other intervention that can

have a role in real time base operation management of PFSA is the Integrated Pharmaceutical Logistics System (IPLS). It is one of the major interventions taken by PFSA to create a strong, unified, healthcare supply chain, to connect all levels of the supply chain, and to provide accurate and timely data for decision making. To initiate IPLS, a number of interventions were implemented, including (1) large-scale capacity building trainings for health facilities and higher levels, (2) a program of supportive supervision, (3) physical improvements to warehouses and storerooms, and (4) implementing paper-based and automated Logistic Information Management Systems (LMIS) (USAID/DELIVER PROJECT, 2015).

4.4 Barriers in adopting SCRM practises

Table 16: Capability to mitigate key supply chain risks faced by PFSA

	Frequency	Percent	Mean	SD
Valid no extent	1	1.4	2.49	.628
small extent	39	54.2		
moderate extent	28	38.9		
great extent	4	5.6		
Total	72	100.0		

Source: Own study

The fourth section of the questionnaire probed for possible barriers that hamper PFSA in adopting SCRM. A list of possible barriers in adopting SCRM is given on the questionnaire so that respondent could rate their relative strength in holding back the SCRM practise from no extent (1) to very great extent (5). The first question of section four ask the respondent to rate the capability of PFSA in mitigating key supply chain risks faced. The findings show currently PFSA has a small to moderate extent capability in mitigating key supply chain risk. The mean is 2.49 and SD 0.628. The finding has implication in showing the overall SCRM effectiveness of PFSA. Risk mitigation is one of the steps included in the processes of SCRM specifically it is a step with in the risk control category (S. Nurmaya Musa, 2012). Risk mitigation deals with diminishing the consequential disruption effects of risks as well as their probability of occurrence. A lower risk mitigation capability score for PFSA has a negative implication in the effectiveness of PFSA SCRM. A lower capacity in identifying risks as well as a higher treat posed by risks of different sources which are indicated in previous findings of this research adds up to a difficulty in achieving an effective SCRM

Table 17: Potential barriers affect strategic sourcing at PFSA

	Never [1]		Rarely [2]		Sometimes [3]		Very often [4]		Always [5]	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Concern about increased costs	0	0	9	12.5	39	54.2	20	27.8	4	5.6
Poor communication across supply chain	1	1.4	14	19.4	30	41.7	24	33.3	3	4.2
Inadequate technology	1	1.4	10	13.9	29	40.3	27	37.5	5	6.9
Lack of management support	0	0	16	22.2	36	50.0	17	23.6	3	4.2
Supplier geographical distance	0	0	9	12.5	25	34.7	29	40.3	9	12.5
Lack of supply chain management knowledge	2	2.8	11	15.3	38	52.8	17	23.6	4	5.6

	N	Mean	Std. Deviation
supplier geographical distance	72	3.53	.872
inadequate technology	72	3.35	.858
concern about increased cost	72	3.26	.750
poor communication across supply chain	72	3.19	.850
lack of supply chain management knowledge	72	3.14	.844
lack of management support	72	3.10	.790
Valid N (list wise)	72		

Source: Own study

This section asks the research participants to rate the frequency potential barriers affecting strategic sourcing at PFSA. From the list of potential barriers included supplier geographical distance is stated as a relatively more frequent potential barrier with a mean 3.53 and SD 0.872, the scores of other barriers was inadequate technology mean 3.35 SD 0.858. Supplier geographical distance pose as a more frequent barrier to the strategic sourcing activities of PFSA because of majority of PFSA procurement are from overseas which sets hurdles in achieving smooth flow of supplies because of longer lead time and failure to assure visibility as inadequate technology is cited as a second frequent barrier in achieving strategic sourcing. Inadequate technology is cited as a potential barrier in achieving strategic sourcing because of the fact that technologies aid in harmonizing communication across a geographical distance which is a potential barrier by itself as well as it aids in maintaining visibility along the supply chain so as in order to reach a decision on a real time basis.

