

Ethiopian Coffee Supply Chain Risk Assessment

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ABSTRACT

The global coffee sector daily confronts risks that could hamper production, curtail potential markets, decimate margins, and even ruin entire networks of growers, roasters, marketers, traders, and exporters. Recent events have vividly demonstrated that a disruption affecting an entity anywhere in the supply chain can have a direct effect on a company's ability to continue operations, get finished goods to market or provide critical services to customers.

Coffee sector can be considered as an important industry for the development of agriculture and rural areas of Ethiopian. However, the current practices in production and the changes of domestic and global economy, especially price crisis risk, Environmental change risk; coffee growers, collectors, unions, Exporters in Ethiopia are in conditions of being exposed to various types of risks and uncertainties.

This study assesses and analyze the risk factors that adversely impact the Ethiopian coffee supply chain and those working within the coffee sector. Eighty-one risk factors are identified using Literature review, questionnaires and interview. These risk factors grouped under nine categories which are including, Financial and Economic Risks, Technical, Personal and Managerial, Resource, Governmental and Political, Contract and Legal, Safety and Security, Environmental, Farm risk and analyzed using FMEA; thirty-two of them are characterized as major risk factors.

By using vensim which is a system dynamic tool, relationship of the major risk factors was made and based on these major risk factors, mitigation strategy and risk management frame work are proposed. The result can help managers to shift resource to identified major risk factors.

Key word: Risk, supply chain, failure mode and effect analysis

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ABBREVIATION

ECSC	Ethiopia Coffee Supply Chain
FMEA	Failure Mode and Effect Analysis
CM	Chain Management
ECX	Ethiopia Commodity Exchange
ECTA	Ethiopia Coffee and Tea Authority
RPN	Risk Priority Number
MOV	Mean Occurrence Value
MSV	Mean Severity Value
PN	Priority Number
EP	Exporters Perspective
SP	Suppliers Perspective
CUP	Cooperative Unions Perspective
ISO/EIC	International Organization for Standardization
ICO	International Coffee Organization
CSA	Central Statistical Agency
GTP	Growth and Transportation Plan

CHAPTER ONE

BACKGROUND OF THE STUDY

1.1 Introduction

The global coffee sector daily confronts risks that could hinder production, limit potential markets, decimate margins, and even ruin entire networks of growers, roasters, marketers, traders, and exporters. The frequency of these risks plays a part in reducing the incentives and willingness of financiers to lend to the sector, and also curbs the interest of coffee sector actors in borrowing to invest in their enterprises. Accordingly, better risk management could well be a step toward easier access to finance (WBG, 2015)

Recent events have vividly demonstrated that a disruption affecting an entity anywhere in the supply chain can have a direct effect on a corporation's ability to continue operations, get finished goods to market or provide critical services to customers. Organizations that think they have managed risk have often overlooked the critical exposures along their supply chains. As noted by Braithwaite and Hall (1999), supply chains that run to hundreds if not thousands of firms over several tiers present significant risk (Braithwaite and Hall, 1999). Some writers suggest that the domino effects of disruptions in supply chains might have been exacerbated in the last decade (Christopher and Lee, 2001).

Suppliers in the coffee bean market have to battle out multiple issues including supplier selection, climatic conditions, price volatility, land productivity, fluctuating demand, and stringent government regulations. As a result, suppliers have to avail procurement services to drive profitability and sustainability in the coffee bean market". Effective supply chain risk management (ESCRM) is essential to a successful business. It is also a competence and capability many enterprises have yet to develop (Thomas P. Ofcan sky, 2004).

Coffee production in Ethiopia is a longstanding tradition and Ethiopia itself accounts for around 3% of the global coffee market. Coffee is important to the economy of Ethiopia; around 60% of foreign income comes from coffee, with an estimated 15 million of the population relying on some aspect of coffee production for their livelihood. In 2006, coffee exports brought in \$350 million, equivalent to 34% of that year's total export (AFRICAN COFFEE PLATFORM).

Ethiopia has seen consistently growing volumes over time. Volume growth is a policy objective for the government, both by increasing yields and preparing new land for coffee. In the federal government Growth and Transformation Plan II (GTP II), coffee production is targeted at 1 million metric tons in 2020. Forecasts by different actors vary (FAST, 2017).

Even though further volume growth was targeted and expected by many, volumes have been stabilized since 2012/13. Where some volume growth has been realized in certain areas, other regions have struggled with weather conditions and pests and diseases (FAST, 2017).

Based on coffee alone, farming households of on average 6 members are far below the international poverty line. Small farms and low yield bring revenue of 452 USD annually, with cost of production high in relation to revenue. Small-scale farmers tend to be risk averse as one failed crop is enough to undermine their living conditions (FAST, 2017).

The literature reviewed shows that little have been explored regarding the supply chain risk assessment in agricultural industries in Ethiopia. Although supply chain risk assessment has been negligibly touched in the agriculture, a gap of information is clearly seen on coffee supply chain and more precisely, in coffee supply chain risk assessment.

1.2 Statement of the problem

According to Supply chain risk leadership Council (2011), Africa account for about 12% of the world's production and in the recent years the production has decreased between 200% and 300%. In most African origins, yields are low, quality is inconsistent, and supply chains are inefficient. United States department of agriculture reports indicates that, Ethiopian coffee production rate from 1961 to 2017 shows the sector has increasing and decreasing production rate which creates more challenge for small scale farmers.

Coffee sector can be considered as an important industry for the development of agriculture and rural areas of Ethiopian. However, the current practices in production and the changes of domestic and global economy, especially price crisis risk, Environmental change risk; coffee growers, collectors, unions, Exporters in Ethiopia are in conditions of being exposed to various types of risks and uncertainties. Although such risks are mentioned in a lot of the industry reports and newspapers, there has been insufficiently systematic analysis on different types of risks.

This study tries to expose the existing risks facing by Ethiopian coffee supply chain actors today, that includes identifying, assessing and finally prioritizing the risks which helps the

supply chain actors to manage and also to quickly recover to stable conditions once a disruption takes place.

1.3 Research Question

- ✓ How supply chain risk factors can be identified, analyzed and finally prioritized?
- ✓ What are the risks that existed within the Ethiopian coffee supply chain?
- ✓ What are the major risk factors which affects Ethiopian coffee supply chain?
- ✓ How can these major risk factor be mitigated to avoid or minimize the impact?

1.4 Objective

1.4.1 General objective

This thesis will assess and analyze the risk factors that adversely impact the Ethiopian coffee supply chain and those working within the coffee sector.

1.4.2 Specific objective

The research is expected to achieve the following objectives:

- ✓ To Identify supply chain risk factors within Ethiopia coffee supply chain.
- ✓ To prioritize the major risk factors which affects Ethiopian coffee supply chain.
- ✓ To provide mitigation options to the major risk factor which can avoid or minimize the impact in Ethiopia coffee supply chain.
- ✓ Propose risk management and mitigation framework.

1.4 Scope and limitations of the study

This study is limited to identifying, Assessing and prioritizing risks that existed in Ethiopian coffee supply chain and finally propose risk mitigation and mitigation framework for the sector.

This research is limited to respondent which have experience and knowledge about risk involving the coffee supply chain which doesn't include coffee farmers and respondent with lower education background.

1.5 Significance of the study

Risk assessment is key elements for any kinds of industry in order to manage uncertainties and unknowns that can impose and create damage to the coffee sector. Coffee sector is a major player in the Ethiopian economy, thus this study will benefit the coffee sector by identifying, assessing, prioritizing the risk and finally propose risk mitigation and mitigation framework.

Ethiopian Coffee Supply Chain Risk Assessment

- ✓ This research will fill the gap that showed by literature reviewed regarding supply chain risk assessment more specifically coffee supply chain risk assessment in Ethiopia.
- ✓ The result of the study can be used by different interested parties including Ethiopian commodities exchange (ECX), exporters, unions, retailers and farmers by indicating which risk requires an immediate action and what types of risk mitigation action required.
- ✓ The result of the study can assist companies those invested and company those looking to invest in coffee sector.

CHAPTER TWO

LITERATURE REVIEW

In this chapter, a critical review of the relevant literature was presented. This leads up to the definition of the gap that exists in the literature and how this work contributes in partially fulfilling the gap.

2.1 Introduction

Nowadays, with more complex supply chains on the one hand and higher uncertainty in a global business world on the other hand, disturbances hit supply chains more often and severe. The negative consequences are massive when risks are poorly managed or remain unnoticed (Hendricks, 2005). Thus, managing supply chain risks needs to be a primary goal of any high-ranking executive team by incorporating risk management as part of each and every supply chain (Cohen, 2007.).

The process of the review was to begin commonly on literature concerning the general concept of risk and work towards more specific literature that could assist in search for response to the research questions as well as survey what researches have already been done on the subject. As the research questions are targeted at the supply chain, literature concerning supply chain risk and specifically risk in coffee sector are examined.

2.2 Concept of Supply Chain

There are a number of definitions for a supply chain in the literature. Some of them are, Supply chain "...a set of value-adding activities that connects a firm's suppliers to the firm's customers" (Harrison, 2005.).The management of upstream and downstream relationships with suppliers and customers, to deliver higher customer value at less cost to the supply chain as a whole (Christopher, 2005.). A supply chain may be defined as an incorporated process where in a number of different business entities (i.e. suppliers, manufacturers, distributors and retailers) work together in an effort to: 1) obtain raw materials, 2) transform those raw materials into specified final products, and 3) distribute these final products to retailers (B. Bigliardi and E. Bottani, 2000).

Customarily the Supply Chain Management (SCM) is defined as the discipline of optimization in delivering goods, services or information connected from supplier to customer, which consists of different levels, as a supplier, manufacturer, distributor and

consumer, but also becomes a network of companies that influence and affect their performance among themselves.

Basically, supply chain is a network of activities and delivery options that performs the functions of procurement of materials, conversion of these materials into intermediate and finished products, and the delivering of these finished products to customers. Supply chains exist in both service and manufacturing organizations, although the complexity of the chain may differ significantly from industry to industry and firm to firm (Lambert, 1998) .

A CM (Chain management) usually lies between fully vertically integrated firms, where the whole material flow is held by a single firm and those where each network member operates independently. Therefore, coordination between diverse actors in the chain is a key in its effective management. Compare SCM to a well-balanced and well-practiced relay team. Such a team is more competitive when each player knows how to be placed for the hand-off. The relationships are the strongest between actors but the whole team needs to make a coordinated effort of enjoy the benefit of the supply chain (Downey, 2012) .

SCM is a way of increasing productivity, effectiveness and profitability through a better market coordination. SCM in agribusiness is the process of getting order to the system of producing, processing, distributing and marketing of food and agricultural products to consumers (Owen, 2013)

Conventionally, marketing, distribution, planning, manufacturing and procuring organizations beside the agricultural supply chain are operated independently but are coordinated in order to serve the same customers. These organizations have their own objectives that are often conflicting. For example, the objective of quality customer service and maximum sales may conflict with manufacturing and delivery goals. Many business operations are designed to maximize throughput and lower cost with slight consideration for the impact on inventory levels and delivery capabilities.

2.2.1 Characteristics of supply chain

Supply chain framework consisting of three components i.e. the structure of the supply chain, the supply chain business processes and the supply chain management components. “The supply chain structure is the network of members and the links between members of the supply chain. Business processes are the activities that produce a specific output of value to

the customer. The management components are the managerial variables by which the business processes are integrated and managed across the supply chain.” (Downey, 2012)

In terms of supply chain structure, (Stonebraker, 2004.) propose three structural features i.e. 1) the members of the supply chain, 2) the structural dimensions of the network, and 3) the diverse types of process links across the supply chain. The members of the supply chain are those companies which a firm cooperates with between points of origin to point of consumption. The structural dimensions of the supply chain concern firstly, the vertical structure, the horizontal structure and the position of the company within the horizontal structure. In terms of vertical structure, a supply chain can be small with few firms in a particular tier, or wide, with many companies. In terms of horizontal structure, a supply chain may be narrow with few tiers or wide with many tiers.

Process links concern the business process linkages between different member companies in the supply chain. These links are how companies manage and incorporate the activities between different firms. The links are of four types: managed process links; not managed business process links; monitored process links or non-member process links. Finally, supply chain management concepts are of two main types; physical and technical management components and managerial and behavioral components (Stonebraker, 2004.). The two main characteristics of supply chains as being the number of stages and the form of integration i.e. the degree of ownership and control, four kinds of configuration, namely independent integrator, collaborative integrator, controlling integrator and full integrator (Kaplan, 1981).

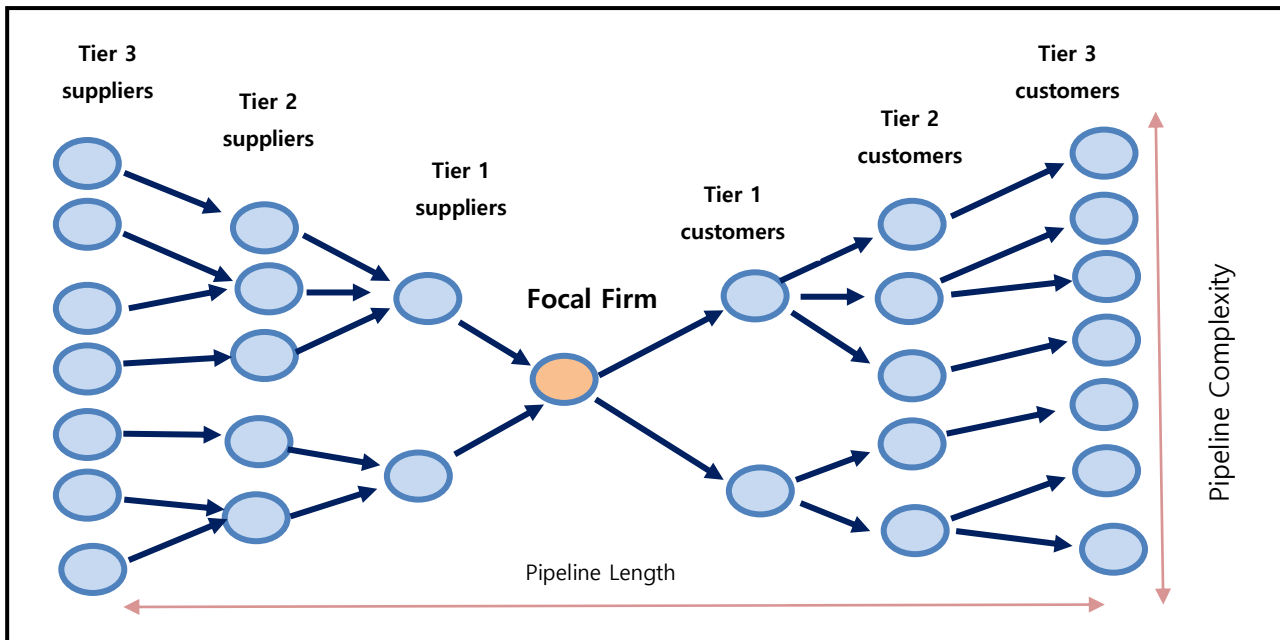


Figure 2.1: supply chain characteristics
(Source: Christopher Owen, 2001)

2.2.1 Supply Chain Risk Management

SCRM is viewed as “the management of supply chain risk through coordination or collaboration among the supply chain partners so as to ensure profitability and continuity”. (Tang, 2006). Risks in supply chains vary from those in individual companies. Differences particularly arise in the intensity of cooperation-related risks, due to mutual dependencies, lower inventories and buffers, or cross-company risk interlinking and resulting effects on supply chain partners in the whole value chain. Therefore, the range of supply chain risk is manifested in the reduction of risks for individual entities of the supply chain and the supply chain as a network entity that is related to multiple supply chain risk sources (Reh, 2009)

Supply chain risk management wishes to identify the potential sources of risk and implement suitable actions to avoid or contain supply chain vulnerability. Consequently, it can be defined as: “the identification and management of risks for the supply chain, through a coordinated approach amongst supply chain members, to reduce supply chain vulnerability as a whole.” (uta jüttner, 2003)

The four fundamental constructs of the supply chain risk management concept enable us to identify the related critical features of the managerial concept: (1) Assessing the risk sources for the supply chain; (2) identifying the risk concept of the supply chain by defining the most relevant risk consequences (3) tracking the risk drivers in the supply chain strategy and (4)

mitigating risks in the supply chain, Whereas these critical pieces could be taken as sequential steps in a managerial process. (uta jüttner, 2003)

2.3.1 Concepts of Risk

There is a variety of definitions of risk given by researchers from different angles that includes the Oxford English Dictionary which has its definition of risk being the following:

“(Exposure to) the possibility of loss, injury, or other adverse or unwelcome circumstance; a chance. or situation involving such a possibility” (OED, 1997).

The Project Management Institution has also issued its definition of risk being the following: “Risk is an uncertain event or condition that, if it occurs, has an effect on at least one [Project] objective” (PMBOK, 2013)

The other one is from the International Organization for Standardization, in its standard on Risk management ISO31000 risk is defined as:

“...effect of uncertainty on objectives. ...An effect is a deviation from the expected – Positive and/or negative” (ISO31000, 2009)

“Risk can be defined as any source of randomness that may have an adverse impact on the market value of a corporation’s assets, net of liabilities, on its earnings, and/or on its raw cash flows”. Numerous types of risks including financial risk, peril, accident and hazard (Kaplan, 1981). There should be understanding on both sides of risk equation. Accordingly, risks should be understood, on the one hand, as both the possibility of losing or the potential failure. On the other hand, risks can be observed as the opportunities to gain profits or future desirable outcomes. As the consequence, risk management should be considered as common way of life (Williams, 1999)

Risk as the answer to the following three questions; The answer to the first question defines an uncertain event, represented by S_i , the answer to the second question is the probability of that event actualizing, symbolized by P_i , the answer to the third question is the consequence of the event actualizing, represented by X_i , formally we can, therefore say that the risk, represent by R , is the following set of triplets:

1. “What can go wrong?”

2. “How likely is it to go wrong?”

3. “If it does go wrong, what are the consequences?” (Kaplan, 1981)

$$R = \{S_i, P_i, X_i\}, \text{ where } i = 1, 2, 3 \dots N$$

Table 2.1 Definition of risk from different Author

	Author	Risk definition
1	Christopher and Lee (2004)	“Effect of external events such as wars, strikes or terrorist attacks and impact of changes in business strategy”.
2	Kleindorfer and Saad (2005)	“Relate risk to i) operational contingencies; ii) natural hazards, earthquakes, hurricanes and storms; and iii) terrorism and political instability.”
3	Spekman and Davis (2004)	Either be objective or subjective, “combination of probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequences of the occurrence”
4	(Harland et al., 2003; Tang, 2006a; Zsidisin, 2003)	“Supply risk usually refers to the occurrence of uncertainties that may halt the inward flow of the supply chain”
5	Johnson (2001)	Defines risk in terms of operational deviations, such as “unpredictable demand, short product.”
6	Khan and Burnes (2007).	“Risk is measurable and manageable event which can affect supply chain. On the other hand, uncertainty may not be measurable.”
7	(OED, 1997).	“(Exposure to) the possibility of loss, injury, or other adverse or unwelcome circumstance; a chance. or situation involving such a possibility”
8	(PMBOK, 2013)	The Project Management Institution has also issued its definition of risk being the following: “Risk is an uncertain event or condition that, if it occurs, has an effect on at least one [Project] objective”
9	(ISO31000, 2009)	“...effect of uncertainty on objectives. ...An effect is a

		deviation from the expected – Positive and/or negative”
10	(Guan and Dong, 2011)	“Risk can be defined as any source of randomness that may have an adverse impact on the market value of a corporation’s assets, net of liabilities, on its earnings, and/or on its raw cash flows”.

Risk is therefore usually seen as a theoretical concept, but even though the concept of risk differs according to perspective, approaches and experience of each sector, the most suitable definition of risk for this research is; event which can hinder or affect the entire supply chain.

2.3.2 Supply chain risk

The SCRLC (2011), defines “supply-chain risk” as the likelihood and consequence of events at any point in the end-to-end supply chain, from sources of raw materials to end use of customers, and “supply-chain risk management” as the coordination of activities to direct and control an enterprise’s end-to-end supply chain with respect to supply-chain risks.

2.3.3 Classification of supply chain risk

The simplest classification would be to divided the risk sources between external and internal. The external risks then are those that rise from outer factors that can be difficult or impossible to manage such as new rules, natural disasters or terrorism. The internal risks then on the other hand originate within the chain itself, either in specific connection points or in the links between them, risks that should be somewhat or fully manageable, such as mechanical breakdowns or incorrect loading of containers. Another classification of supply chain risk sources is “Environmental risk sources, network-related risk sources and organizational risk sources” (Juttner, 2003).