Table 18: Potential barriers affecting implementation Real-Time SCRM

	Never [1]		Rarely [2]		Sometimes [3]		Very often [4]		Always [5]	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Concern about increased costs	0	0	9	12.5	46	63.9	15	20.8	2	2.8
Poor communication across supply chain	0	0	10	13.9	33	45.8	28	38.9	1	1.4
Inadequate technology	2	2.8	6	8.3	33	45.8	29	40.3	2	2.8
Lack of management support	0	0	17	23.6	36	50.0	17	23.6	2	2.8
Supplier geographical distance	1	1.4	6	8.3	18	25.0	39	54.2	8	11.1
Lack of supply chain management knowledge	2	2.8	7	9.7	39	54.2	18	25.0	6	8.3

	N	Mean	Std. Deviation
supplier geographical distance	72	3.65	.842
inadequate technology	72	3.32	.784
poor communication across supply chain	72	3.28	.716
lack of supply chain management knowledge	72	3.26	.856
concern about increased cost	72	3.14	.657
lack of management support	72	3.06	.767
Valid N (list wise)	72		

Source: Own study

Real-time SCRM is all about agility, being up to date, and on the spot management approach that greatly call for being on time and staying informed. This section asked the research participant to rate the frequency of potential barriers that affects implementation of real-time SCRM. The findings indicate supplier geographical distance as a relatively more frequent barrier with mean 3.65 and SD 0.842. The scores of the barriers affecting implementation of SCRM was inadequate technology mean 3.32 SD 0.784, poor communication across supply chain mean 3.28 SD 0.716, lack of supply chain management knowledge mean 3.26 SD 0.856, concern about increased cost mean 3.14 SD 0.657, and lack of management support mean 3.06 SD 0.767. Supplier geographical distance is sated as a more frequent barrier from achieving real-time SCRM which also supported by inadequate technology to communicate with suppliers, track orders and ensure visibility as well as which further explained by poor communication across the supply chain. As the frequency of occurrence of the mentioned barriers increased it also become even harder to implement real time SCRM as it is all about being on time.

Table 19: Potential barriers affecting implementation Real-Time SC base operation management as SCRM practise

	Never [1]		Rarely [2]		Sometimes [3]		Very often [4]		Always [5]	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Concern about increased costs	1	1.4	6	8.3	44	61.1	19	26.4	2	2.8
Poor communication across supply chain	1	1.4	12	16.7	37	51.4	18	25.0	4	5.6
Lack of management support	1	1.4	14	19.4	32	44.4	24	33.3	1	1.4
Lack of supply chain management knowledge	4	5.6	7	9.7	30	41.7	25	34.7	6	8.3

	N	Mean	Std. Deviation
lack of supply chain management knowledge	72	3.31	.959
concern about increased cost	72	3.21	.691
poor communication across supply chain	72	3.17	.822
lack of management support	72	3.14	.793
Valid N (list wise)	72		

Source: Own study

Real time base operation for management of supply chain risks are actions that are accomplished internally within the organization in order to be more informed and up-to-date in a preparation to mitigate SC risks and to act with agility if they occur. Research participant were asked to rate the frequency of occurrence of these potential barrier that hampers the implementation of real-time base operation management as SCRM practise. Concern about increased cost stated as a more frequent barrier with a mean of 3.21 SD 0.691 while the other potential barriers score is as follow; lack of supply chain management knowledge mean 3.31 SD 0.959, poor communication across supply chain mean 3.17 SD 0.822, and lack of management support with a mean of 3.14 and SD 0.793. Concern about increased cost as it frequently occur can explained in terms of reluctance for investing in infra structure and other inputs for technologies that could help in configuration of SCRM or reluctance for holding extra inventories with the aim to operate lean and economical. But According to Chopra and Sodhi (2004), supply chain disruptions can occur for a wide variety of reasons such as industrial plant fires, transportation delays, work slowdowns or stoppages, or natural disasters. Companies running lean operations no longer have inventory or excess capacity to make up for production losses, so that material flow problems rapidly escalate to wide-scale network disruptions.

Table 20: Potential barriers affecting implementation of management of supplier related risk

	Never [1]		Rarely [2]		Sometimes [3]		Very often [4]		Always [5]	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Concern about increased costs	1	1.4	7	9.7	44	61.1	18	25.0	2	2.8
Poor communication across supply chain	0	0	8	11.1	38	52.8	21	29.2	5	6.9
Lack of management support	0	0	13	18.1	36	50.0	20	27.8	3	4.2
Supplier geographical distance	1	1.4	11	15.3	28	38.9	23	31.9	9	12.5
Lack of supply chain management knowledge	2	2.8	7	9.7	31	43.1	26	36.1	6	8.3

	N	Mean	Std. Deviation
supplier geographical distance	72	3.39	.943
lack of supply chain management knowledge	72	3.38	.879
poor communication across supply chain	72	3.32	.766
lack of management support	72	3.18	.775
concern about increased cost	72	3.18	.699
Valid N (list wise)	72		

Source: Own study

As discussed before supply risk poses a significant higher threat to the overall smooth SC operation of a given organization and it is a more frequently happening and studied risk factor within a supply chain (Melo *et al*, 2006). Therefore Management of supplier related risk is considered to have a key role in the overall SCRM processes. Here potential barriers that could affect implementation of management of supplier related risk overall show a relatively higher frequency. Lack of supply chain management knowledge shows a higher frequency with mean 3.38 and SD 0.879, supplier geographical distance has also similar frequency with mean 3.39 SD 0.943, poor communication across supply mean 3.32 SD 0.766 lack of management support mean 3.18 SD 0.775, and concern about increased cost has a mean of 3.18 and SD 0.699. An overall high frequency for this question shows though supply risk is considered as a prime risk category yet there are highly frequently occurring barriers that can potentially hamper the implementation of management of supplier related risk.

CHAPTER FIVE

5. SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATION

5.1 Summary of findings

From the findings of the research it is shown that external (supplier) risk pose a higher treat to the supply chain activities of PFSA while internal risk factors, distribution risk, and end to end supply chain risk present the next level of risks for PFSA. Supplier risk which poses a relative higher treat was rated in terms of factors like supplier lead time, single supplier risk, unavailability of items, poor supplier performance, cost escalation, poor communication and coordination with supplier, and possibility of improper supplier selection only based on minimum price. Internal risks which constitute the second higher treat at PFSA are composed of factor like rapid staff turnover, forecasting error, strategic risk, lack of funds, obsolete and expired inventories, lack of adequate number of staffs, and lack of training and knowledge when listed with descending threat score.

External distribution risks are found to be the third factor that can cause supply chain disruption. Factors included and rated in the distribution risk are unexpected rise in demand; longer lead time in meeting demands, communication barrier with branches, warehouse inadequacies, cargo damage and theft, and infrastructure unavailability when listed with descending threat score. External end to end supply chain risks are ranked as the fourth possible disruption causing risks and factors include currency fluctuation, theft and adulteration, quality assurance risk, and as well as other environmental disruption risk like occurrence of epidemic, manmade disaster, political risk and natural catastrophe.

The research also pin point methods employed in identifying risk by the Agency. None of the listed risk identification methods employed more than moderately. According to the result risk estimation is used in a small to moderate extent followed by previous risk assessment, brain storming session, developing a risk register, and surveys.

The other objective of the research was to assess currently employed SCRM practises at the agency. The findings show SCRM is practised small to moderate extent currently. The findings show none of the supply management tools are used regularly and activities like decentralizing distribution, increasing inventory level, improving demand forecasting, shift from single to multiple supplier base, improving collaboration with supplier are practised as a SCRM approach.

The other objective of the research was factors that are considered as a potential barrier in performing supply chain risk management practises. The findings show that PFSA has now a moderate extent of capability to mitigate key supply chain activities currently. Among the factors that are listed as a potential barrier in adopting a SCRM are supplier geographical distance, inadequate technology, poor communication across the supply chain, and lack of supply chain management knowledge are stated as frequently occurring barriers.

5.2 conclusions

This research was conducted with the objectives of assessing the supply chain risk management practise at PFSA. On doing so the research also identify supply chain risks faced by PFSA, assess current SCRM practises employed by PFSA, and determine the barriers in adopting SCRM practise. Over all from the findings of the research it can be concluded that PFSA is not making enough activities in identifying risks as use of proactive and formal risk identification tools like survey and developing a risk register only to a small extent. A weak risk identification capacity of PFSA that is identified in terms of use of risk identification in only small extent greatly compromises effectiveness of the SCRM process.