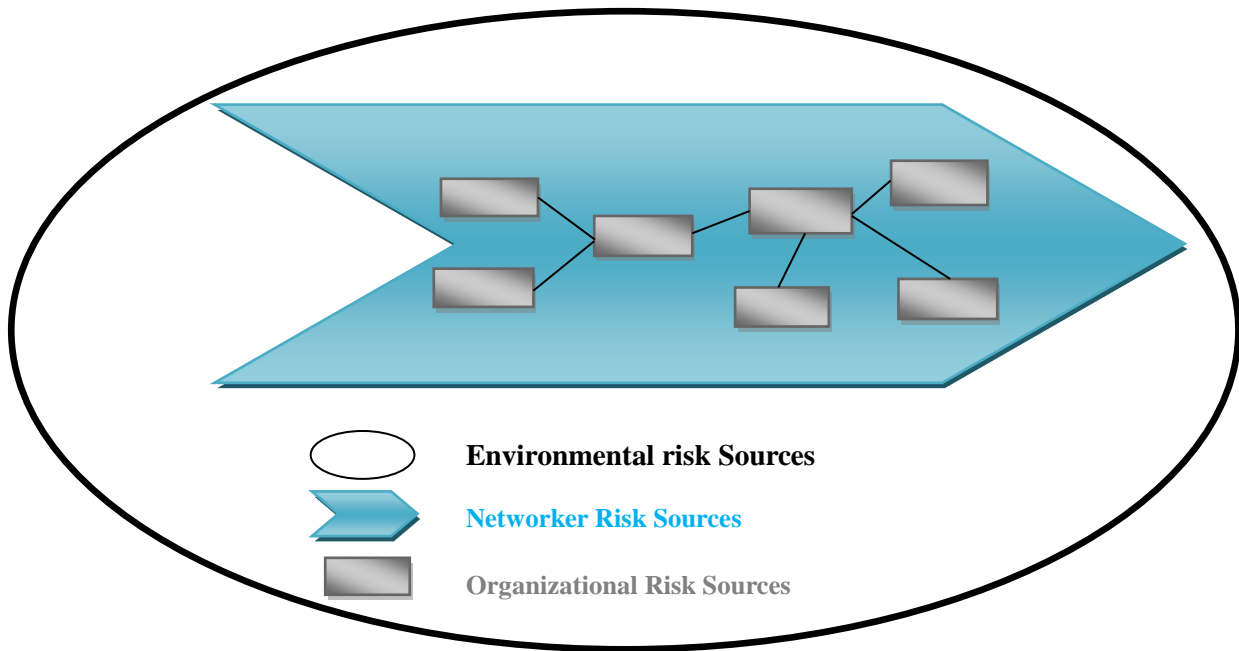


Figure: 2.2 Three categories of risk sources in supply chains

Source: (juttner, 2003)

“Environmental risk sources comprise any uncertainties arising from the supply chain environment interaction. 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). Organizational risk sources lay within the boundaries of the supply chain parties and range from labor (e.g. strikes) or production uncertainties (e.g. machine failure) to IT system uncertainties.

Network-related risk sources as the third category arises from interactions between organizations within the supply chain.” (juttner, 2003).

- Internal to the firm
 - ✓ Process
 - ✓ Control
- External to the firm but internal to the supply chain network
 - ✓ Demand
 - ✓ Supply
- External to the network

✓ Environmental (Christopher M. &, 2004)

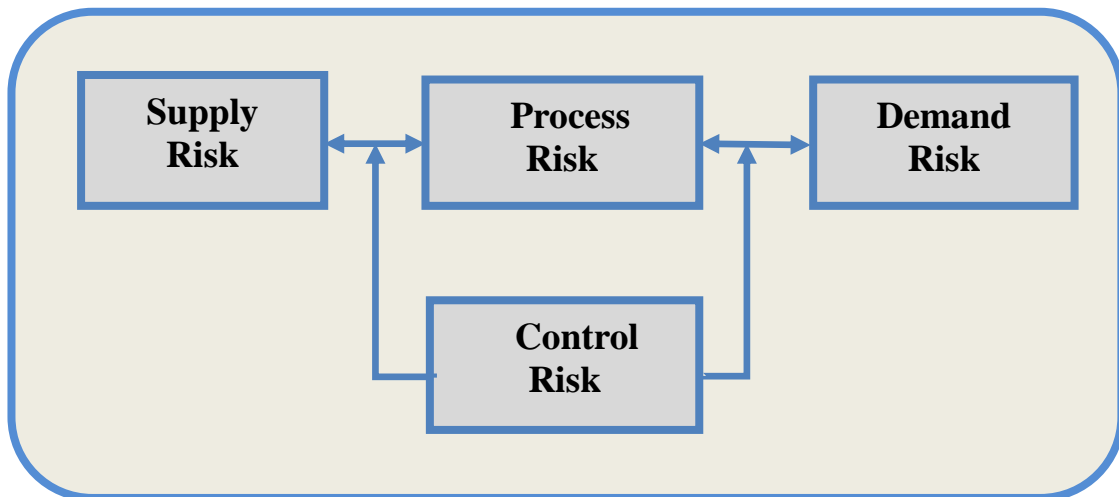


Figure :2.3 five categories of risk sources in supply chain

Source (Christopher M. &, 2004)

Supply chain risk sources are any variables which cannot be expected with certainty and from which disruptions can arise. From an inter-organizational supply chain understanding, Mason-Jones and (Towill 1998) proposed five overlapping categories of supply chain risk sources: environmental risk sources, demand and supply risk sources, process risk sources and control risk sources.

2.4 Supply Chain Risk Assessment

2.4.1 International Standard

There are numerous standards on supply chain processes as well as risk management in general. Perhaps most identifiable of all are the standards issued by the International Organization for Standardization referred to as ISO. First to mention is the ISO31000:2009 standard on Risk Management - Principles and Guidelines. It is a broad guideline on all risk management, from risk identification to risk analysis and risk evaluation. As well as risk treatment, risk monitoring and communication.

“This International Standard provides principles and generic guidelines on risk management. This International Standard can be used by any public, private or community enterprise, association, group or individual. Therefore, this International Standard is not specific to any industry or sector” (ISO31000, 2009)

In addition to be applicable to any type of industry it provides a common approach in risk

management that can be used to deal with any types of risks, having negative or positive effects. The second ISO standard to be mentioned is the ISO/EIC 31010:2009 that addresses specifically risk assessment. It is a supporting standard for ISO 31000 and it provides a range of techniques that can be applied in risk assessment as well as guidelines on selection and application.

*“Risk assessment attempts to answer the following fundamental questions:
 what can happen and why (by risk identification)?
 what are the consequences?
 what is the probability of their future occurrence?
 are there any factors that mitigate the consequence of the risk or that
 reduce the probability of the risk?” (ISO/IEC31010, 2009)*

The standard divide risk assessment into three parts in sequence.

1. **“Risk Identifications** is the process of finding, recognizing and recording risk
2. **Risk analysis** is about developing and understanding of the risk
3. **Risk evaluation** uses the understanding of risk obtained during risk analysis to make decisions about future actions” (ISO/IEC31010, 2009)

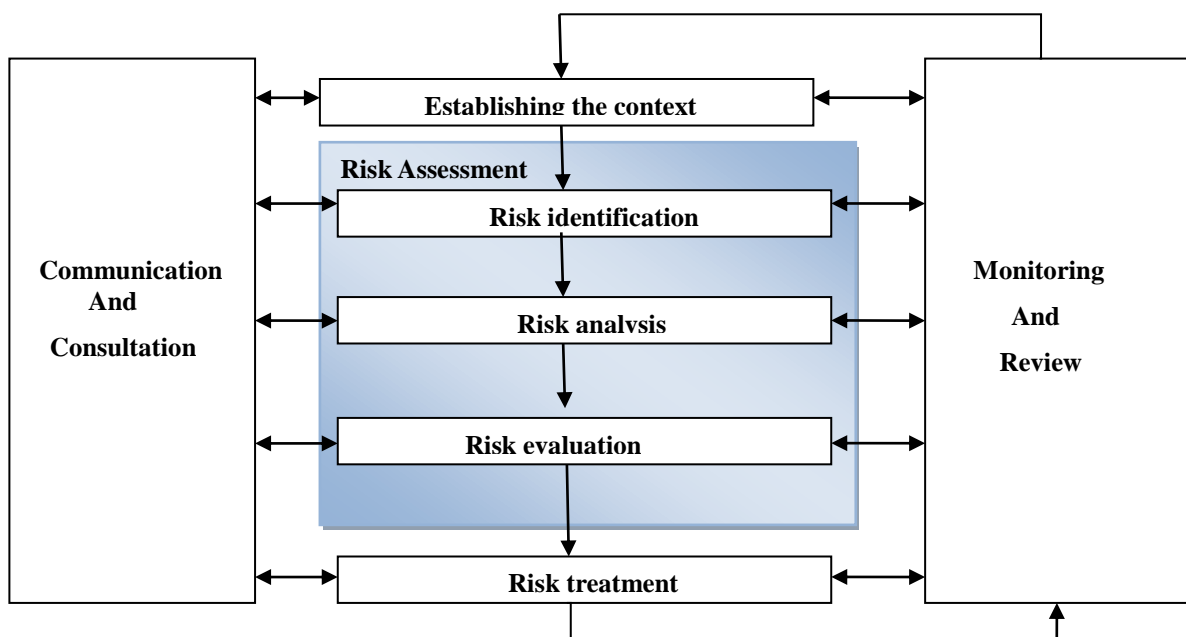


Figure :2.4 Contribution of Risk Assessment to The Risk Management Process

SOURCE: (ISO/IEC31010, 2009)

The process starts with identifying internal and external environments. Enterprises may carelessly overlook internal risks. These may include those posed by a rogue employee, as well as those posed by insufficient policies, strategies, or organizational structures. The

external environment in which an enterprise, and its suppliers, must work will also pose different risks. For example, some suppliers will face weather risks, while others, because of their distance, may have greater transportation risks. Mapping its supply chain can benefit an enterprise identify the risks it faces and how best to prioritize and address them. To prioritize and address risks, firms will need to identify conditions for determining what may pose a risk to its operations. One possible starting point is the supply chains for the products most affecting firm profitability.

Once a firm realizes how to identify risks, it may undertake risk identification and assessment, which contains risk identification, risk analysis, and risk evaluation. Risk identification may require using a list of common risks including external risks such as natural disasters, accidents, disruption, or labor uncertainty; supplier risks such as production problems, financial issues, or subcontractor problems; distribution risks such as cargo damage, warehouse insufficiencies, or supply pipeline constrictions; and internal risks such as personnel absence or facility unavailability.

2.4.2 Risk assessment process

Risk assessment process as “a set of logical, systemic and well-defined activities that provide the decision make with a sound identification, measurement, quantification and evaluation of the risk associated with certain natural phenomena or man activities” (SCRLC, 2011).

The risk-assessment process should differentiate between risks that should be included in the risk-management process and those that should not. Normal differences in product demand and quality, and those that are maintained within acceptable limits, do not signify risks that should be included in the risk-management process. Characteristics that can cause irregular variations, that is, those which the supply chain cannot flex and respond to, should be included (SCRLC, 2011).

2.4.2.1 Risk Identification

Risk identification defined as “identifying the sources and nature of risk and the uncertainty associated with the activities or phenomena under consideration is often considered to be the first and major step in the risk assessment process” (SCRLC, 2011)

Developing an initial risk register, which is a one-time work, is necessary to identify baseline risks. Too many organizations start a risk management program without knowing what threats

the organization faces, or what consequence a disruption would have. As a result, they focus too much defending against the wrong threats or too little protecting against threats that matter. Worse, they may fail to expect important threats, or fail to recognize the consequence an apparently insignificant threat. Risk identification might start with brainstorming sessions, previous risk assessments, surveys, or other efforts to identify and list potential risks within supply-chain processes. (SCRLC, 2011)

A business-impact analysis can help organization evaluate the threats a firm might face and their consequences. Such analysis might start with a “worst-case” scenario focusing on the business process that are most critical to recover and how they might be recovered slightly. A business-impact analysis should identify critical business functions and allocate a level of importance to each function based on the operational or financial consequence. It should also set recovery-time objectives and the resources required for these. (SCRLC, 2011)

The initial risk record, even if including all identified risks for mapped processes, will likely not cover all risks, or even all major risks to the supply chain. It is a starting point to identify significant supply-chain risks. Once the baseline risks are identified, the organization should occasionally review the status of risks in the risk register, including new risks as they develop and excluding risks that are no longer relevant. (SCRLC, 2011)

Table 2.2 Risk factors

Author	Title	Risks
A. Ghadge, S. Dani, M. Chester and R. Kalawsky (2013)	A systems approach for modeling supply chain risks	<ul style="list-style-type: none"> ▪ Integration risk ▪ IP risk ▪ Supply risk ▪ Geopolitical risk ▪ Safety risk ▪ Financial risk ▪ Technology risk ▪ Skill/performance risk ▪ Poor management risk ▪ Information distortion risk ▪ Demand risk ▪ Quality risk
Rao Tummala, Tobias	Assessing and managing	<ul style="list-style-type: none"> ▪ Transportation Paperwork and

Schoenherr, 2011	risks using the Supply Chain Risk Management Process (SCRMP)	<ul style="list-style-type: none"> scheduling risks ▪ System risks ▪ Physical plant Lack of capacity Flexibility (capacity) risks ▪ Inventory risks ▪ Disruption risks ▪ Delay risks ▪ Demand risks
Ou Tang and Nurmaya Mus, 2011	Identifying risk issues and research advancements in supply chain risk management	<ul style="list-style-type: none"> ▪ Information related risk ▪ Financial related risk ▪ Material flow risk
Ila Manuj John T. Mentzer, 2008	Global supply chain risk management	<ul style="list-style-type: none"> ▪ Supply risk ▪ Operational Risk ▪ Demand Risk ▪ Security Risk ▪ Macro Risk ▪ Policy Risk ▪ Competitive risk ▪ Resource Risk
SCRLC supply chain risk leadership council 2011	Supply chain Risk management: A compilation of best practice	<ul style="list-style-type: none"> ▪ External End –to-End Risk ▪ Suppliers Risk ▪ Distribution Risk ▪ Internal Enterprise Risks
Ann Vereecke, Vlerick Leuven etal, 2010	Supply Chain Risk Management a unique function, or simply one of the Supply Chain Manager’s tasks	<ul style="list-style-type: none"> ▪ Supply Risk ▪ Demand Risk ▪ Process Risk ▪ Control Risk ▪ Environmental Risk
Thinh Hoang Si, Huong Nguyen Thi, 2015	Risk analysis: case study for coffee growers in the central high land area	<ul style="list-style-type: none"> ▪ Financial Risk ▪ Personal Risk ▪ Institutional Risk

	(Tay Nguyen), Vietnam	<ul style="list-style-type: none"> ▪ Marketing Risk ▪ Production Risk ▪ Farm Risk
Parizat Jan van Hilten, Christopher Wunderlich, and Robert Nsibirwa. 2011	Ugandan coffee supply chain risk assessment	<p>Production risk</p> <ul style="list-style-type: none"> ▪ Pest and disease (coffee wilt, coffee borer leaf rust, others) <p>Market risk</p> <ul style="list-style-type: none"> ▪ Price ▪ Foreign exchange risk <p>Enabling Environmental risk</p> <ul style="list-style-type: none"> ▪ Loss of global market ▪ Transport related risk ▪ Theft, fraud, and adulteration

2.4.2.2 Risk Analysis

The risk analysis process should estimate the likelihood and consequence of risks facing a firm and accordingly prioritize them for ultimate treatment. To begin, firms may choose to rank risk events based on a qualitative overall risk level. Such a simplistic approach should only be used for the initial risk register but provides an easy way to quickly prioritize perceived risks and select those that should receive priority attention. (SCRLC, 2011)

Once an enterprise has identified its top risks, it may use more sophisticated methods, such as the bow-tie method, to fully understand the nature of the risk and to rate the likelihood and consequence of inherent risk (i.e., risk in the absence of any treatment) and residual risk (i.e., level of risk remaining after treatment). The bow-tie risk analysis method is a form of cause and consequence analysis the two dimensions of risk events and it clearly ties treatment actions against each dimension of a risk event.

2.4.2.3 Risk Evaluation

Enterprises may use their ratings of the likelihood and consequence of risks before and after treatment to evaluate residual risk levels against acceptable risk levels, that is, their risk tolerance. If the likelihood and consequence of residual risks is found to be greater than their risk tolerance, then enterprises need to devise further risk treatments to reduce the level of residual risk (SCRLC, 2011).

Acceptable risk levels will be unique to each organization and supply chain. They may vary by commodity, product, or service, as well as over time. Different risk-tolerance levels may be set for different levels of the organization. While generally tied to financial impact, through which risks may best be understood and compared, risks may also be tied to other corporate assets such as reputation. One leading firm even considers the consequence of potential risks by impact to stock price. One way an organization may wish to assess its risk tolerance is through a risk “frontier” graph, plotting the likelihood of events by their consequence. (SCRLC, 2011).

Almost Certain	Medium	High	High	High	High
Likely	Low	Medium	High	High	High
Possible	Low	Medium	Medium	High	High
Unlikely	Low	Low	Medium	Medium	High
Rare	Low	Low	Low	Low	Medium
	Negligible	Minor	Moderate	Significant	Severe

Figure 2.5 Risk “Heat” Map (Source: SCRLC,2011)

2.4.3 Mitigating Risks for the Supply Chain

Risk mitigating strategies on the other hand are those strategic moves organizations deliberately undertake to mitigate the uncertainties identified from the various risk sources (Miller, 1992). The four, interrelated basic constructs of supply chain risk management are summarized in the following figure.

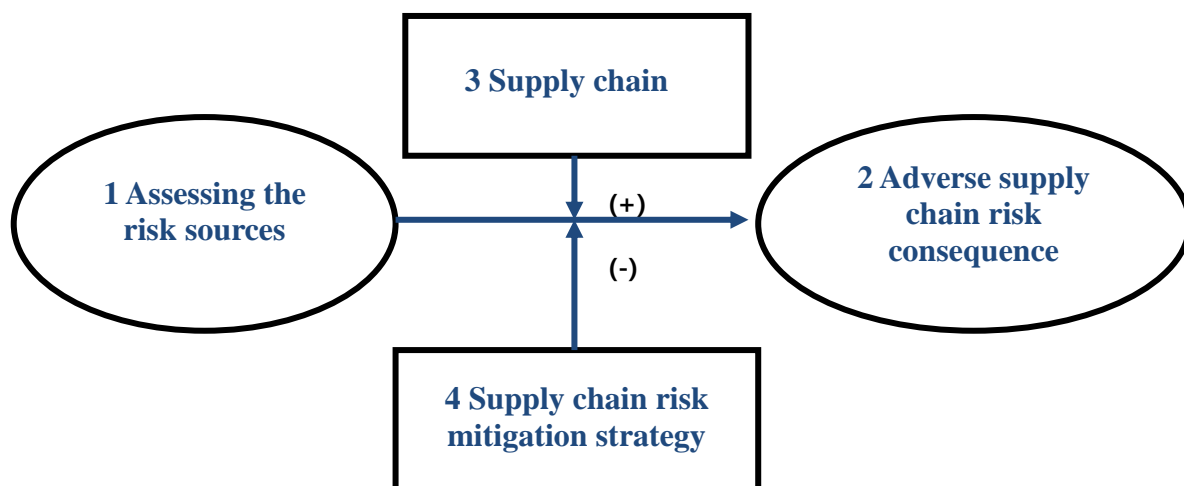


Figure 2.6 risk management process *Source: (Juttner, 2003)*

Supply chain risk management aims to identify the potential sources of risk and implement appropriate actions to avoid or contain supply chain vulnerability. Consequently, it can be defined as: “the identification and management of risks for the supply chain, through a coordinated approach amongst supply chain members, to reduce supply chain vulnerability as a whole.”

The four basic constructs of the supply chain risk management concept enable us to identify the related critical aspects of the managerial concept: (1) Assessing the risk sources for the supply chain; (2) identifying the risk concept of the supply chain by defining the most relevant risk consequences (3) tracking the risk drivers in the supply chain strategy and (4) mitigating risks in the supply chain, Whereas these critical aspects could be taken as sequential steps in a managerial process.

From a single organization view, Miller (1992) distinguishes five generic strategies companies undertake in order to mitigate risk, four of which can be adapted to supply chain contexts: (1) avoidance, (2) control, (3) cooperation and (4) flexibility.

Avoidance occurs when risks associated with operating in a given product market or geographical area are considered to be unacceptable (Miller, 1992). From a supply chain perspective, avoidance can be related to products/geographical markets and/or supplier and customer organizations. A company could drop specific products, suppliers or geographical markets if supply is seen to be unreliable.

Companies may seek to control contingencies from the various risk sources, rather than passively treat uncertainties as constraints within which they must operate (Miller, 1992). Not surprisingly, control strategies were most widespread. Examples in supply chains include vertical integration, increased stockpiling and the use of buffer inventory or maintaining excess capacity in production, storage, handling and/or transport or finally, imposing contractual requirements on suppliers.

Compared with control initiatives, cooperative responses involve joint agreements, rather than unilateral control, as a means of achieving uncertainty reduction (Miller, 1992). From a supply chain perspective, the focus is on joint agreements among organizations in the supply

chain to improve supply chain visibility and understanding, to share information on exposures to specific risk sources and finally, to prepare joint business continuity plans.

Unlike the strategic moves of control, which attempt to increase the predictability of contingencies from the various risk sources, flexibility increases responsiveness while leaving the predictability of factors unchanged (Miller, 1992). One supply chain example is postponement, where companies delay the decision to make, configure, label or ship a product to a particular destination. Postponement reduces their dependence on forecasts and increases the ability to respond to variability or even disruptions in demand. A second supply chain example is multiple and Localized sourcing, which one manager classified as the traditional form of managing risk through spreading risk.

2.5 Agro-Food Supply chain

Food supply chain defined as “Responsibility for the supply of safe, healthy and nutritious food is shared by all involved, from primary production to final preparation and consumption”. Supply chain for agro-food has different characteristics with other supply chain (Burlingame, 2007)

Growth in agricultural production is necessary not only to increase food availability and raise the income and nutrient levels of the population, but also to the development process. According to Colman and Young (2014), it is widely accepted that a prerequisite for rapid economic growth is the channeling of agricultural surplus (production in excess of own consumption) to the non-farm sector. They observe that in terms of production processes, the successful CM in agriculture should focus on: -

- i. The activities and services that influence the supply of agricultural output;
- ii. The factors which govern usage of productive inputs (like labor, fertilizer, and machinery);
- iii. The efficiency of resource use; and
- iv. The impact of technological change.

SCM best practices in marketing shows various indicators such as demand forecasting, product availability, inventory management and distribution (G. Kumar and T. Nambirajan, 2006). This leads to the jurisdiction of the supply chain, which in turn is a prerequisite for organizations to react to market uncertainties, finance and maintain its performance.

Food industries are transforming towards interconnected global network. Food supply chain has unique characteristics compared to other types of supply chain. First, food supply chain tends to be relatively longer and influenced by complex factors. Second, the time of production, storage and transportation need strict supervision. Third, the food supply chain has relatively strong commonality and sociality (Guan, 2011).

Logistics and supply chain play crucial roles in the food industry, which involves multi-disciplinary and multiple viewpoints (Melyukhina, 2011). Framework for assessment food supply chain (FSC) and logistics developed by integrating four main elements: quality, safety, sustainability and logistic efficiency. The other thing that must be considered in the agro-food supply chain is a problem in transportation (Burlingame, 2007). Food supply chain and risk is defined as the possibility of breakdown, operational difficulties, credit loss and economic loss due to various uncertain factors during the operation process of each and every nodal enterprise along food supply chain (Melyukhina, 2011).

2.5.1 Argo business Risk

The terminology of agribusiness risk can be created from the combination of the definition of risk as given above and the perception of agribusiness that is “the sum total of all operations involved in the production and distribution of food and fiber” (Cook, 2000). Therefore, agribusiness risk can be inferred to risks occurring in all agribusiness activities within a particular agricultural industry or supply chain such as coffee or rice industry or supply chain. This perception makes it reasonably thoughtful to argue that agribusiness risks are the best classified as accordance with the position of actors in agricultural supply chain, meaning that a particular actor in a certain supply chain will likely incur some particular types of risks.

2.6 Supply chain risk assessment methods and tools

There are basically two kinds of approaches to supply chain risk identification. The first one relies on brainstorming. This technique makes use of in-depth interviews with experts in order to define possible risks as well as to investigate the relationships between their causes and effects (Hallikas et al. 2002; Sinha et al. 2004).

The second approach to supply chain risk identification is based on the development of taxonomies of risks and associated sources and manifestations. Many reported applications of this technique classify supply chain risks according to the material, information, and economic flows. Delays or poor quality of suppliers, production disruptions, inadequate

inventory levels, and lack of capacity are some of the most frequently identified risks related to the flow of materials.

As far as supply chain risk analysis is concerned, it is usually performed by means of a number of qualitative, semi-quantitative, and quantitative methods. Qualitative methods define levels of judgment for the probability of occurrence and the severity of impact of risky events based on different scales. Probability may be evaluated through scales made up of several levels, such as ‘rare’, ‘unlikely’, ‘likely’, and ‘almost certain’. In a similar way, the scale for the severity of impact may include either two levels, e.g. ‘severe’ and ‘light’, or three or more levels, such as ‘high’, ‘medium’, and ‘low’ or ‘negligible’, ‘minor’, ‘major’, and ‘severe’ (Sinha et al. 2004; Sheffi 2005). The levels of probability and impact can be combined together to estimate the degree of risk that is again measured by a qualitative scale, such as ‘low’, ‘medium’, ‘high’, and ‘very high’ (Norrman and Jansson 2004).

In a semi-quantitative evaluation, the levels of judgment are replaced with numerical values. A scale ranging from 1 to 4 for the probability of occurrence may represent very unlikely, improbable, probable, and very probable events respectively and values from 1 to 4 for the severity of impact may indicate insignificant, minor, serious, and catastrophic influences of risky events respectively (Hallikas et al. 2002). Additionally, some authors determine the importance of risk factors by calculating a relative weight for each of them with approaches such as the Analytic Hierarchy Process (Wu et al. 2006). FMEA (Failure Mode and Effect Analysis) to be used as a standalone tool for analyzing risks in a supply chain as it can identify, estimate and evaluate risk events. However, FTA and Analytic Hierarchy Process can complement each other, and a hybrid application of these two tools offers a less complicated process for analyzing supply chain risk.

Table 2.3 Risk management methodologies terms and criteria

Term	Description of criteria		
T_v -threat value	(1-low; 2-medium and 3-high)		
V_v -vulnerability value			
$P=T_v * V_v$ – probability P_1 – level of risk			
I_{vx} - impact value (x= confidentiality, integrity or availability)	(1- very low; 2- low; 3- medium; 4- high; 5- very high)		
$R_x= I_{vx} * P_1$ - Risk (x= confidentiality, integrity or availability)	risk level	Action	treatment risk

$1 \leq R_x \leq 2$	very low	not require any action ⁵	risk retention
$3 \leq R_x \leq 4$	low	required monitoring of risk	risk retention
$5 \leq R_x \leq 10$	medium	need some action and monitoring risk	risk retention
$11 \leq R_x \leq 20$	high	necessary actions	risk reduction
$21 \leq R_x \leq 25$	very high	necessary actions	reduction

(Source: International Organization for Standardization, ISO 31000 – Risk management – Principles and guidelines (2009))

When a significant amount of past data is available, quantitative risk analysis may be performed by applying simulation methods, such as Montecarlo technique, Petri Nets, and Fault and Event Trees, to calculate the probability of occurrence and the impact of risky events (Kleindorfer and Saad 2005; Wu and Olson 2008; Tuncel and Alpan 2010).

Author	Title	Method	Result
Christian Hollstein, Frank Himpel	supply chain risk management	Theoretical-conceptual framework with empirical-inductive findings	Flexibility and capacity, as well as redundancy and standardization factors may yield a common benefit if proper logistics systems are applied.
Mauricio F. Blos, Mohammed Quaddus and H.M. Wee, Kenji Watanabe	Supply chain risk management (SCRM): a case study on the automotive and electronic industries in Brazil	Explorative investigation based on a supply chain vulnerability map (SCVM)	Better supply chain communication, SCRM and business continuity management (BCM) training program and the creation of a chief risk officer (CRO), are significant factors that reduce disruptions of supply chain risk.
Thomas Yew Sing Lee	Supply Chain Risk Management	Mathematical model (Mean-variance approach to determine the optimal set of	Numerical results should give us some insights regarding the impact of risk and uncertainty on selecting the optimal set of suppliers or the optimal number of suppliers to kept

		suppliers in the presence of supplier failure risks.)	as part of the supply chain partnership
Thinh Hoang Si, Huong Nguyen Thi, 2015	Risk Analysis: Case Study for Coffee Growers in The Central High Land Area (Tay Nguyen), Vietnam	Value chain approach and the combination of quantitative and qualitative methods.	The results show that the farmers are facing a variety of risks among which drought, yield and price risks are the most important. The analysis of yield risk and price can provide farmers, the government and other actors in coffee industry of Vietnam with clear understandings about the risks in terms of the chance of occurrence and level of severity.
Pórhallur Jóhannsson, 2015	Supply Chain Risk Assessment Focusing on maritime transport to and from Iceland	FMEA (Failure Mode and Effect Analysis) FTA (Fault Tree Analysis)	The techniques provide in combination nine risk factors that are classified as key risk factors in addition to various other risk factors classified as less urgent.
Anna Corinna Cagliano* Alberto De Marco Sabrina Grimaldi Carlo Rafele, 2012	An integrated approach to supply chain risk analysis	SCOR-Model, Risk Breakdown Structure and the Risk Breakdown Matrix, performance indicators	an extensive validation of the approach by applying it to multiple supply chain settings is required in order to uncover its potential weaknesses and foster refinements.

2.7 Summary and Literature Gap

Risk is commonly seen as a theoretical concept, but even though the concept of risk varies according to perspective, approaches and experience of each sector, the most suitable definition of risk for this research is an event which can hinder or affect the entire supply chain.

Regarding to risk identification which is the first step of risk assessment process, different authors put different risks factors on different occasions. For our research, the risk identified in the literature will be categories in methodology section which later be used for questioner and interview data collection methods.

From the above literature reviews risk identification process can be done through two methods the first one is brainstorming and the other is risk classification. The later can be used for our research, and risk assessment process can be conducted using three major categories and this are qualitative method, semi quantitative and quantitative method. According to (Kleindorfer and Saad 2005; Wu and Olson 2008; Tuncel and Alpan 2010), When a significant amount of past data is available, quantitative risk analysis may be performed by applying simulation methods, which require investing in information systems and human resources to gather a huge amount of additional past data which usually are not available. Therefore, for this research qualitative and semi quantitative methods will be used.

The literature reviewed shows that little have been explored regarding the supply chain risk assessment in agricultural industries in Ethiopia. Although supply chain risk assessment has been negligibly touched in the agriculture, a gap of information is clearly seen on coffee supply chain and more precisely, in coffee supply chain risk assessment.

The literature reviewed shows that little have been explored regarding the supply chain risk assessment in agricultural industries in Ethiopia. Although supply chain risk assessment has been negligibly touched in the agriculture, Limited risk factor identified in the coffee supply chain and these risk factors are not specific., a gap of information is clearly seen on coffee supply chain and more precisely, in coffee supply chain risk assessment Most of the research focuses in risks related to farmers and lack in providing mitigation strategies and framework.

This study tries to uncover the existing risks facing the Ethiopian coffee supply chain actors today, that includes identifying, assessing and finally prioritizing the risks which helps the supply chain actors to manage and also to quickly recover to stable conditions once a disruption takes place.

CHAPTER THREE

PRELIMINARY REVIEW

3.1 Introduction

Coffee is one of the most important traded commodities in the world. The sector's trade structure and performance have large development and poverty consequences, given the high concentration of production by small-holders in poor developing countries.

Ethiopia exported 3.2 million bags in 2012, making it the most African coffee exporter and the tenth largest exporter in the world (ICO, 2013). Its share of the international coffee trade in 2013 was about 3 percent. Coffee is the most important export product of the country, accounting for about a quarter of the value of all exports in 2012. Coffee is cultivated by over 4 million primarily smallholder farming households and, with those working in ancillary activities to coffee production, even more households are dependent on coffee for part of their livelihoods. Furthermore, coffee plays an important part in social gatherings and is important in local consumption, as more than half of Ethiopia's coffee production is consumed locally (CSA, 2013).

3.2 Coffee in Ethiopia

Ethiopia is endowed with a good production environment for growing coffee with combination of suitable altitude, temperature, rainfall, soil type, and pH. Ethiopia is the center of origin for Coffee Arabica. The country owns a diverse genetic base for this Arabica coffee with considerable heterogeneity. Ethiopia produces a range of distinctive Arabica coffees and has considerable potential to sell a large number of specialty coffees (Nure, 2008).

Little of the lower-value Robusta coffee is produced in Ethiopia, being better suited for production in lower altitude equatorial climates. Coffee production in Ethiopia is almost exclusively situated in the two regions of Oromia and the Southern Nations, Nationalities, and People Regions (SNNPR) in the south and west of the country.

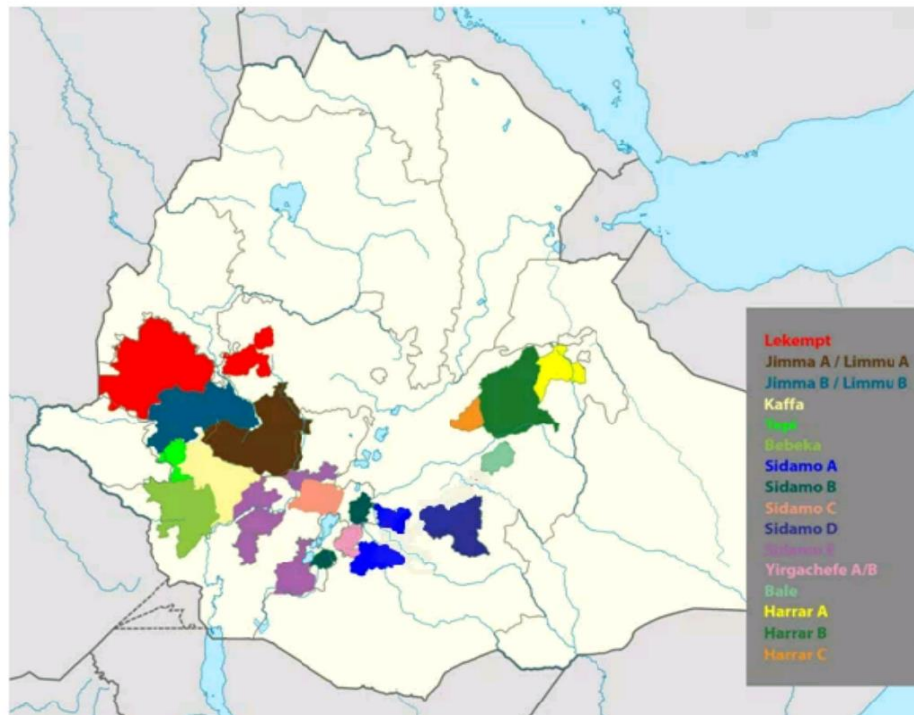


Figure 3.1 Coffee production area in Ethiopia

(Source: <http://www.tradeaid.org.nz/news/>, Feb 16, 2018)

Smallholder farmers produce 95 percent of Ethiopia's coffee (Tefera, 2013). It is produced under several types of production schemes, including forest, semi-forest, garden, and plantation coffee. Forest coffee is grown under natural forest cover and is gathered by farmers from trees with minor tree care. Semi-forest coffee is also grown in forest environments, but there is some limited maintenance by farmers, mostly annual weeding. This type of coffee has clearly demarcated boundaries of ownership, although the trees usually are located away from agricultural plots. Garden coffee is a coffee from trees planted by farmers in the vicinity of their residences. It is often intercropped with other crops or trees. (Tulu, 2008)

Plantation coffee is grown on large commercial farms, private as well as state farms. Modern production process such as irrigation, modern input use, mulching, stumping, and pruning are often applied in this case it is estimated that these different production systems make up about 10, 35, 50, and 5 percent, respectively, of total coffee production in the country (Kufa, 2012).

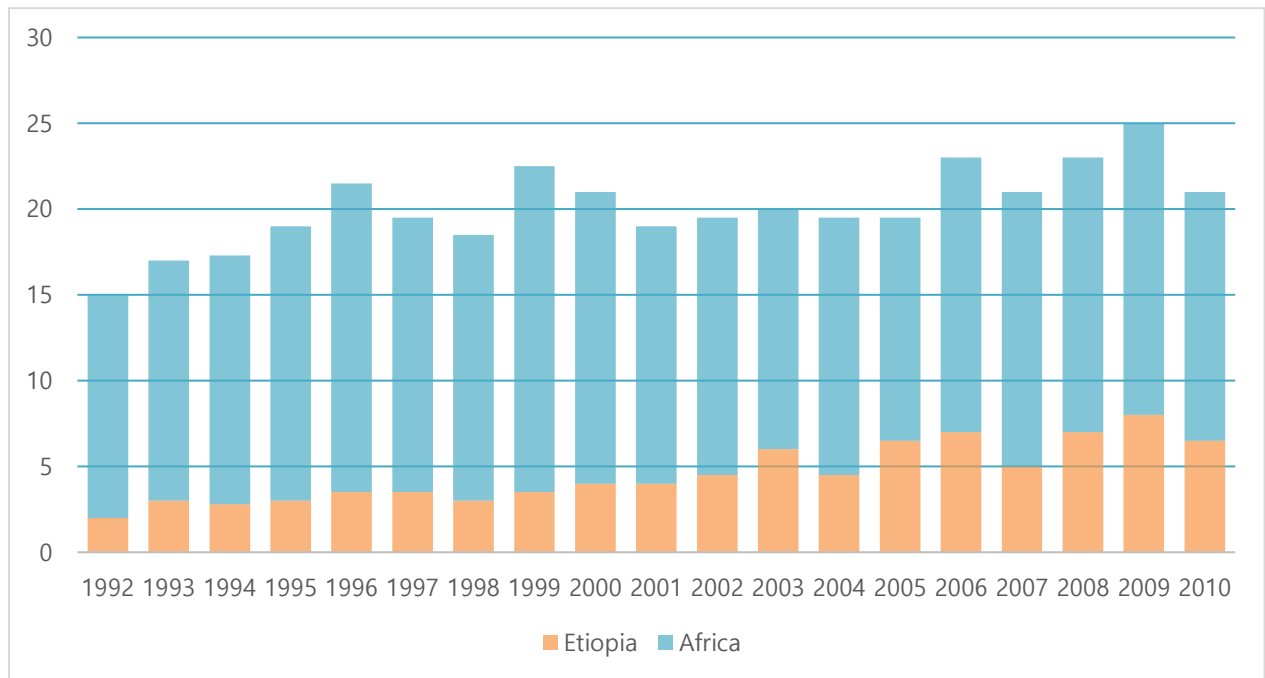


Figure:3.2 Africa and Ethiopia coffee production between 1992-2010 in million bags

Source (international coffee organization)

3.3 Ethiopian Commodity Exchange

Coffee marketing in Ethiopia has undertaken several transformations over the decades. Recent initiatives to rise value and benefit the coffee sector include fair trade certification by cooperatives, organic and specialty coffee promotion, and the trade-marking and licensing initiatives that has successfully recognized international branding of three of Ethiopia 's major coffee types: Sidamo, Yirgachefe, and Harar. In July 2008, a new law (Proclamation 702/2008) and the supporting regulation issued by the Council of Ministers replaced the existing coffee quality control and marketing legislation governing the sector for the past nearly four decades. The law specifies that all supply coffees, with the exception of grower direct exports, are to be traded in the newly established Ethiopia Commodity Exchange (Chemonics International Inc, 2010).

Small farmers sell to local merchants, who in turn sell to distributors and collectors who export through the ECX. Cooperative farms sell directly to the ECX and capture limits that would otherwise be captured by merchants and collectors. Prior to catalogue on the exchange, coffee producers must submit coffee to the coffee inspection centers for grading and consolidation through mills/warehouses. The government goal is to standardize coffee by region (Harar, Sidamo) and grade (1-9) rather than regionally or locally specialized produce.

Ethiopian Coffee Supply Chain Risk Assessment

This enables buyers to source a standard region at a standard grade, and trade for a set price on the ECX (Chemonics International Inc, 2010)

Ethiopia Commodity Exchange (ECX), a modern trading system based on standard coffee contracts establishes standard parameters for coffee grades, transaction size, payment and delivery, and trading order matching, while, at the same time, conserving the origins and types of coffee as distinct. Unlike the current auction trading system, quality control is undertaken in liquoring and inspection units located in the major coffee producing areas and the coffee is then weighed and inventoried in ECX operated warehouses. Trade is thus on the basis of warehouse receipts issued to the depositor rather than on sample basis. ECX manages a Central Depository of electronic warehouse receipts, removing the risks of paper loss or fraud.