External (supplier) risk pose a higher treat to the supply chain activities of PFSA while internal risk factors, distribution risk, and end to end supply chain risk present the next level of risks for PFSA. The treat here is double as supply risks poses a significant higher risk to the integrity of the given company supply chain as it is a risk associated with a company's suppliers, or supplier's suppliers being unable to deliver the materials the company needed to effectively meet its demand forecasts.

SCRM is practised in small to moderate extent and factors like supplier geographical distance, inadequate technology, poor communication across the supply chain, and lack of supply chain management knowledge are identified as a potential barrier in adopting a SCRM. Finally it can be concluded that PFSA is found to be weak in identifying risks which is the first and crucial steps in the process of SCRM though the presence of different operational and environmental risks that pose moderate to high level of treat to the operations of the Agency. More over weaker use of SCRM tools, lower risk mitigation capabilities, and a higher frequency of potential barriers all indicated from the findings indicates that the Agency currently has a difficulties in implementing an effective SCRM process.

5.3 Recommendation

The study has shown weak risk identification, a higher supplier risk, a weak implementation of SCRM, and a number of barriers in adopting SCRM. From the findings and conclusion of the study there are a number of issues PFSA should address in order to accomplish an efficient PSC by reducing the occurrence of disruptions, and their magnitude of consequences by making use of an efficient SCRM.

Since risk identification is regarded as a key aspect of SCRM process PFSA should primarily improve its risk identification potential. Once risk are identified and anticipated it makes easier to propose methods in managing the identified risks. More over proactive identification of risks prior to their occurrence is more economical than dealing with the risks once they occurred (Zsidisin *et al*, 2004).

PFSA should also work its best in addressing supply risk as it is rated as of prime importance by the respondents of this research. Issues under supply risk like, longer lead time, single supplier, unavailability of items, performance of supplier, and possibility of improper supplier selection only based on price should be addressed in detail in order to reduce probability of disruption from failed supply. Addressing supply risk should given a significant focus as supply risks are found to be the single most cause of SC disruption. Other factors of risk under the category of internal and distribution risk factors should also be addressed. Environmental disruption risks like occurrence of epidemic, manmade disaster, and natural catastrophe are also rated as they pose treat to the PSC and preparation should be done for minimizing their consequential damage since they could occur any time.

A number of factors are identified as a potential barrier in implementing a SCRM practise. These factors like inadequate technology, concern about increased cost, poor communication across supply chain should be deal with in order to tackle them. The other barrier supplier geographical distance can be solved by establishing a better communication and visibility of processes by making use of modern technologies as well as building the capacity of local pharmaceutical manufacturer is also recommended since it has pure advantage in simplifying processes, cutting lead time and costs involved.

5.4 Implication for further research

This research assessed SCRM practice, risk factors, and barriers in implementation of SCRM at PFSA. However other researches can be conducted with broader scope which could involve stakeholders like suppliers, public health institution, and regulatory bodies like MOH. Researches with a cause and effect kind of approach can also be conducted in determining factors affecting SCRM processes at PFSA or other organizations.

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College of Business and Economics (CoBE)

SCHOOL OF COMMERCE

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Date: 22/7/16

To Whom It May Concern

Dear Madam/Sir,

The department of Logistics and Supply Chain Management of Addis Ababa University –School of Commerce would kindly request your esteemed organization to extend the required assistance to Mr./Mrs./ Bisrat Mengistu a graduate Logistics and Supply Chain Management student who is currently working on a research entitled” supply chain risk management the case of PFSA

“for the partial fulfillment of Master of Arts degree in Logistics and Supply Chain Management.

The department would appreciate your all-rounded assistance that will be given to the student researcher regarding the provision of pertinent information to the thesis work indicated above. The department strongly believes in such a university-industry collaboration that will enable it to design, develop and enrich the curriculums to meet industry requirements & standards. This collaboration will play its own role in enhancing or stimulating the research culture in the country.