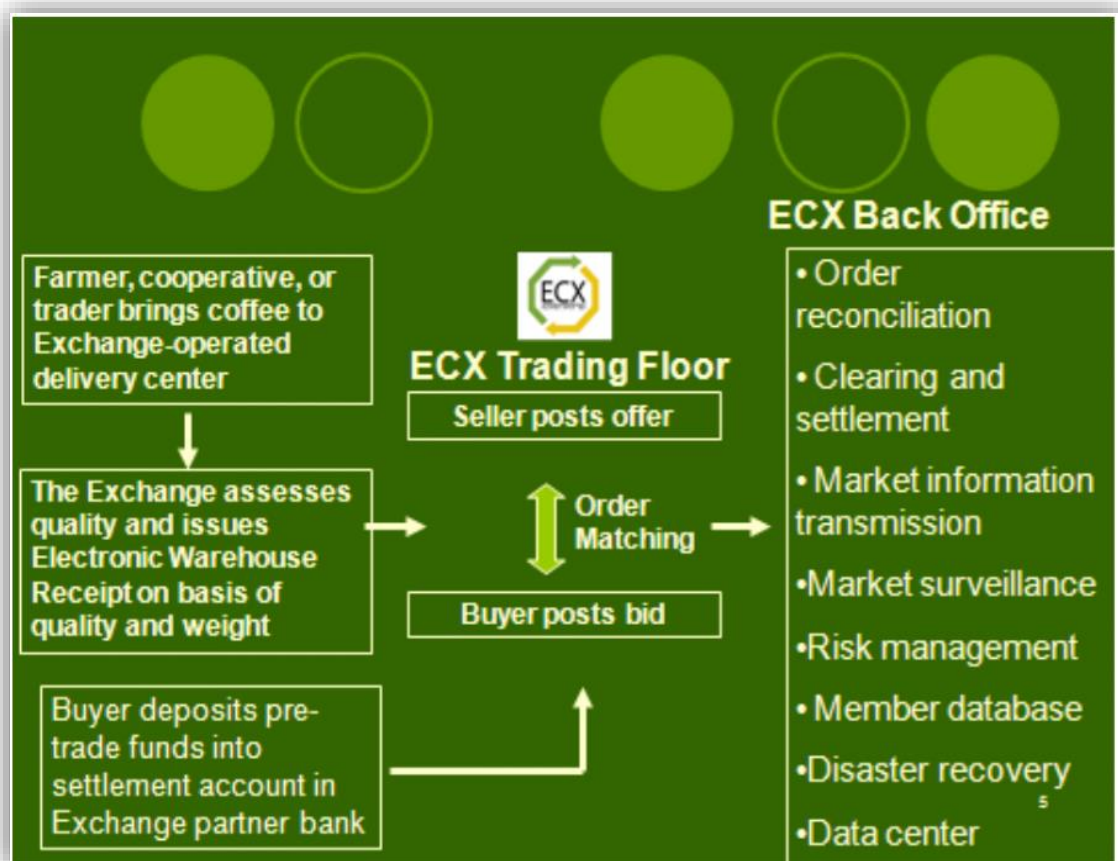


Figure 3.2 ECX operation structure (Source: Chemonics International Inc, 2010)

ECX quality certification is based on a modification of the existing quality grading system, with a new coffee classification based on coffee classes, types, and grades. The two processing classes are washed, unwashed, and types are determined according to regional and

sub-regional origins. The original set of grades was expanded from five grade distinctions to nine. ECX inventory management is based on a non-identity preserved, first-in-first-out system, in which coffee is stocked by classification rather than by identity of the depositor. Moreover, quality and quantity are certified both at initial deposit by the depositor and at delivery (pick-up) by the buyer (Chemonics International Inc,2010)

Trading can only occur on the basis of warehouse receipts and can only be conducted by registered members of the Exchange, trading either for themselves or on behalf of clients. The trading platform is an open outcry competitive bidding system, with a trading floor in Addis Ababa and sequential trading sessions according to different classes and types of coffee.

Trades are entered into a data system and order reconciliation is undertaken automatically to ensure the validity of the trade. Following reconciliation, at the end of each trading session, the ECX Clearing and Settlement system automatically undertakes a netting exercise to determine net obligations of members after multiple buy and sell trades and then proceed to settle all trades through an electronic interface with partner settlement banks in which all Members are required to hold accounts and to make pre-trade deposits. This ensures a zero-default system (Chemonics International Inc,2010).

At settlement, which occurs within less than a day of trade, the warehouse receipt title is transferred to the buyer and the buyer can take the delivery. Prices of traded coffee are transmitted in real time (in less than five seconds) to a number of data outlets: electronic display boards in regional towns and rural centers, instant mobile messaging, websites– and at the end of trading day– to radio, TV, and print media (Chemonics International Inc,2010).

The coffee cooperative unions were established and bound to buy, consolidate and market cooperative supplied coffee internationally. In the supply chain model, they would be the lead firms in the local value chain. As of the end of 2005, cooperatives had formed four coffee unions owned and directed by the member cooperatives. Altogether there were 154 cooperatives in the four unions with nearly 180,000 farmer members. The Oromia Coffee Cooperative was established in June 1999 but the other three, Sidamo, Yirgachefe and Kafa Forest Coffee Unions, were established with direct support by ACDI/VOCA under Agriculture Commodity Exchange for Africa (ACE) (Chemonics International Inc,2010).

3.3.1 Volume and Grades of Exports

ECX has over 450 registered buyers/exporters that are members of the exchange with licenses to bid for and export coffee. Unlike other producing countries in the region, Ethiopia does not allow multinational companies (MNCs) to register as exporters. (Daviron and Ponte, 2005) suggest that as a result of the absence of MNC competition at the auction level, the industry is much more locally controlled than elsewhere in Africa ‘.

There have been substantial domestic policy reforms in the last decade that affected the structure and performance of the coffee export sector. First, from December 2008 onwards it became obligatory for private traders to sell their coffee through the Ethiopian Commodity Exchange (ECX), a new modern commodity exchange.

ECX trades standard coffee contracts, based on a warehouse receipt system, with standard parameters for coffee grades, transaction size, payment, and delivery. The first level quality control is decentralized and commenced in nine liquoring and inspection units in major production areas. The establishment of the ECX has directed to important changes in the structure of the coffee value chain (Gabre-Madhin, 2012).

Second, the government interfered in the coffee market on several occasions in an effort to reduce hoarding by exporters. In April 2009, six large traders were expelled from exporting coffee because of their presumed excessive hoarding. The government revoked their licenses, closed down their warehouses, seized their coffee stocks, and sold them on their behalf (Alemu, 2009). A policy was further executed in May 2011 that limited the amount of coffee an exporter can store. An exporter, for example, selling and buying coffee on the ECX will have his or her right to trade on the commodity exchange cancelled if found to be storing more than 500 metric tons of coffee without a shipment contract with an importer (Tefera and Tefera, 2013). Failing to follow to these regulations has led to the banning of coffee exporters, as seen in 2011 and 2013 (Araya, 2011; Yewondwossen, 2014).

Third, there have been a number of changes concerning export taxes on coffee over time. Fundamental changes include the removal of entry barriers (Proclamation No. 70/1993); the consolidation of all taxes and duties charged on coffee export into a single tax family (Proclamation No. 99/1998), which consolidated all taxes on coffee export to 6.5 percent; and,

following the 2002 international coffee crisis, the waiving of all export taxes on coffee exports.

Finally, an Ethiopian Fine Coffee Trademark Licensing Institute was set up in February 2005 with the purpose of setting up a system to secure legal ownership in international markets of specialty coffee names (especially Sidamo, Harar, and Yirgacheffe) (Agre, 2004). There was initial resistance against this initiative, but they were eventually settled. The goal of this effort was to add brand value to Ethiopian coffee.

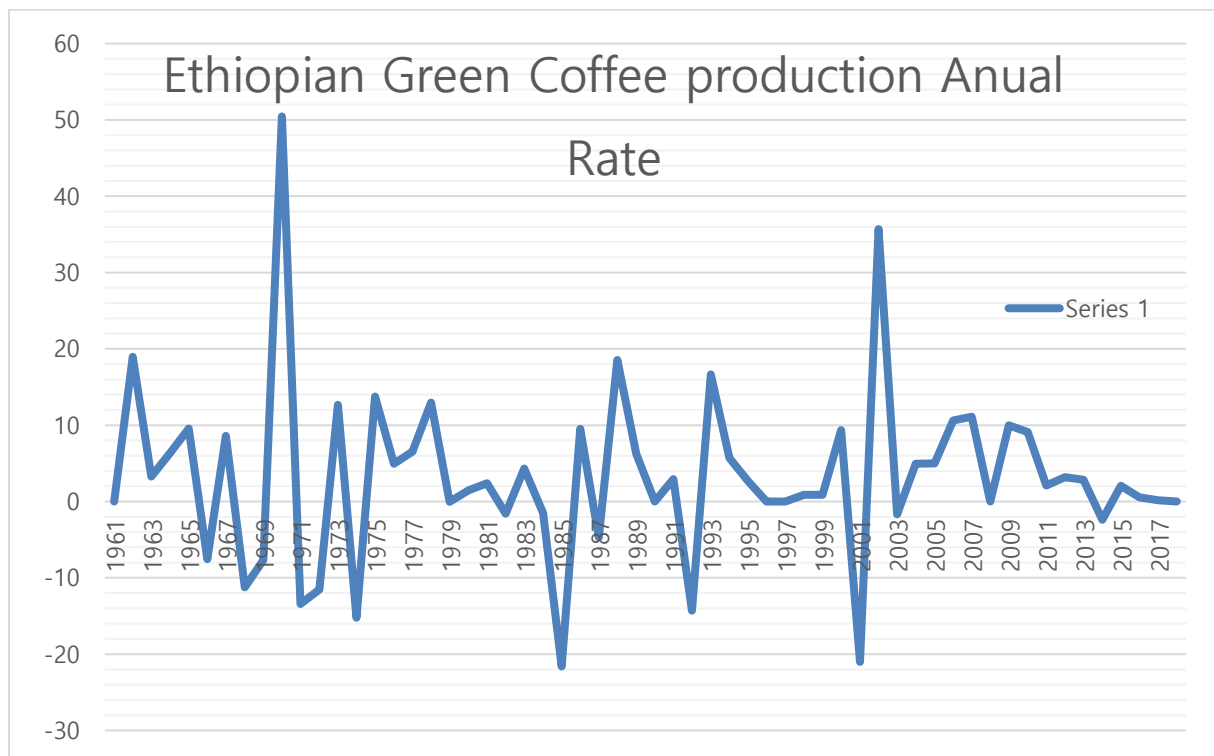


Figure 3.4 Annual production rate of green coffee (1961-2018)

Source (United State Department of Agriculture)

3.4 Coffee quality

There are several measures of coffee quality in the Ethiopian market. They contain, most importantly, certification, which affects marketability and prices, but not necessarily the intrinsic quality of the coffee; geographical indications of origin; grades; and washing.

In the global coffee sector, it is valued that around 16 percent of current coffee production is certified. This share should reach over 25 percent by 2015). There are currently a number of certification systems in place, most importantly Fair Trade, Organic Coffee, Bird Friendly, UTZ, and Global Forest Alliance. In the case of Ethiopia, the share of certified coffee is

increasing, but is significantly lower than in other countries. For instance, data from the Ministry of Trade show that only 2 percent of coffee transactions over the period 2006-2013 were done under the Fair-Trade scheme. This indicates that Ethiopia likely foregoes the commercial rewards of the price premiums associated with these certification schemes.

3.5 Coffee export destination

Ethiopian coffee was exported on average to about 50 countries per annum over the period 2005 to 2012. The share of different destination markets for coffee exported from Ethiopia in 2012. The largest share of coffee exports went to Germany. It accounts for one-third of Ethiopia's coffee exports. The second most important importing country of Ethiopian coffee is Saudi Arabia, accounting for 12 percent of coffee exports.

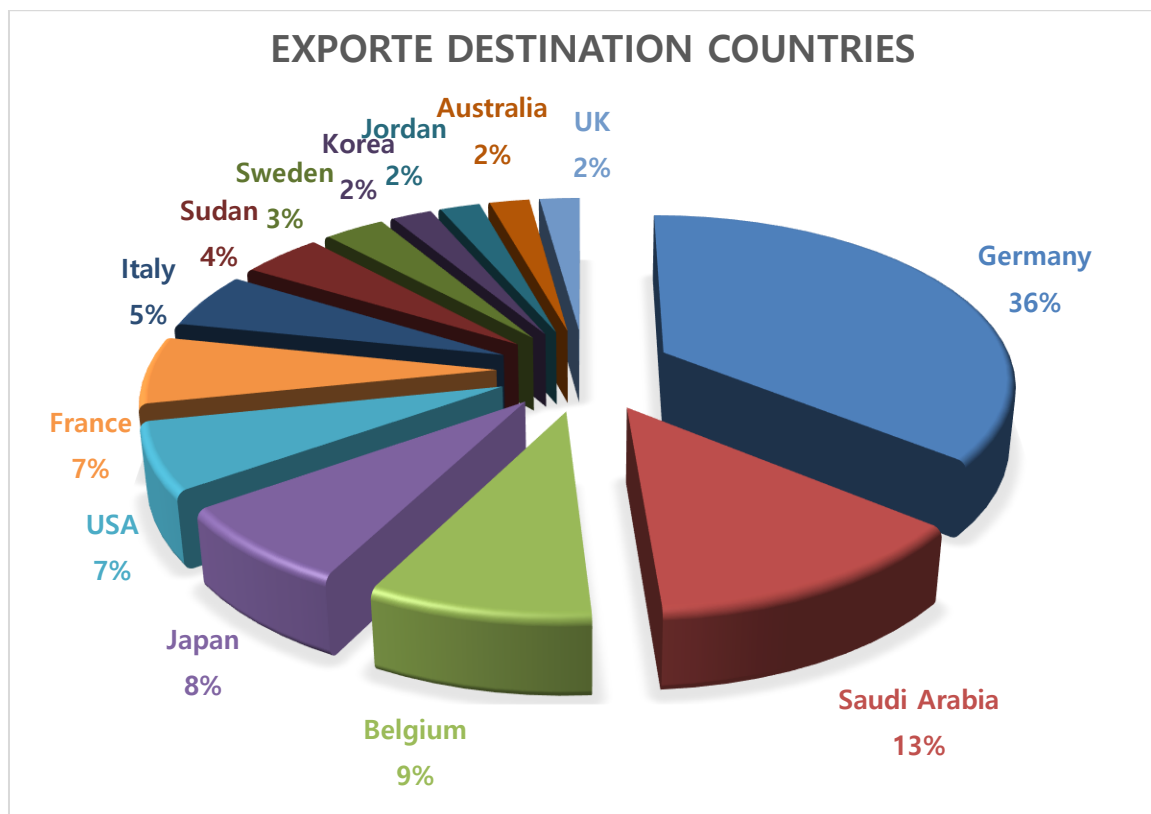


Figure 3.4 Share of different destination markets for Ethiopia's coffee exports in 2012

(Source: Ministry of trade)

3.6 Performance of Ethiopia's coffee export sector

Figure 3.3 compares the export prices, as reported by the Ministry of Trade, and the composite price of Brazilian natural Arabica coffee, as constructed by the International Coffee

Organization (ICO), based on coffee futures contracts in commodity exchanges in London and New York. The graph illustrates the large variations found in coffee prices over time. Coffee prices in 2011 were five times higher than prices in 2002, with the price in 2011 at around 2.5 USD per lb., compared to 0.5 USD per lb. in 2002. Whereas the price has come down significantly since its peak in 2011, prices in mid-2013 had not yet declined to the low level of 2002. This big price variability in recent years has led both to increasingly unpredictable windfalls and losses in Ethiopia's export sector. Several main informants reported that a absence of hedging instruments in local coffee markets, such as futures contracts, was a source of weakness in the coffee sector in the face of this price variability in Ethiopia.

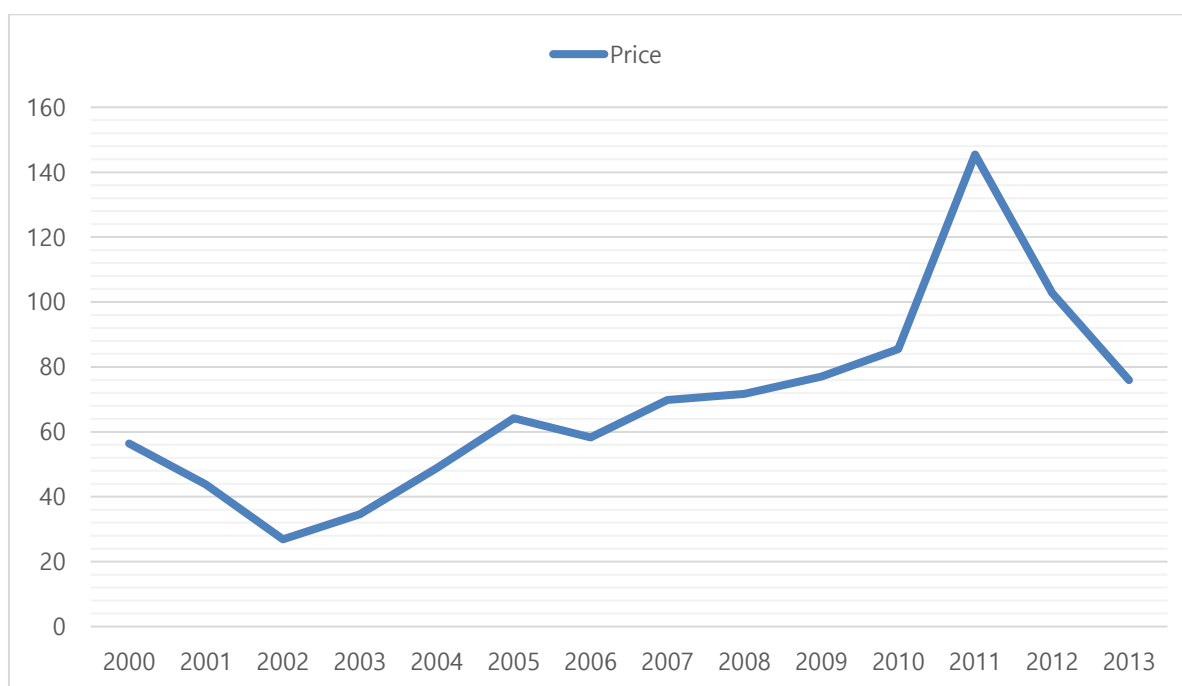


Figure 3.5 Prices paid for exporters in Ethiopia (USD) 2002 to 2013
(Source: Minster of tried and ICO)

3.7 Ethiopia Domestic coffee supply Chain Actors

Figure 3.6 illustrates the domestic coffee value chain from farm gate to export. Market players are numerous and include smallholder coffee farmers or state farms, primary collectors (“sebsabies”), suppliers (“akrabies”), processors, cooperatives unions, exporters and various government institutions. Many participants are required to have specific licenses for their respective functions. For instance, sebsabies have to sell to akrabies and akrabies are required to deliver their coffee to the auction and are not permitted to export it. Finally, exporters are allowed to buy coffee exclusively from the auction (LMC2003).

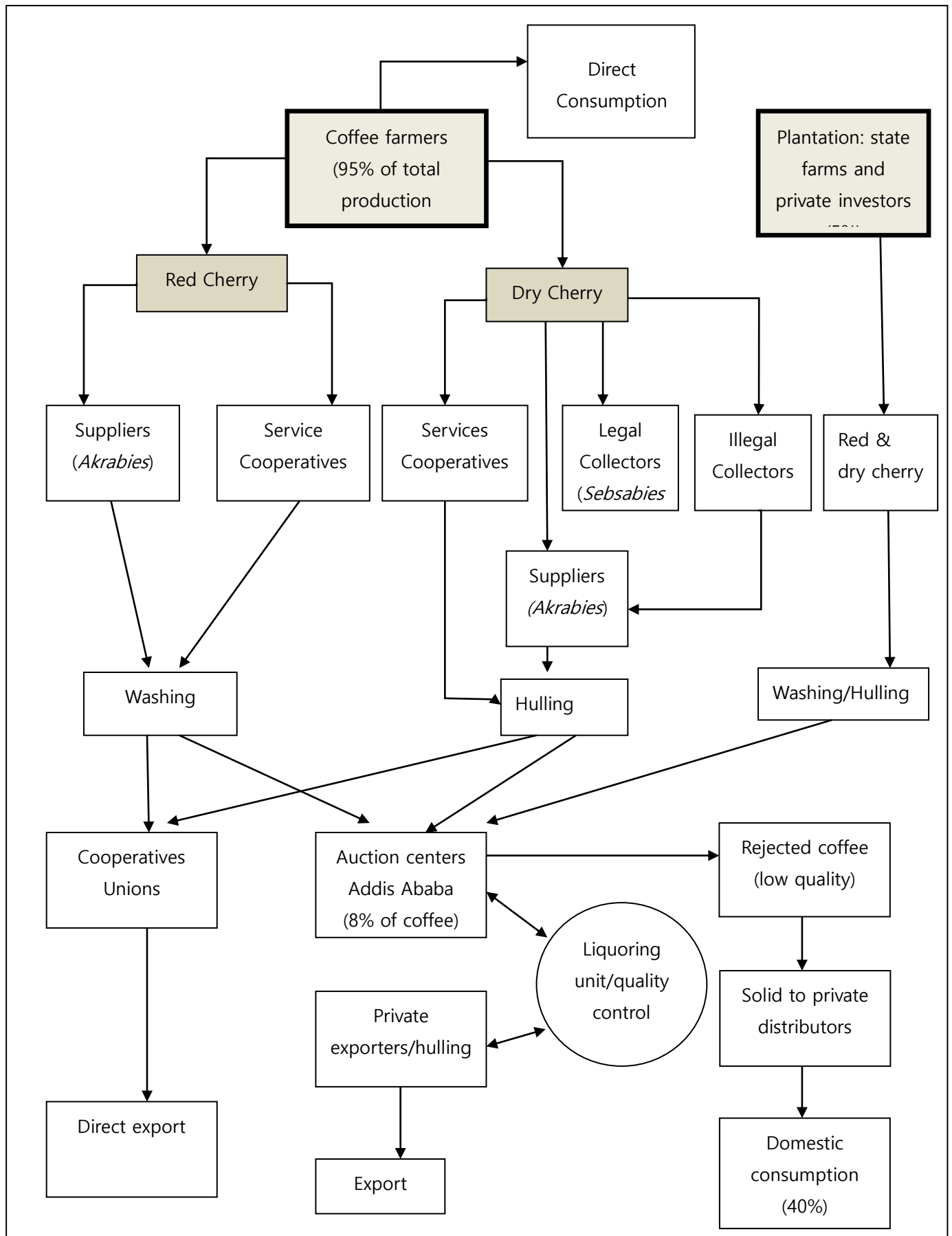


Figure 3.6: Ethiopian coffee supply chain (*Source: Chemonics International Inc, 2010*)

Deliveries which do not meet export standards are rejected and redirected for the domestic market. Ethiopia, along with Brazil, is one of the only producing countries with a strong coffee-drinking culture. A large proportion of coffee consumption in Ethiopia is on farm, which makes levels of consumption difficult to assess (LMC 2003). The ICO estimate for local consumption in 2005 was 1.83 million (60 kg) bags, more than 40 per cent of production (ICO statistical database).

3.8 Private versus public coffee exporting firms

The extent to which cooperatives and parastatals, including the Ethiopian Grain Trade Enterprise (EGTE) and state farms, play a part in coffee exports from Ethiopia. Three main findings. First, the share of cooperatives and parastatals in export trade is comparatively small. The large majority of coffee exports is in the hands of the private sector. The lowest share in total exports for the private sector was achieved at the end of 2009, when its share was 83 percent. However, in most years the private sector largely dominated, with a share close to 90 percent.

CHAPTER FOUR

RESEARCH METHODOLOGY

This chapter covers an overview of the Research methodology used in the study. The discussion in this chapter is structured around the research design, population, data collection and data analysis.

4.1 Research Methodology

The research method is a technique for collecting data which can involve specific instruments such as questionnaires or structured interview etc. In this study the methodology includes the sampling, the data collection and data processing and analysis techniques. The main effort of this study is to identify the key risk factors that have high frequency of occurrence and impact in the Ethiopian coffee supply chain, to calculate their magnitude and prioritizing them in accordance. Therefore, the research approach is both quantitative and qualitative. The former is chosen because it is suitable to help identify the nature of the causes of the problems and their consequence, the later helps for quantification of certain variables in the study population. Hence, research methodology selected includes a comprehensive literature review, a closed ended questionnaire with unstructured interview.

4.1.1 Sample and sampling techniques

(Wood, 1998) defined the sampling as the procedure of selecting representative units of a population for the study in a research investigation. Two sampling methods used by the researchers: stratified random sampling and purposive sampling.

Stratified random sampling: will be used to select suitable number of respondents from various departments or units. This type of sampling is helpful to the researcher to categorize the population in to subgroups based on suitability. Purposive sampling: this technique will be used by the researcher to question predefined groups which can have relevant information on the subject matter.

A population consists of the totality of the observation with which we are concerned (Wal pole & Myers, 1998). This research focused on cooperative unions, Exporters, Suppliers and Ethiopia coffee and tea authority and ECX.

Table 4.1 Respondent profile

Chain Actors	Number of Respondents	Work Experience (year)	Academic Qualification
Ethiopian coffee and tea authority and Ethiopian Commodity Exchange	7	≥ 10	B.Sc. and above
Exporters	18	≥ 10	B.Sc. and above
Suppliers/Akirabi	16	≥ 10	B.Sc. and above
Cooperative unions(Farmers)	6	≥ 10	B.Sc. and above

From Ethiopia coffee and tea authority and ECX 7, 3 from each two selected cooperative unions total 6, 18 from exporters and 16 from suppliers.

4.1.2 Framework for the Research

The research framework shows the key concepts, assumptions and relationships between theory and research work. It was developed by the researcher to help mobilize the research work and its procedure or logical structure to achieve the goals.

The research starts with identifying the expected outcome from the research. The outcomes were listed in the objective section of the research in which targets were set also. Based on the targets, methodology to conduct the research was developed. To understand more about the subject matter, literature survey was made on related areas and risk factors which were used identify evaluation areas, factors, measuring parameters.

Types of data, supply chain actors and data collection methods were identified and relevant data were collected accordingly. Collected data was analyzed by evaluating the research outcomes, the identified risks where analyzed and prioritized. Based on the analyzed data conclusion and recommendation was made.

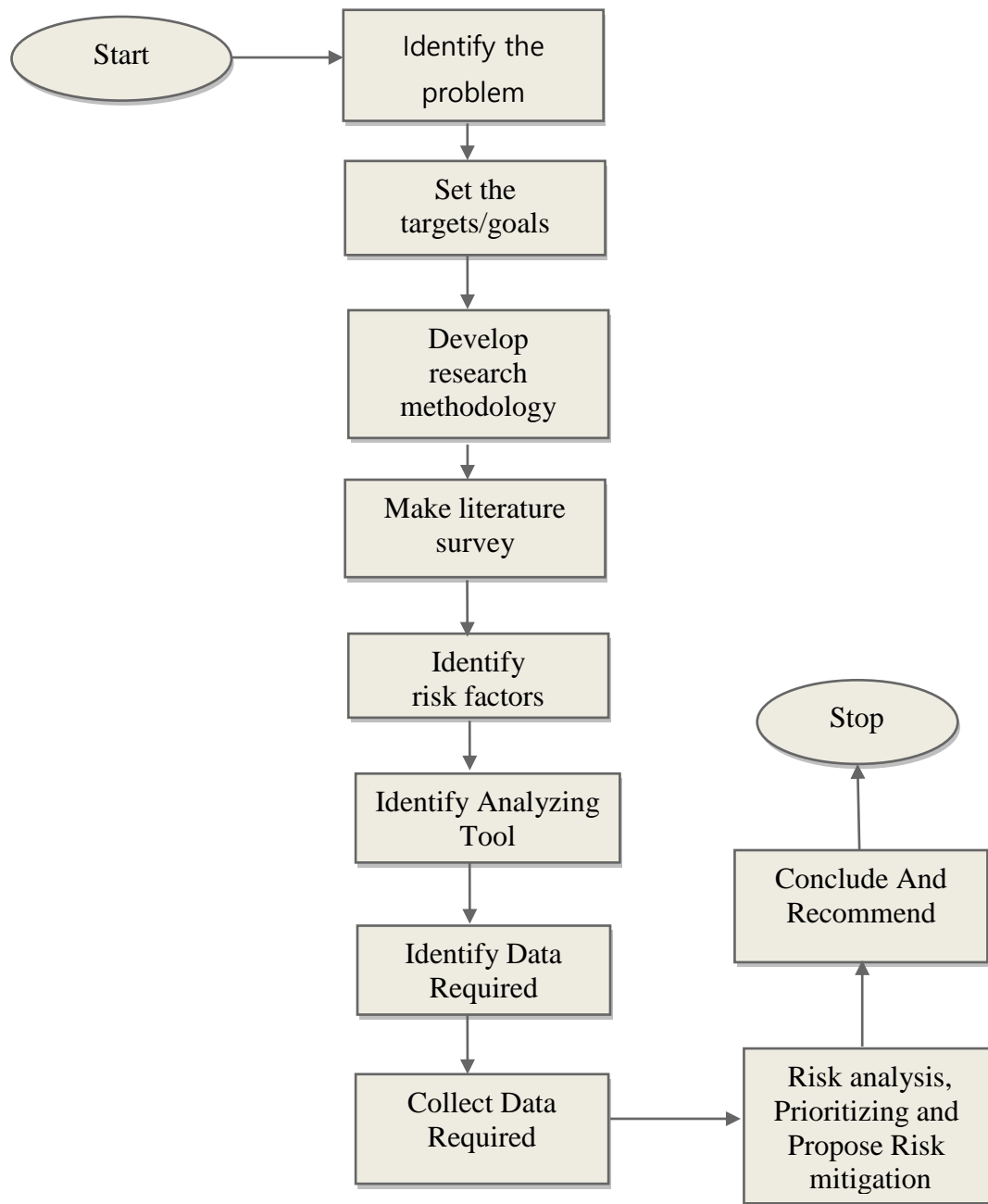


Figure 4.1. Framework for the Research

4.1.3 Data Collection

Data gathering is the precise, systematic gathering of relevant information to the research problems, using methods such as interviews, participant observation, survey, focus group discussion, narratives and case histories (Burns N., 1987).

In this study data gathered through a comprehensive literature review to identify the major risk factors, a questionnaire to rank each risk occurrence and severity to obtain the risk

magnitude and unstructured interview to identify relationship between major risk factors and to provide clarification regarding the questionnaire and a situation where the participants can express their intake and comment regarding the questionnaire.

Different books, Journals, research papers, and substantial information from internet websites have been assessed to develop adequate concepts & understandings. Among these are definitions of risk, supply chain risk, supply chain risk management, risk factor identification, supply chain risk assessment process, mitigation strategies and finally, supply chain risk assessment tools are included.

4.1.3.1 Questionnaire Design

The questionnaire survey conducted to rank the major risk factors in Ethiopia coffee supply chain and by assessing the consequences and impact of this factor on the coffee supply chain actor's. Furthermore, to identify the most affected party by the risk. The identified risk factor will be placed in to major categories. The questionnaire will be composed of three sections to accomplish the aim of this research, as follows.

1. **General information about respondent's profile**
2. **Measurement of Risk Magnitude (RM):** Risk Magnitudes (RM) are measured considering the likelihood of occurrence (RL) indicated as Rare, Unlikely, Possible, Likely, almost certain and impact (risk severity) (RS) on the supply chain indicated as Insignificant, Minor, Moderate, Major, and Catastrophic.

To ensure obtaining complete and meaningful response to the questionnaire an unstructured interview was prepared with each respondent to explain the objective of the study and to get input towards the questionnaire design, especially towards identifying risk factors.

4.2 Data Processing and Analysis

Data analysis is a mechanism for reducing and organizing data to produce findings that require interpretation by the researcher (Burns N., 1987).

4.2.1 Measurement of Reliability

The first step in analyzing survey data is to check the reliability of the instrument (Likert scale). The reliability of an instrument is the degree of consistency with which it measures the attribute it is supposed to be measuring (Polit D., 1985). The less variation an instrument produces in repeated measurements of an attribute, the higher its reliability.

The measures of internal reliability of a given scale were evaluated using Cronbach's Alpha. High values of Cronbach's Alpha indicate that all the items included in the scale are measuring the same thing.

4.2.2 Failure Mode and Effects Analysis

Failure Mode and Effects Analysis referred to as FMEA is a technique that was developed in the late 1940s by engineers in the US armed forces. The objective was to classify failures according to their impact on mission safety. Later it was adopted and refined in the Apollo space program to mitigate risk in processes where small sample sizes were affecting risk analysis. From there on the application of the technique gained momentum as manufacturing companies such as Ford Motor Company adopted the method. Following further popularity, the method is currently extensively used in variety of studies and industries such as design, manufacturing and services.

From the list of methods suggested by the ISO/EIC 31010:2009 standard, FMEA is one of few which is characterized and highly applicable for risk identification, analysis and evaluation.

Table 4.2 FMEA Components

Risk identification	Severity Rating (S)	Occurrence Rating (R)	Detectability Rating (D)	Risk priority number RPN=S*R*D
Risk identified through literature and questioner	rating corresponding to the seriousness of an effect of a potential failure mode. (scale: 1- 5.	A rating corresponding to the rate a failure mode can occur. (scale: 1-5.	A rating corresponding to the likelihood that current controls will detect the potential failure mode before it happens. (scale: 1- 5	For a given potential failure mode, how bad the outcome is multiplied by how likely it would actually happen multiplied by what things are in place today to prevent or notice it before it happens

Each identified potential failures are assigned values as to the likelihoods of occurrence, degree of severity and detectability. By multiplication of these values a risk priority number is obtained. Furthermore, the effects of these risks on the supply chain and are evaluated and appropriate actions decided to eliminate or minimize the effects.

Table 4.3: Risk Likelihood Descriptors

Rating	Description	Likelihood of Occurrence
1	Rare	Highly unlikely, but it may occur in exceptional circumstances. It could happen, but probably never will.
2	Unlikely	Not expected, but there's a slight possibility it may occur at some time
3	Possible	The event might occur at some time as there is a history of casual occurrence in similar institutions.
4	Likely	There is a strong possibility the event will occur as there is a history of frequent occurrence in similar institutions.
5	Almost Certain	Very likely. The event is expected to occur in most circumstances as there is a history of regular occurrence in similar institutions.

CHAPTER FIVE

DATA PRESENTATION AND ANALYSIS

This chapter presents the collected data, target population with questionnaire return rate, measure of reliability and data analysis and discussion.

5.1 Data Presentation

The major risk factors that affect the coffee supply chain were identified through literature review and questionnaire survey. The questionnaires were targeted at experienced respondents from Ethiopian coffee and tea authority, ECX (Ethiopian Commodity Exchange), Exporters and Cooperative unions. The questions for the survey were structured based on the information gathered through literature review. The main purpose was to identify and rank the major risk factors affecting the coffee supply chain and prioritize them in accordance for mitigation.

5.1.1 Target Population

The ranking and prioritization of the major risk factors was carried out from the perspective of Ethiopian coffee and tea authority, ECX (Ethiopian Commodity Exchange), Exporters and Cooperative unions who met the minimum criteria as shown in Table 5.1.

The questioner was distributed to 10 Ethiopian coffee and tea authority and ECX, 20 for exporters 20 for suppliers, 10 farmer cooperative unions including Yirgachefe coffee cooperative union and Oromia coffee cooperative union.

Table 5.1: Questionnaire Return Rate

Supply chain Actors	Number of questionnaires sent	Number of responses received	Response rate (percent)	Response rate (percent)
Ethiopian coffee and tea authority and Ethiopian Commodity Exchange	10	7	70%	100%
Exporters	20	18	90%	92.39%
Suppliers	20	16	80%	96.74%
Farmers' Cooperative unions.	10	6	60%	94.57%

Before the questionnaires were distributed to each respondent, a quick briefing was made to elaborate the context of the questionnaire regarding, the object of the thesis and some reference attached to the questionnaire to explain some technical terms and also the definition of each Likert scale.

The respondents are managers, directorates, team leaders and supervisors. Most of them have qualifications of BSc and MSc mostly in coffee related, management degrees and with experience ten years and above.

5.2 Data Analysis and Discussion

In this section, first measurement of internal consistency ("reliability") of each Likert scale was checked with the help of SPSS (Version 23) statistical tool. The mean value for risk occurrence rate and risk severity rate is also done using SPSS (Version 23), using the two-mean value which are Mean Occurrence (MOV) Value and Mean Severity (MSV) Value and also FMEA table Priority number is extracted.

5.2.1 Measures of Reliability

Each question was a 5-point Likert item from "Rare" to "Almost Certain" to risk occurrence and "Insignificant" to "Catastrophic" to risk consequence. Then all responses both from Ethiopian Coffee and Tea Authority and ECX, Exporters, Suppliers, Farmers' Cooperative Union perspective was feed in to SPSS.

Finally, in order to understand whether the questions in this questionnaire all reliably measure the same latent variable, a Cronbach's alpha was run on all respondents. Two measures of alpha are reported in the Table 5.2: Cronbach's Alpha and Cronbach's Alpha Based on Standardized Items. The first Cronbach's alpha employs the covariance's among the items, whereas the alpha based on standardized items employs the correlations among items. On Table 5.2, we can see that Cronbach's alpha is 0.701, 0.773, 0.736, 0.738, 0.734, 0.772, 0.811 and 0.780 which indicates an acceptable cut-off value.

Table 5.2: Reliability Analysis of Risk Occurrence and Impact

Description	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
Risk occurrence from Ethiopian Coffee and Tea Authority and ECX Perspective	.701	.620	81
Risk Severity from Ethiopian Coffee and Tea Authority and ECX Perspective	.773	.796	81
Risk occurrence from Farmers cooperative unions	.736	.781	81
Risk Severity from Farmers cooperative unions	.786	.795	81
Risk occurrence from Suppliers	.734	.703	81
Risk Severity from Suppliers	.772	.794	81
Risk occurrence from Exporters	.811	.707	81
Risk Severity from Exporters	.780	.794	81

The analysis was done by dividing the Ethiopian coffee supply chain actors in to two major Categories(perspective) which are Ethiopian Coffee and Tea Authority and ECX Perspective and the other Cooperative Unions, Exporters and Suppliers perspective.

The identified risks through literature review and questioner are classified and categorized under nine groups which are;

1. Financial and Economic Risks
2. Technical Risks
3. Personal and Managerial
4. Resource Risks
5. Governmental and Political Risks
6. Contract and Legal
7. Safety and Security
8. Environmental Risks
9. Farm risk

These identified and classified risks are analyzed under two perspectives. First, under service providers like Ethiopian Coffee and Tea Authority and ECX Perspective and the other one supply chain actors (Cooperative Unions, Exporters and Suppliers perspective).

5.2.2 Ethiopian Coffee and Tea Authority and ECX Perspective

1 Financial and Economic Risks

From table 5.3 in financial and Economic category we can see that four risk factors which are

fluctuation of interest rate, delay in payment to Supplier/collector/Exporter, Change in bank formalities and regulations and delay of bank service are low risks and represented by green color and risks including Increase of tax rate, Currency exchange risks/Lack of currency, Bankruptcy, Insufficient insurance amount and occurrence and Absence of price index represented by yellow color need a close attention.

Table 5.3 Financial and Economic Risks by Ethiopian Coffee and Tea Authority and ECX Perspective

No.	Financial and Economic Risks	Mean Occurrence Value	Mean Severity Value	Priority Number PN
1	High Inflation	3.29	3.86	12.70
2	Market volatility	3.29	3.71	12.21
3	Fluctuation of interest rate	1.57	2.14	3.36
4	Increase of tax rate	2.14	2.43	5.20
5	Currency exchange risks/Lack of currency	3.43	2.57	8.82
6	Cash flow problems	3.29	3.29	10.82
7	Delay in payment to Supplier/collector/Exporter	1.14	1.57	1.79
8	Change in bank formalities and regulations	1.14	0	0
9	Delay of bank service	2.29	2.14	4.90
10	Bankruptcy	2.29	3.43	7.86
11	Insufficient insurance amount and occurrence	3.14	3.00	9.42
12	Absence of price index	2.43	4.00	9.72

Top significant risks in the ECSC related to the financial and economic risks are mainly are High Inflation, Market volatility and Cash flow problems. Thus, this is an indication that these risks need an immediate action since they are high in the list and indicated in red color.