Thanking you profoundly, for investing your precious time to support the student researcher in order to complete his/her thesis work successfully within the given time target.

If you have doubts or questions you can access the coordinator via e-mail: busha-temesgen2003@yahoo.com

Sincerely Yours,

Busha Temesgen

Coordinator, Logistics and Supply Chain Management MA Program

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Annex 2

Questionnaire

Introduction

Dear respondent Thank you for agreeing to participate in this survey and for your valuable inputs. I am currently conducting a research with the theme “Supply chain risk management (SCRM) the case of PFSA” For the partial fulfilment of the requirements for Master of Arts in logistics and supply chain management, school of commerce Addis Ababa University. The aim of the research is to gain a general understanding of trends in SCRM at PFSA.

The research is purely for academic purpose and your identity stay **anonyms (no need for names)**. The survey will take around 25 minutes to complete but allow yourself enough time so that you do not have to rush. Please be responsible to answer honestly in order to get the most accurate result. Thank you.

Should you have any question about the survey please feel free to contact
Name Bisrat Mengistu **Mob.** 0911-355-500 **Email** Bisrathe@gmail.com

PART A Kindly respond to the question by ticking the most appropriate response you think

1. Gender

☐ Male

☐ Female

2. The highest academic qualification you achieved

☐ College certificate

☐ Diploma

☐ Bachelor degree

☐ Master's degree

Others specify_____

3. For how long have you worked in PFSA

☐ Less than a year

☐ 1-2 years

☐ 3-5 years

☐ more than 5 years

4. Please indicate your current directorate

☐ Storage and Distribution Directorate

☐ Forecasting and Capacity Building Directorate

☐ Procurement Directorate

☐ Fund Management Directorate

☐ Human Resource and General Service Directorate

☐ Planning, monitoring, and evaluation directorate

☐ Branch co-ordination directorate

☐ Medical device utilization specification preparation & evolution
directorate

☐ Pharmaceutical supply management IT directorate

☐ Human resource and general service directorate

Part B identifying the main supply chain risk faced by PFSA

1. To what extent does PFSA use the following in identifying risks?

	Not at all [1]	Small extent [2]	Moderate extent [3]	Great extent [4]	Very great extent [5]
Risk estimation					
Previous risk assessment					
Developing risk register					
Brainstorming session					
Surveys					

2. In your opinion how much threat is posed on PFSA by the below mentioned potential risks.

External end to end supply chain risks					
	No treat [1]	Low treat [2]	Moderate treat [3]	High treat [4]	Highest treat [5]
Quality assurance					
Regulatory approval					
Currency fluctuation					
Taxes, customs, and other regulation					
Theft and adulteration					

External , supplier risk					
	No treat [1]	Low treat [2]	Moderate treat [3]	High treat [4]	Highest treat [5]
Possibility of improper supplier selection only based on minimum price					
Performance of supplier					
Lead times					
Cost escalation					
Poor communication and coordination					
Unavailability of items					
Single supplier					

External , distribution risks					
	No treat [1]	Low treat [2]	Moderate treat [3]	High treat [4]	Highest treat [5]
Infrastructure unavailability					
Cargo damage and theft					
Warehouse inadequacies					
Longer lead time					
Communication barrier with branches					
Unexpected rise in demand					

External environmental disruption risk					
	No treat [1]	Low treat [2]	Moderate treat [3]	High treat [4]	Highest treat [5]
Political risk					
Natural catastrophe e.g. Flooding, earthquake					
Manmade disaster e.g. fire, war					
Occurrence of epidemic					

Internal, agency's risk					
	No treat [1]	Low treat [2]	Moderate treat [3]	High treat [4]	Highest treat [5]
Obsolete and expired inventories					
Lack of training and knowledge					
Lack of adequate number of staff					
Rapid staff turn over					
Forecasting errors					
Lack of funds					
Strategic risk					

3. In your opinion how much threats is posed on PFSA by the above mentioned potential risks collectively.

	No treat [1]	Low treat [2]	Moderate treat [3]	High treat [4]	Highest treat [5]
End to end supply chain risk					
External supplier risk					
External distribution risk					
Internal agency's risks					