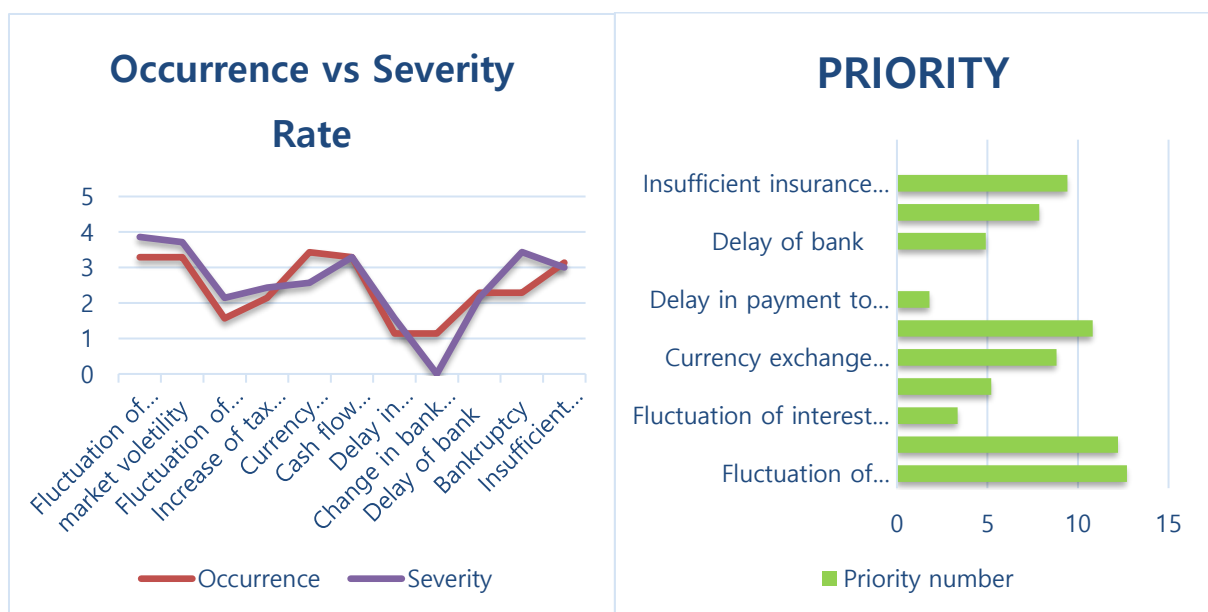


Figure 5.1: a) Occurrence and Severity Financial and Economic Risks b) Risk Priority

2 Technical Risks

From table 5.4 in Technical Risks category we can see that one risk factor which is Change in scope of work is low risk and represented by green color and risks including Poor judgment in estimating time and resource, Underestimation of quantities, Mistakes during production, Inaccurate prediction of equipment production rate, Unclear specifications, Defective workmanship and rework, Insufficient supervision and Late internal approval process represented by yellow color and need a close attention.

Table 5.4 Technical Risks by Ethiopian Coffee and Tea Authority and ECX Perspective

No.	Technical Risks	Mean Occurrence Value	Mean Severity Value	Priority Number PN
1	Poor judgment in estimating time and resource	2.57	3.00	7.71
2	Underestimation of quantities	2.43	2.71	6.59
3	Poor product handling on site	4.00	4.14	16.56
4	Mistakes during production	2.57	3.57	9.18
5	Inaccurate prediction of equipment production rate	2.43	3.29	8.00
6	Unclear specifications	2.71	2.71	7.34
7	Defective workmanship and rework	3.71	2.43	9.02
8	Change in scope of work	1.71	2.00	3.42
9	Poor documentations	4.14	4.14	17.14
10	insufficient and incorrect information	3.00	3.57	10.71
11	Insufficient supervision	2.57	3.43	8.82
12	Late internal approval process	2.86	3.00	8.58

The top significant risks in the ECSC related to the Technical Risks are mainly are Poor product handling and Poor documentations and insufficient and incorrect information. Thus, this is an indication that these risks need an immediate action since they are high in the list and indicated in red color.

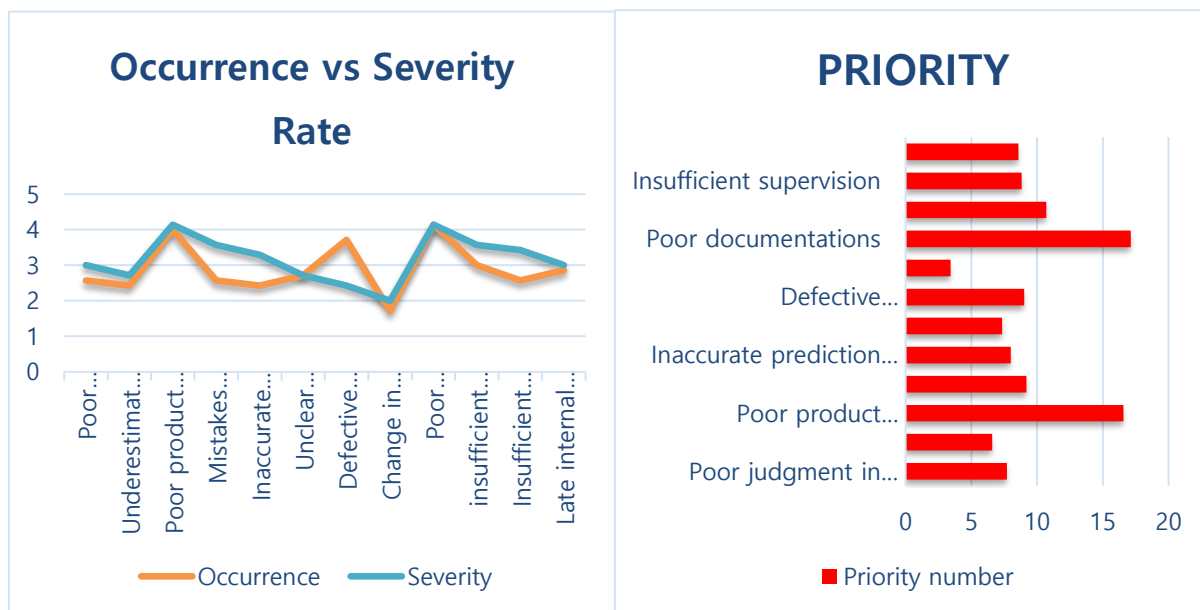


Figure 5.2: a) Occurrence and Severity for Technical Risks b) Priority of Risk

3 Personal and Managerial Risks

From table 5.5 in Personal and Managerial Risks category we can see that three risk factors which are Absenteeism (forearm, staff), Clashes (staff) and Protest and interference are low risks and represented by green color and risks including Low speed of decision making, Destructive relation among supply chain actors, Labor problem and dispute (workers strike), Poor material management and planning and Corruption and lack of respect for law represented by yellow color need a close attention.

Similarly, as indicated in Table, the top significant risks in the ECSC related to the Personal and Managerial risks are mainly are Poor provision of information to partners, Unethical behavior/practice used by chain actors, Lack of personal training and management support, Lack of technical and managerial skill of staff, Inadequate chain actors experience, Low harmony between chain actors, Poor communications and misunderstanding and Poor equipment management and planning risks indicated by red color. Thus, risks need an immediate action since they are high in the list.

Table 5.5 Personal and Managerial risks by Ethiopian Coffee and Tea Authority and ECX Perspective

No.	Personal and Managerial Risks	Mean Occurrence Value	Mean Severity Value	Priority Number PN
1	Poor provision of information to partners	3.86	3.43	13.24

2	Unethical behavior/practice used by chain actors	4.00	3.43	13.72
3	Low speed of decision making	2.29	3.14	7.19
4	Lack of personal training and management support	3.57	3.86	13.78
5	Lack of technical and managerial skill of staff	3.86	3.86	14.90
6	Inadequate chain actors experience	3.71	4.00	14.84
7	Low harmony between chain actors	4.00	4.29	17.16
8	Poor communications and misunderstanding	3.71	3.57	13.25
9	Destructive relation among supply chain actors	3.14	3.43	10.77
10	Labor problem and dispute (workers strike)	2.43	2.29	5.57
11	Absenteeism (forearm, staff)	1.71	1.71	2.92
12	Clashes (staff)	1.71	1.57	2.69
13	Poor material management and planning	3.14	3.43	10.77
14	Poor equipment management and planning	3.43	3.71	12.73
15	Poor labor planning	3.00	2.57	7.71
16	Corruption and lack of respect for law	3.86	2.43	9.38
17	Protest and interference	1.57	1.57	2.47

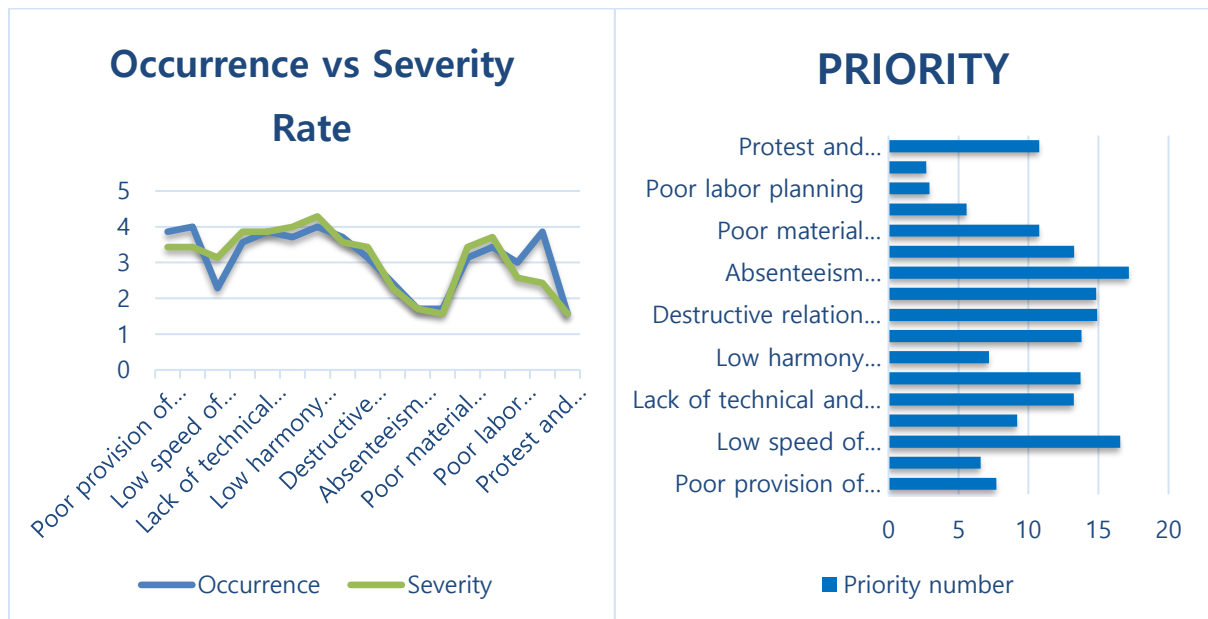


Figure 5.3: a) Occurrence and Severity of Personal and Managerial Risks

b) Priority of Risk

4 Government and Political Risks

From table 5.6 in Government and Political Risks category we can see that one risk factor which Changes in laws and regulations is low risk and represented by green color and risks including Excessive procedure by government agencies, Government intervention/political,

Lack of cooperation from government, Custom and Export restrictions, change in priority and focus by the Government and Monopolistic chain actor represented by yellow color need a close attention.

Table 5.6 Government and Political risks by Ethiopian Coffee and tea Authority and ECX Perspective

No.	Government and Political Risks	Mean Occurrence Value	Mean Severity Value	Priority Number PN
1	Excessive procedure by government agencies	2.86	3.29	9.41
2	Bureaucracy in government agencies	3.29	3.71	12.21
3	Government intervention/political	2.57	2.71	6.97
4	Changes in laws and regulations	2.00	1.71	3.42
5	Lack of cooperation from government	2.29	4.00	9.16
6	Custom and Export restrictions	2.00	2.86	5.72
7	Change in priority and focus by the Government	2.00	4.00	8.00
8	Monopolistic chain actor	2.43	2.57	6.25
9	Corruption	4.00	4.29	17.16
10	Political unrest (blockade, Protests...)	3.29	4.29	14.11

Bureaucracy in government agencies, Corruption and Political unrest (blockade, Protests...) risks will strongly affect the overall performance of the chain.

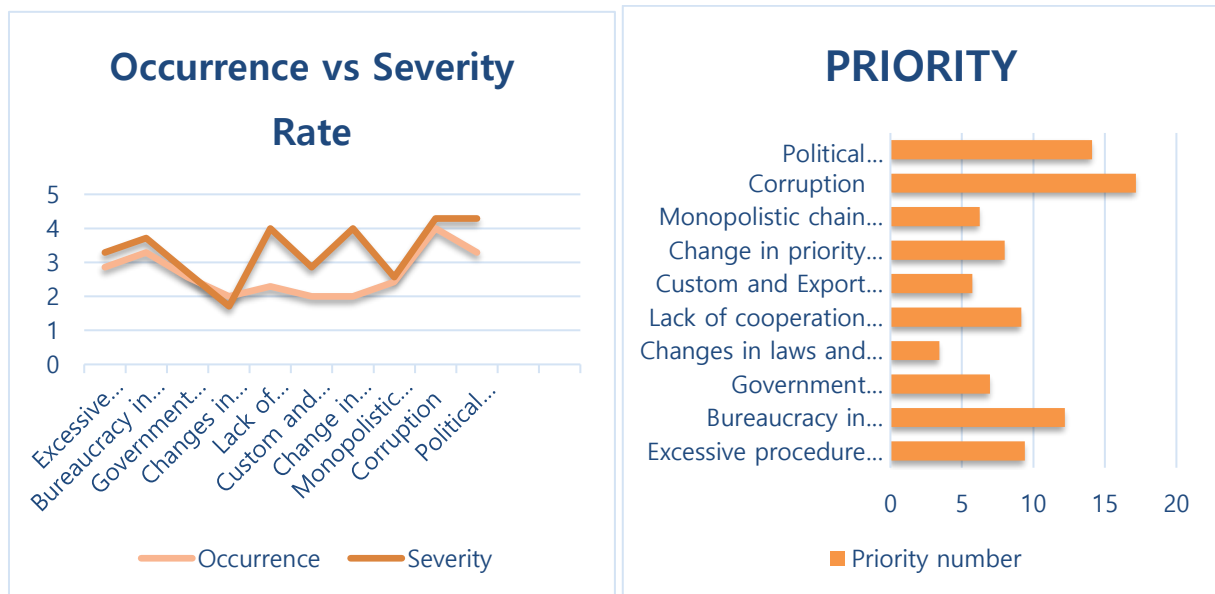


Figure 5.4: a) Occurrence and Severity of Government and Political Risks b) Priority of Risk

Government and Political Risks

Similarly, as indicated in Table, the top significant risks in the ECSC related to the Government and Political Risks are mainly due to the above red colored risks. Thus, this is an indication that these risks need an immediate action since they are high in the list and indicated in red color.

5 Contractual and Legal Risks

From table 5.7 in Contractual and Legal Risks category we can see that four risk factors which are Contract modifications and Absence of alternative dispute resolution clauses in the contract are low risks and represented by green color and risks including Mistakes and discrepancy in contract documents, Inappropriate type of contract used, Contract flaws, Unfair and unreasonable requirement or inappropriate risk allocation in contract, Local laws, Ambiguous conditions of contract (Insufficient details in contract documents), Long court case and Third party delays represented by yellow color need a close attention.

Table 5.7 Contractual and Legal Risks by Ethiopian Coffee and Tea Authority and ECX Perspective

No.	Contractual and Legal Risks	Mean Occurrence Value	Mean Severity Value	Priority Number PN
1	Contract modifications	2.71	1.57	4.26
2	Mistakes and discrepancy in contract documents	2.71	2.29	6.21
3	Inappropriate type of contract used	2.57	2.71	6.97
4	Contract flaws	2.86	2.57	7.35
5	Unfair and unreasonable requirement or inappropriate risk allocation in contract	2.86	2.71	7.75
6	Local laws	1.86	2.86	5.32
7	Ambiguous conditions of contract (Insufficient details in contract documents)	2.57	3.14	8.07
8	Lack of clear understanding of contract document by all stakeholders	3.43	3.29	11.29
9	Long court case	2.57	3.43	8.82
10	Absence of alternative dispute resolution clauses in the contract	2.71	1.71	4.63
11	Third party delays	2.57	2.00	5.14

As indicated in Table, the top significant risk in the ECSC related to the Contractual and Legal Risks is mainly are Lack of clear understanding of contract document by all stakeholder's. Thus, this is an indication that these risks need an immediate action since they are high in the list and indicated in red color.

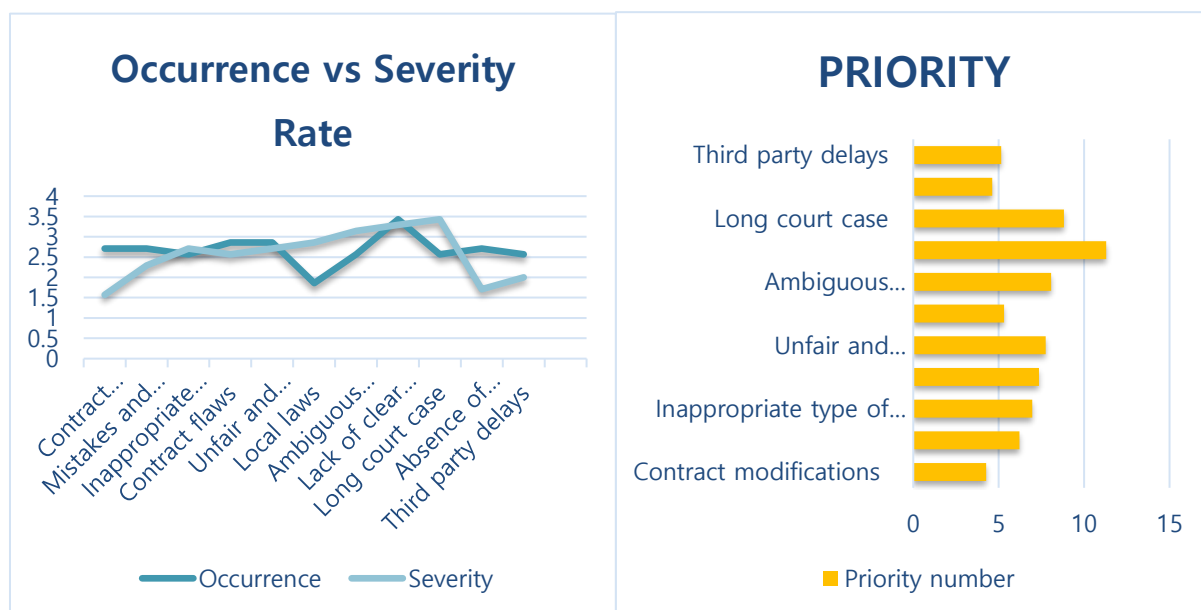


Figure 5.5: a) Occurrence and Severity Contractual and Legal Risks

b) Priority of Risk

6 Safety and Security

From table 5.8 in Safety and Security category we can see that four risk factors which are Accident and injuries during Transportation, Vandalism and Epidemic/deadly diseases are low risks and represented by green color and risk like Accident and injuries in production site represented by yellow color need a close attention.

Table 5.8 Safety and Security risk by Ethiopian Coffee and Tea Authority and ECX Perspective

No.	Safety and Security	Mean Occurrence Value	Mean Severity Value	Priority Number PN
1	Accident and injuries in production site	1.71	3.14	5.37
2	Accident and injuries during Transportation	1.43	2.00	2.86
3	Theft	3.43	3.29	11.29
4	Vandalism	1.43	1.00	1.43
5	Contraband	3.57	4.00	14.28
6	Epidemic/deadly diseases	1.43	2.00	2.86

Similarly, as indicated in Table 5.3, the top significant risks in the ECSC related to the Safety and Security risks are mainly are Theft and Contraband. Thus, this is an indication that these risks need an immediate action since they are high in the list and indicated in red color.

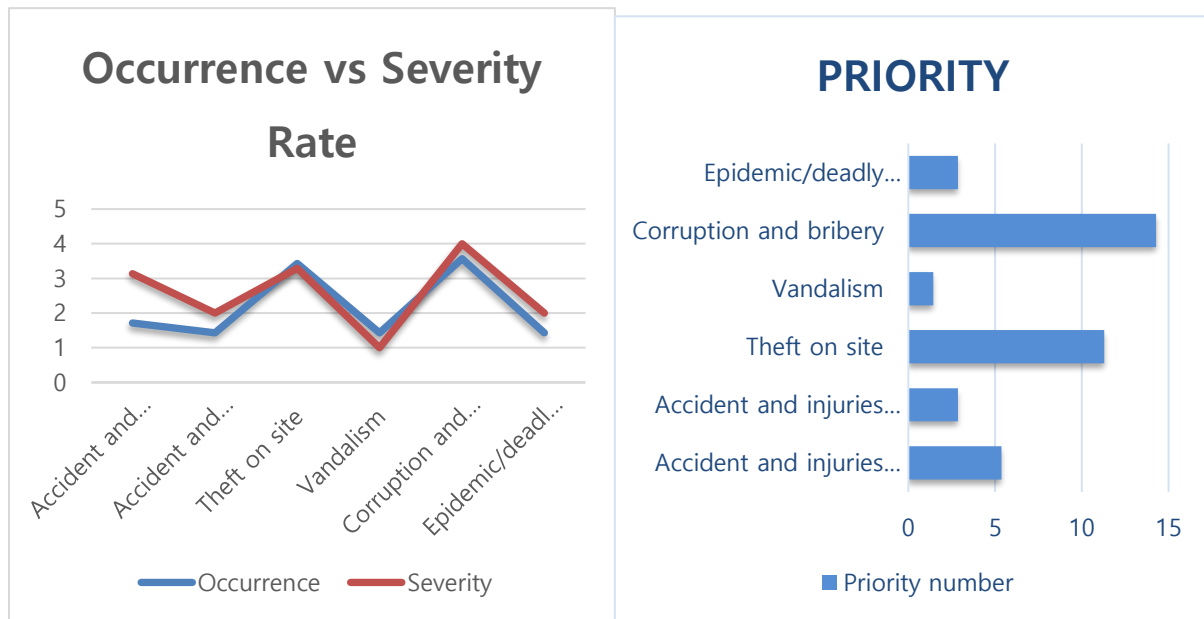


Figure 5.6: a) Occurrence and Severity Safety and Security

b) Priority of Risk

7 Resource Risks

From table 5.9 in Resource Risks category we can see that one risk factor which Unavailability of Supplier/collectors is low and represented by green color and risks including Availability/shortage of labor and Wastage of material represented by yellow color need a close attention.

Table 5.9 Resource Risks by Ethiopian Coffee and Tea Authority and ECX Perspective

No.	Resource Risks	Mean Occurrence Value	Mean Severity Value	Priority Number PN
1	Availability/shortage of labor	1.86	3.14	5.84
2	Unavailability of Supplier/collectors	1.57	1.43	2.25
3	Shortage of materials for production	3.14	3.43	10.77
4	Shortage of equipment for production	3.14	3.57	11.21
5	Low product quality	3.43	3.14	10.77
6	Lack of maintenance for equipment	2.86	4.00	11.44
7	Transportation problem due (spare parts, fuel, maintenance system)	3.29	3.29	10.82
8	Wastage of material	2.57	2.57	6.61

Similarly, as indicated in Table, the top significant risks in the ECSC related to the Resource Risks are mainly are Shortage of materials for production, Shortage of equipment for production, Lack of maintenance for equipment, Transportation problem due (spare parts, fuel, maintenance system) and Low productivity risks. Thus, these risks need an immediate action since they are high in the list and indicated in red color.

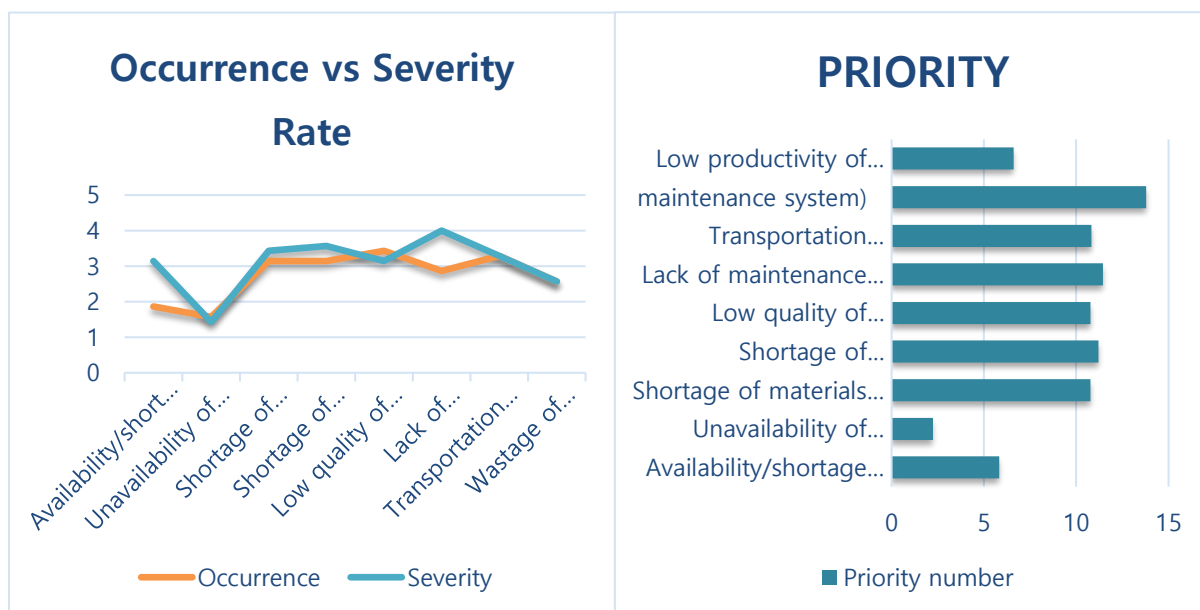


Figure 4.7: a) Occurrence and Severity Resource Risks

b) Priority of Risk

8 Environmental and Physical Risk

In Physical/Environmental Risks category we can see that one risk factor which Flood and earth quake low risk is and represented by green color and risks including Geotechnical fault (contaminated soil) represented by yellow color by all three supply chain actors and need a close attention.

Table 5.11 Environmental and Physical risk by Ethiopian Coffee and Tea Authority and ECX Perspective

No.	Physical/Environmental Risks	Mean Occurrence Value	Mean Severity Value	Priority Number PN
1	Exceptionally adverse climatic condition	3.29	4.71	15.97
2	Difficult landscape	3.39	3.14	10.64
3	Remoteness/accessibility of site	3.36	2.71	9.11
4	Flood, earthquake...	1.23	3.54	4.35
5	Geotechnical fault (contaminated soil)	1.6	4.14	6.62

As indicated in Table, the top significant risks in the ECSC related to the Resource Risks are mainly are Exceptionally adverse climatic condition, Difficult landscape and Remoteness/accessibility of site risks. These risks need an immediate action since they are high in the list and indicated in red color.

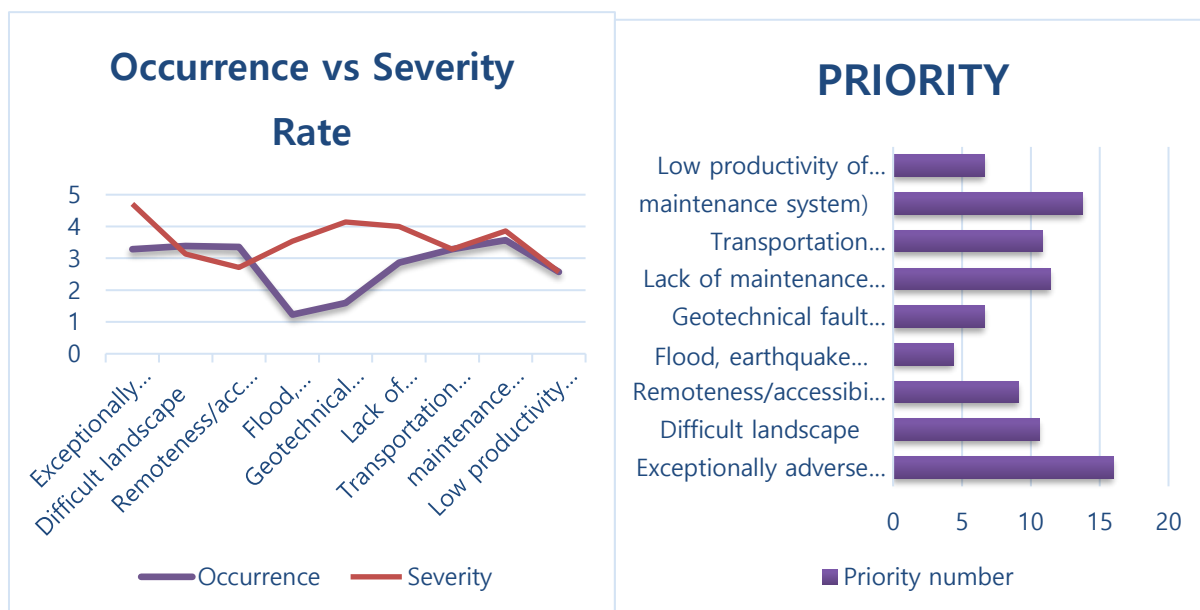


Figure 4.8: a) Occurrence and Severity Environmental and Physical Risk

b) Priority of Risk

9 Farm Risk

In Farm Risks category we can see that none of risk factor are low risk and risks including Aging trees, Poor harvesting methods, shifting to other product, Contamination coffee and finally Lack of proper storage with adequate facilities represented by yellow color and need a close attention.

Table 5.12 Farm Risk by Ethiopian Coffee and Tea Authority and ECX Perspective

No.	Risk Factor	Mean Occurrence Value	Mean Severity Value	Priority Number PN
1	Aging trees	3.25	2.95	9.57
2	Pest and disease (coffee wilt, coffee borer leaf rust, others)	3.9	5	19.5
3	Poor harvesting methods	3	3	9
4	Shifting to other product	2.4	4	9.6
5	Contamination coffee	2	4	8
6	Lack of proper storage with adequate facilities.	2.5	3	7.5
7	Low productivity	3.57	3.86	13.78

Pest and disease (coffee wilt, coffee borer leaf rust, others) and Low product quality risk will strongly affect the overall productivity of the farm. Similarly, as indicated in Table, the top significant risks in the ECSC related to the Resource Risks are mainly due to the above red colored risks. Thus, this is an indication that this risk need an immediate action since they are

high in the list.

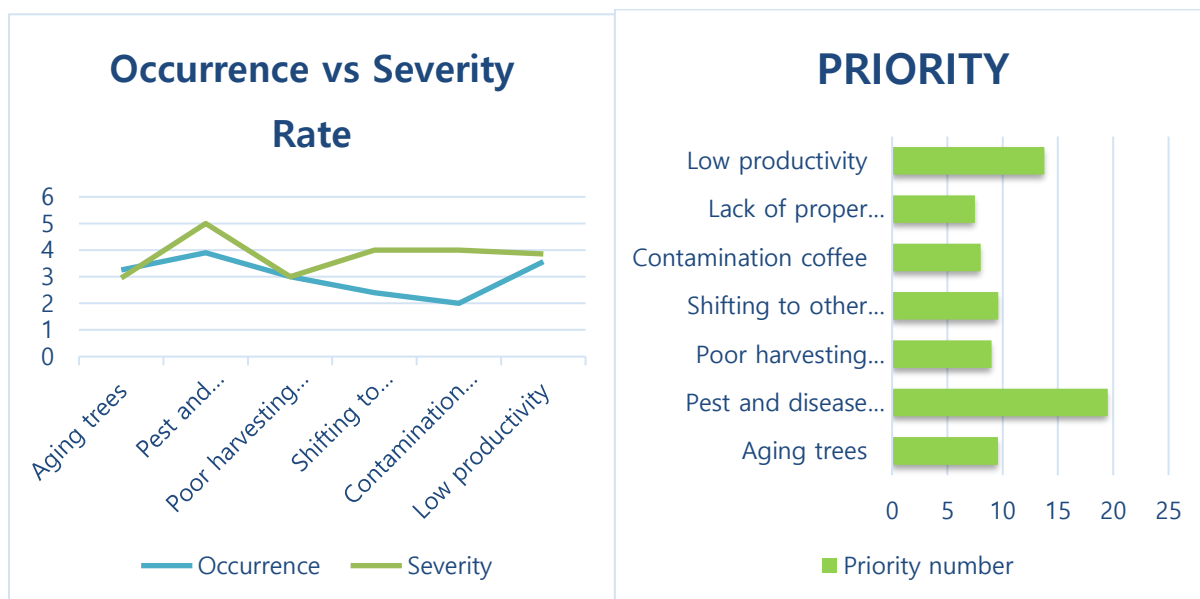


Figure 4.9: a) Occurrence and Severity Farm Risk

b) Priority of Risk

Major risk factor (ECTA and ECX Perspective)

From the table below, we can see that major risk ranked based on ECTA and ECX Perspective pests and diseases are the higher (19.5) risk factor and ranked 1 and the minimum risk factor

Table 5.13 Major risk factor from ECTA and ECX Perspective

No.	Resource Risks	Priority Number $P=O*S$	Rank
1	Pest and disease (coffee wilt, coffee borer leaf rust, others)	19.5	1
2	Corruption	17.16	2
3	Poor documentations	17.14	3
4	Poor product handling on site	16.56	4
5	Exceptionally adverse climatic condition	15.54	5
6	Lack of technical and managerial skill of staff	14.90	6
7	Inadequate chain actors experience	14.84	7
8	Contraband	14.28	8
9	Political unrest (blockade, Protests...)	14.11	9
10	Low productivity	13.78	10
11	Unethical behavior/practice used by chain actors	13.72	11
12	Poor provision of information to partners	13.24	12
13	Poor equipment management and planning	12.73	13
14	High Inflation	12.70	14
15	Market volatility	12.21	15
16	Bureaucracy in government agencies	12.21	15

17	Remoteness/accessibility of site	12	17
18	Lack of maintenance for equipment	11.44	18
19	Lack of clear understanding of contract document by all stakeholders	11.29	19
20	Theft	11.29	19
21	Shortage of equipment for production	11.21	21
22	Cash flow problems	10.82	22
23	Transportation problem due (spare parts, fuel, maintenance system)	10.82	22
24	Low product quality	10.77	24
25	Shortage of materials for production	10.77	24
26	insufficient and incorrect information	10.71	26

Source: Author computation

insufficient and incorrect information is ranked 25 and scored 10.71. The above risks have high impact on the coffee supply chain which represented by red color in each category and need an immediate mitigation action.

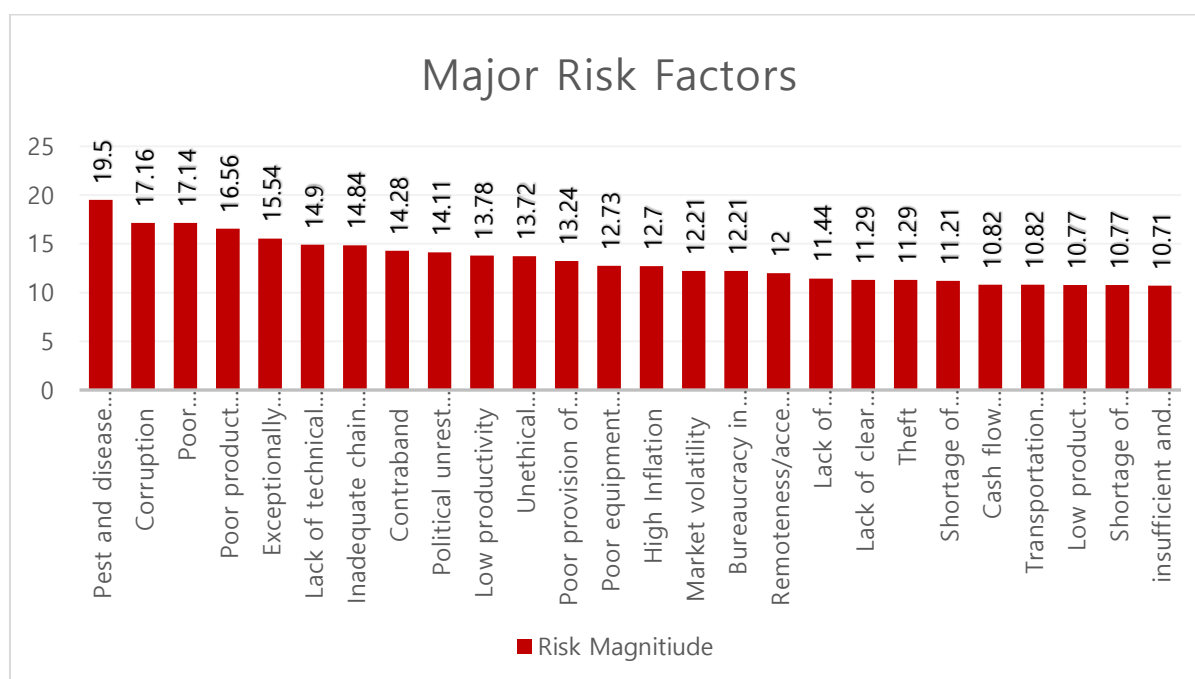


Figure 5.10 Major risk factor from ECTA and ECX Perspective

5.2.3 Cooperative Unions, Exporters and Suppliers perspective

1 Financial and Economic Risks

In Financial and Economic category, we can see that four risk factors which are fluctuation of interest rate, delay in payment to suppliers/collectors/Exporter, change in bank formalities and regulations and delay of bank service are low risks and represented by green color and risks

including Increase of tax rate, Currency exchange risks/Lack of currency, Bankruptcy, Insufficient insurance amount and occurrence and Absence of price index represented by yellow color need a close attention.

Table 5.14 Financial and Economic Risks by Cooperative Unions, Exporters and Suppliers perspective

No .	Financial and Economic Risks	MOV (EP)	MSV (EP)	PN (EP)	MOV (SP)	MSV (SP)	PN (SP)	MOV (CUP)	MSV (CUP)	PN (CUP)
1	High Inflation	3.33	2.56	8.53	3.38	2.61	8.82	3.75	2.63	9.86
2	Market volatility	4.35	4.64	20.2	4.5	4	18	4.04	4.7	19
3	Fluctuation of interest rate	1.39	2.06	2.86	1.63	2.11	3.44	1.38	2.13	2.94
4	Increase of tax rate	2.00	2.00	4	2.06	2.00	4.12	2.00	2.00	4
5	Currency exchange risks/Lack of currency	2.35	2.83	6.65	3.38	2.78	9.40	1.75	2.88	5.04
6	Cash flow problems	3.00	3.28	9.84	3.25	3.22	10.47	3.00	3.25	9.75
7	Delay in payment to Supplier/collector/Exporter	1.11	1.33	1.48	1.31	1.39	1.82	1.13	1.38	1.56
8	Change in bank formalities and regulations	1.11	1.22	1.35	1.19	1.28	1.52	1.13	1.25	1.41
9	Delay of bank service	2.11	1.50	3.17	2.25	1.50	3.38	2.13	1.50	3.20
10	Bankruptcy	2.94	3.33	9.79	2.25	3.33	7.45	2.88	3.38	9.73
11	Insufficient insurance amount and occurrence	2.33	2.94	6.85	3.19	2.94	9.38	2.25	3.00	6.75
12	Absence of price index	2.28	3.89	8.87	2.25	3.94	8.87	2.25	3.88	8.73

The top significant risks in the ECSC related to the financial and economic risks are mainly due to High Inflation and Market volatility and Cash flow problems. Thus, this is an indication that these risks need an immediate action since they are high in the list and indicated in red color,



Figure 5.11: Financial and Economic Risks Priority by Cooperative Unions, Exporters and Suppliers perspective

2 Technical Risks

From Technical Risks category we can see that one risk factor which Change in scope of work is low risk and represented by green color and risks including Poor judgment in estimating time and resource, Underestimation of quantities, Mistakes during production, Inaccurate prediction of equipment production rate, Unclear specifications, Defective workmanship and rework, Insufficient supervision and Late internal approval process represented by yellow color and need a close attention.

Table 5.15 Technical Risks by Cooperative Unions, Exporters and Suppliers perspective

N o.	Technical Risks	MOV (EP)	MSV (EP)	PN (EP)	MOV (SP)	MSV (SP)	PN (SP)	MOV (CUP)	MSV (CUP)	PN (CUP)
1	Poor judgment in estimating time and resource	1.89	2.94	5.57	2.56	3.06	7.83	1.88	3.00	5.64
2	Underestimation of quantities	3.06	2.22	6.79	2.44	2.22	5.42	3.00	2.25	6.75
3	Poor product handling on site	4.06	4.22	17.13	4.00	4.22	16.88	4.00	4.25	17
4	Mistakes during production	1.72	2.61	4.49	2.56	2.61	6.68	1.75	2.63	4.60
5	Inaccurate prediction of equipment production rate	1.72	2.72	4.68	2.44	2.78	6.78	1.75	2.75	4.81
6	Unclear specifications	3.00	3.00	9	2.69	3.00	8.07	3.00	3.00	9
7	Defective workmanship and rework	3.39	1.61	5.48	3.69	1.67	6.16	3.38	1.63	5.51
8	Change in scope of work	1.33	1.61	2.14	1.75	1.61	2.82	1.38	1.63	2.25
9	Poor documentations	4.06	3.72	15.10	4.13	3.72	15.37	4.00	3.75	15
10	insufficient and incorrect information	3.33	3.44	11.46	3.06	3.50	10.71	3.38	3.50	11.83
11	Insufficient supervision	2.33	2.28	5.31	2.63	2.33	6.13	2.38	2.38	5.66
12	Late internal approval process	3.33	2.44	8.13	2.88	2.50	7.2	3.38	2.50	8.45

Poor product handling, Poor documentations and insufficient and incorrect information risks will strongly affect the overall performance of the chain. Also, as indicated in Table, the top significant risks in the ECSC related to the Technical Risks are mainly due to Poor product handling and Poor documentations and insufficient and incorrect information. These risks need an immediate action since they are high in the list and indicated in red color.