PART C determine supply chain risk management practises employed by PFSA

1. to what extent does PFSA currently use supply chain risk management practise

- ☐ No extent (1)
 ☐ Small extent (2)
 ☐ Moderate extent (3)
 ☐ Great extent (4)
 ☐ Very great extent (5)

2. How often do PFSA use the following potential SCRM tools?

	Never [1]	Rarely [2]	Sometimes [3]	Very often [4]	Always [5]
Sourcing tool					
Inventory optimization tool					
Sales tool					
Operation planning tool					
Master data management tool					
Spend management analysis tool					

Others specify_____

3. How often do PFSA use the following as a practise to manage supply chain risks?

	Never [1]	Rarely [2]	Sometimes [3]	Very often [4]	Always [5]
Improve demand forecasting					
Stream line processes					
Creation of supply chain risk register					
Increase inventory level					
Decentralize distribution					

4. How often do PFSA use the following supplier strategies to manage suppliers' related risk?

	Never [1]	Rarely [2]	Sometimes [3]	Very often [4]	Always [5]
Improve collaboration with supplier					
Shift from single to multiple supplier base					
Conduct risk audits of key suppliers					
Supplier development					

5. How often do PFSA use the following strategic sourcing or advanced procurement practises?

	Never [1]	Rarely [2]	Sometimes [3]	Very often [4]	Always [5]
Regular screening and monitoring of current suppliers					
Require critical suppliers to produce a detailed plan of disruption awareness					

Include expected costs of disruption in the total cost of equation					
Require supplier to provide timely information and visibility of material flow					

6. How often do the following Real-Time supply chain management practises are used in PFSA?

	Never [1]	Rarely [2]	Sometimes [3]	Very often [4]	Always [5]
Conducting frequent meetings/teleconferences with critical supplier					
Implement technologies to track containers in distribution channel					
Conduct a detailed disruption incident report and analysis following a major disruption event					
Create an exception event detection and early warning system					

7. How often do these real time base operation management practises are employed in PFSA?

	Never [1]	Rarely [2]	Sometimes [3]	Very often [4]	Always [5]
Improve visibility of inventory buffer in domestic distribution channel					
Classify buffered materials for different levels of criticality					
Training key employees					
Developing real time supply chain configuration decision report					

PART D determine the barriers to adopting supply chain risk management practises

1. In your opinion to what extent is PFSA **capable to mitigate** key supply chain risks it faces right now?

- ☐ No extent (1)
 ☐ small extent (2)
 ☐ Moderate extent (3)
 ☐ great extent (4)
 ☐ Very great extent (5)

2. How often do the following potential barriers affect implementation of strategic sourcing or advanced procurement practise as a SCRM practice in PFSA?

	Never [1]	Rarely [2]	Sometimes [3]	Very often [4]	Always [5]
Concern about increased costs					
Poor communication across supply chain					
Inadequate technology					
Lack of management support					
Supplier geographical distance					
Lack of supply chain management knowledge					

3. How often do the following potential barriers affect implementation of Real-Time supply chain risk management practise as SCRM practise in PFSA?

	Never [1]	Rarely [2]	Sometimes [3]	Very often [4]	Always [5]
Concern about increased costs					
Poor communication across supply chain					
Inadequate technology					
Lack of management support					
Supplier geographical distance					
Lack of supply chain management knowledge					

4. How often do the following potential barriers affect implementation of Real-Time supply chain base operations management practise as SCRM practice in PFSA?

	Never [1]	Rarely [2]	Sometimes [3]	Very often [4]	Always [5]
Concern about increased costs					
Poor communication across supply chain					
Lack of management support					
Lack of supply chain management knowledge					

5. How often do the following potential barriers affect implementation of supplier strategies as SCRM practise at PFSA in management of supplier related risk?

	Never [1]	Rarely [2]	Sometimes [3]	Very often [4]	Always [5]
Concern about increased costs					
Poor communication across supply chain					
Lack of management support					
Supplier geographical distance					
Lack of supply chain management knowledge					

Thank you!!!