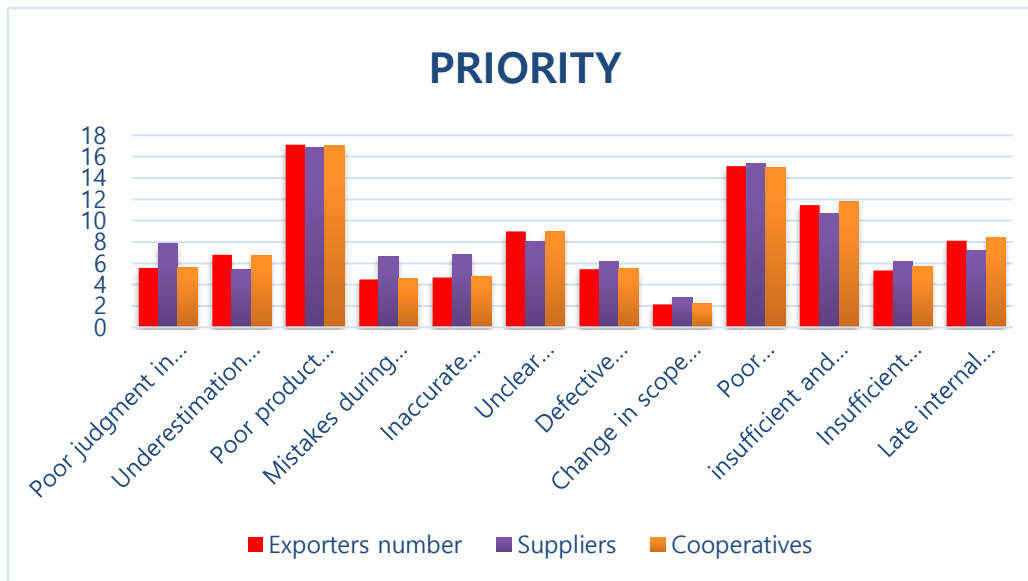


Figure 5.12: Technical Risks Priority by Cooperative Unions, Exporters and Suppliers perspective

3 Personal and Managerial Risks

In Personal and Managerial Risks category we can see that three risk factors which are Absenteeism (forearm, staff), Clashes (staff) and Protest and interference are low risks and represented by green color and risks including Low speed of decision making, Destructive relation among supply chain actors, Labor problem and dispute (workers strike), Poor material management and planning and Corruption and lack of respect for law represented by yellow color need a close attention.

Table 5.16 Personal and Managerial risks by Cooperative Unions, Exporters and Suppliers perspective

No .	Personal and Managerial Risks	MOV (EP)	MSV (EP)	PN (EP)	MOV (SP)	MSV (SP)	PN (SP)	MOV (CUP)	MSV (CUP)	PN (CUP)
1	Poor provision of information to partners	3.67	3.33	12.22	3.81	3.39	12.92	3.75	3.38	12.68
2	Unethical behavior/practice used by chain actors	2.39	1.94	4.64	3.94	1.94	7.64	2.38	2.00	4.76
3	Low speed of decision making	2.39	3.00	7.17	2.31	3.00	6.93	2.38	3.00	7.14
4	Lack of personal training and management support	3.72	4.11	15.29	3.56	3.89	13.85	3.63	4.00	14.52
5	Lack of technical and managerial skill of staff	2.00	3.17	6.34	3.81	3.22	12.27	2.00	3.25	6.5
6	Inadequate chain actors experience	2.17	3.17	6.88	3.69	3.06	11.29	2.25	3.13	7.04
7	Low harmony between chain actors	4.06	3.89	15.79	3.94	3.94	15.52	4.00	3.88	15.52
8	Poor communications and misunderstanding	3.94	3.78	14.89	3.75	3.83	14.36	3.88	3.75	14.55
9	Destructive relation	3.61	3.89	14.04	3.06	3.89	11.90	3.50	3.88	13.58

	among supply chain actors									
10	Labor problem and dispute (workers strike)	2.06	1.72	3.54	2.38	1.72	4.09	2.00	1.75	3.5
11	Absenteeism (forearm, staff)	1.50	1.33	1.99	1.75	1.33	2.33	1.50	1.38	2.07
12	Clashes (staff)	1.39	1.56	2.17	1.69	1.50	2.54	1.38	1.50	2.07
13	Poor material management and planning	2.50	3.72	9.3	3.06	3.61	11.05	2.50	3.63	9.08
14	Poor equipment management and planning	3.28	2.89	9.48	3.31	2.83	9.37	3.25	2.88	9.36
15	Poor labor planning	2.78	1.94	5.39	2.88	1.94	5.59	2.75	2.00	5.5
16	Corruption and lack of respect for law	4.11	3.11	12.78	3.81	3.06	11.66	4.13	3.13	12.93
17	Protest and interference	1.56	2.89	4.51	1.63	2.89	4.71	1.50	2.88	4.32

As shown in Table, the top significant risks in the ECSC related to the Personal and Managerial risks are mainly due to Poor provision of information to partners, Unethical behavior/practice used by chain actors, Lack of personal training and management support, Lack of technical and managerial skill of staff, Inadequate chain actors experience, Low harmony between chain actors, Poor communications and misunderstanding and Poor equipment management and planning risks. Therefore, these risks need an immediate action since they are high in the list and indicated in red color.

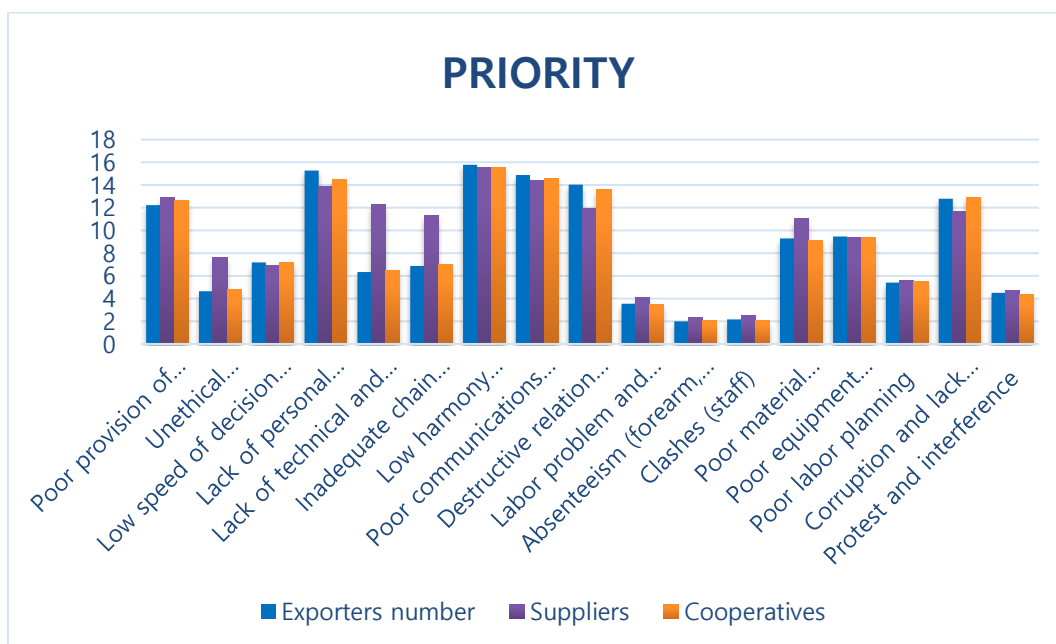


Figure 5.13: Personal and Managerial Risks Priority by Cooperative Unions, Exporters and Suppliers perspective

4 Government and Political Risks

From table 5.6 in Government and Political Risks category we can see that one risk factor which Changes in laws and regulations is low risk and represented by green color and risks including Excessive procedure by government agencies, Government intervention/political, Lack of cooperation from government, Custom and Export restrictions, change in priority and focus by the Government and Monopolistic chain actor represented by yellow color need a close attention.

Table 5.17 Government and Political risks by Cooperative unions, Exporters and Suppliers perspective

N o.	Government and Political Risks	MRO V (EP)	MRS V (EP)	PN (EP)	MRO V (SP)	MRSV (SP)	PN (SP)	MROV (CUP)	MRSV (CUP)	PN (CUP)
1	Excessive procedure by government agencies	3.33	2.89	9.62	2.88	2.83	8.15	3.38	2.88	9.73
2	Bureaucracy in government agencies	3.72	3.83	14.25	3.25	3.89	12.64	3.75	3.88	14.55
3	Government intervention/political	2.22	2.61	5.79	2.56	2.67	6.84	2.25	2.63	5.92
4	Changes in laws and regulations	2.06	2.17	4.47	2.06	2.11	4.35	2.00	2.13	4.26
5	Lack of cooperation from government	2.11	4.06	8.57	2.31	4.06	9.38	2.13	4.00	8.52
6	Custom and Export restrictions	2.17	2.33	5.06	2.06	2.33	4.80	2.13	2.38	5.07
7	Change in priority and focus by the Government	1.78	4.06	7.23	2.19	4.17	9.13	1.88	4.13	7.76
8	Monopolistic chain actor	2.17	2.06	4.47	2.44	1.94	4.73	2.13	2.00	4.26
9	Corruption	4.06	4.28	17.38	3.94	4.22	16.63	4.00	4.25	17
10	Political unrest (blockade, Protests...)	3.56	4.22	15.02	3.19	4.17	13.30	3.50	4.25	14.88

Bureaucracy in government agencies, Corruption and Political unrest (blockade, Protests...) risks will strongly disturb the overall chain. Similarly, as indicated in Table, the top significant risks in the ECSC related to the Government and Political Risks are mainly due to the above red colored risks. Hence, this indicate that these risks need an immediate action since they are high in the list.

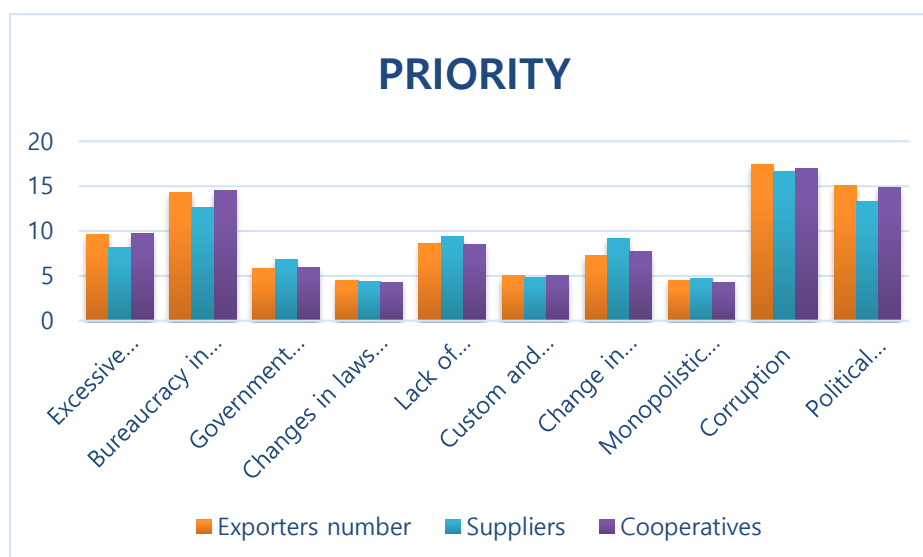


Figure 5.14: Government and Political Risks Priority by Cooperative Unions, Exporters and Suppliers perspective

5 Contractual and Legal Risks

From table 5.7 in Contractual and Legal Risks category we can see that four risk factors which are Contract modifications and Absence of alternative dispute resolution clauses in the contract are low risks and represented by green color and risks including Mistakes and discrepancy in contract documents, Inappropriate type of contract used, Contract flaws, Unfair and unreasonable requirement or inappropriate risk allocation in contract, Local laws, Ambiguous conditions of contract (Insufficient details in contract documents), Long court case and Third party delays represented by yellow color need a close attention.

Table 5.18: Contractual and Legal Risks by Cooperative Unions, Exporters and Suppliers perspective

No .	Contractual and Legal Risks	MRO V (EP)	MRSV (EP)	PN (EP)	MRO V (SP)	MRS V (SP)	PN (SP)	MROV (CUP)	MRSV (CUP)	PN (CUP)
1	Contract modifications	2.50	1.33	3.33	2.81	1.39	3.91	2.50	1.38	3.45
2	Mistakes and discrepancy in contract documents	2.44	1.56	3.81	2.75	1.61	4.43	2.38	1.63	3.88
3	Inappropriate type of contract used	2.17	1.94	4.21	2.56	1.94	4.97	2.13	2.00	4.26
4	Contract flaws	2.89	1.94	5.61	2.88	2.00	5.76	2.88	2.00	5.76
5	Unfair and unreasonable requirement or inappropriate risk allocation in contract	1.94	2.17	4.21	2.88	2.06	5.93	2.00	2.13	4.26
6	Local laws	1.89	2.94	5.56	1.88	3.06	5.75	1.88	3.00	5.64
7	Ambiguous conditions of contract (Insufficient details in contract documents)	2.28	2.94	6.70	2.63	3.06	8.05	2.25	3.00	6.75

8	Lack of clear understanding of contract document by all stakeholders	2.22	2.89	6.42	3.44	2.94	10.11	2.25	2.88	6.48
9	Long court case	1.67	2.39	3.99	2.56	2.67	6.84	1.63	2.50	4.08
10	Absence of alternative dispute resolution clauses in the contract	2.94	1.83	5.38	2.81	1.83	5.14	2.88	1.88	5.4144
11	Third party delays	2.00	1.50	3	2.63	1.50	3.95	2.00	1.50	3

Lack of clear understanding of contract document by all stakeholder’s risk could strongly affect stockholders. As shown in Table, the top significant risk in the ECSC related to the Contractual and Legal Risks is mainly due to Lack of clear understanding of contract document by all stakeholder’s. Thus, this is an indication that these risks need an immediate action since they are high in the list and indicated in red color.



Figure 5.15: Contractual and Legal Risks Priority by Cooperative Unions, Exporters and Suppliers perspective

6 Safety and Security

In Safety and Security category we can see that four risk factors which are Accident and injuries during Transportation, Vandalism and Epidemic/deadly diseases are low risks and represented by green color and risk like Accident and injuries in production site represented by yellow color need a close attention.

Table 5.19: Safety and Security by Cooperative Unions, Exporters and Suppliers perspective

N o.	Safety and Security	MROV (EP)	MRSV (EP)	PN (EP)	MROV (SP)	MRSV (SP)	PN (SP)	MROV (CUP)	MRSV (CUP)	PN (CUP)
1	Accident and injuries in production site	1.72	3.06	5.26	1.81	3.11	5.63	1.75	3.13	5.48
2	Accident and injuries during Transportation	1.50	3.11	4.67	1.50	3.11	4.67	1.50	3.13	4.70
3	Theft	2.67	2.78	7.42	3.50	2.89	10.12	2.63	2.88	7.57
4	Vandalism	1.39	1.39	1.93	1.50	1.33	1.99	1.38	1.38	1.90
5	Contraband	3.83	3.61	13.83	3.56	3.61	12.85	3.75	3.63	13.61
6	Epidemic/deadly diseases	1.28	1.89	2.42	1.50	1.83	2.75	1.25	1.88	2.35

Similarly, as indicated in Table 5.3, the top significant risks in the ECSC related to the Safety and Security risks are mainly due to Theft and Contraband. Hence, this is an indication that these risks need an immediate action since they are high in the list and indicated in red color.

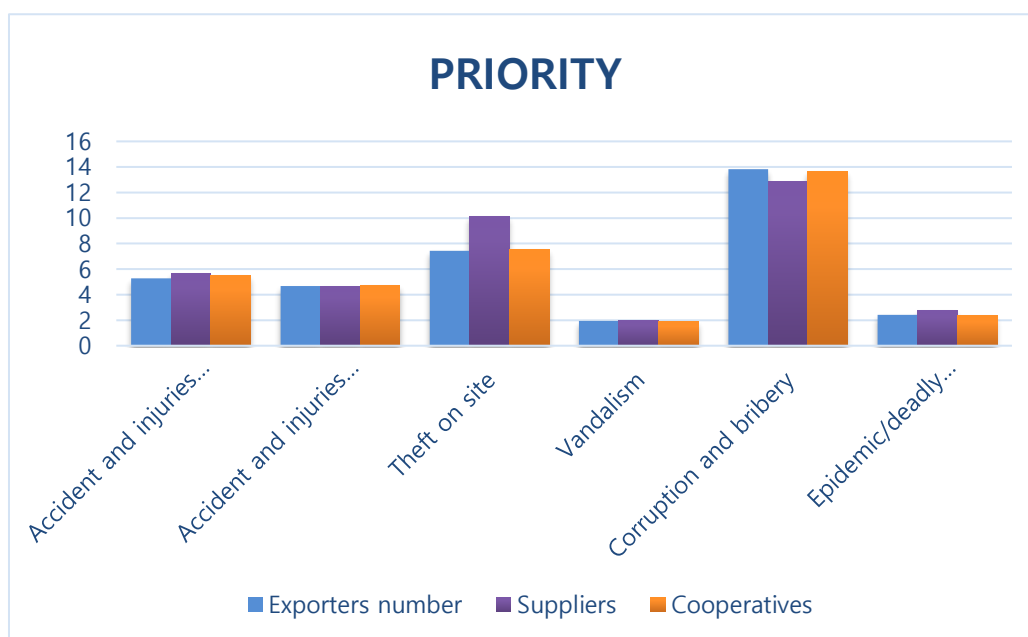


Figure 5.16: Safety and Security risk Priority by Cooperative Unions, Exporters and Suppliers perspective

7 Resource Risks

In Resource Risks category we can see that one risk factor which Unavailability of suppliers/collector low risk is and represented by green color and risks including Availability/shortage of labor and Wastage of material represented by yellow color need a close attention.

Table 5.20: Resource Risks by Cooperative Unions, Exporters and Suppliers perspective

No	Resource Risks	MROV (EP)	MRSV (EP)	PN (EP)	MROV (SP)	MRSV (SP)	PN (SP)	MROV (CUP)	MRSV (CUP)	PN (CUP)
1	Availability/shortage of labor	1.50	2.39	3.59	1.94	2.39	4.64	1.50	2.38	3.57
2	Unavailability of Supplier/collectors	1.28	1.39	1.78	1.63	1.28	2.09	1.25	1.38	1.73
3	Shortage of materials for production	3.17	2.33	7.39	3.19	2.33	7.43	3.13	2.38	7.45
4	Shortage of equipment for production	3.44	3.50	12.04	3.19	3.50	11.17	3.50	3.50	12.25
5	Low product quality	2.83	2.22	6.29	3.44	2.17	7.47	2.88	2.25	6.48
6	Lack of maintenance for equipment	2.11	3.72	7.85	2.81	3.61	10.14	2.13	3.63	7.73
7	Transportation problem due (spare parts, fuel, maintenance system)	3.61	3.28	11.84	3.25	3.22	10.47	3.63	3.25	11.80
8	Wastage of material	2.50	2.61	6.53	2.50	2.56	6.4	2.50	2.63	6.58

The top significant risks in the ECSC related to the Resource Risks are mainly are Shortage of materials for production, Shortage of equipment for production, Lack of maintenance for equipment, Transportation problem due (spare parts, fuel, maintenance system) and Low productivity risks. Thus, this is an indication that these risks need an immediate action since they are high in the list and indicated in red color.



Figure 5.17: Resource Risks Priority by Cooperative Unions, Exporters and Suppliers perspective

8 Physical/Environmental Risks

In Physical/Environmental Risks category we can see that one risk factor which Flood and earth quake low risk is and represented by green color and risks including Geotechnical fault (contaminated soil) represented by yellow color by all three supply chain actors and need a

close attention.

Table 5.21: Physical/Environmental risks by Cooperative Unions, Exporters and Suppliers perspective

No.	Physical/Environmental Risks	MOV (EP)	MSV (EP)	PN (EP)	MOV (SP)	MSV (SP)	PN (SP)	MOV (CUP)	MSV (CUP)	PN (CUP)
1	Exceptionally adverse climatic condition	3.50	4.44	15.54	3.25	4.50	14.63	3.50	4.50	15.75
2	Difficult landscape	3.44	3.22	11.08	3.25	3.28	10.66	3.50	3.25	11.38
3	Remoteness/accessibility of site	4.00	3.00	12	3.25	3.06	9.95	4.00	3.00	12
4	Flood, earthquake...	1.22	3.89	4.75	1	3.94	3.94	1.25	2.88	3.6
5	Geotechnical fault (contaminated soil)	1.83	4.28	7.83	1.81	4.28	7.75	1.88	4.25	7.99

Exceptionally adverse climatic condition, Difficult landscape and Remoteness/accessibility of site risks will strongly affect the overall performance of the chain. Similarly, as indicated in Table, the top significant risks in the ECSC related to the Resource Risks are mainly due to the above red colored risks. Thus, this is an indication that these risks need an immediate action since they are high in the list and indicated in red color.

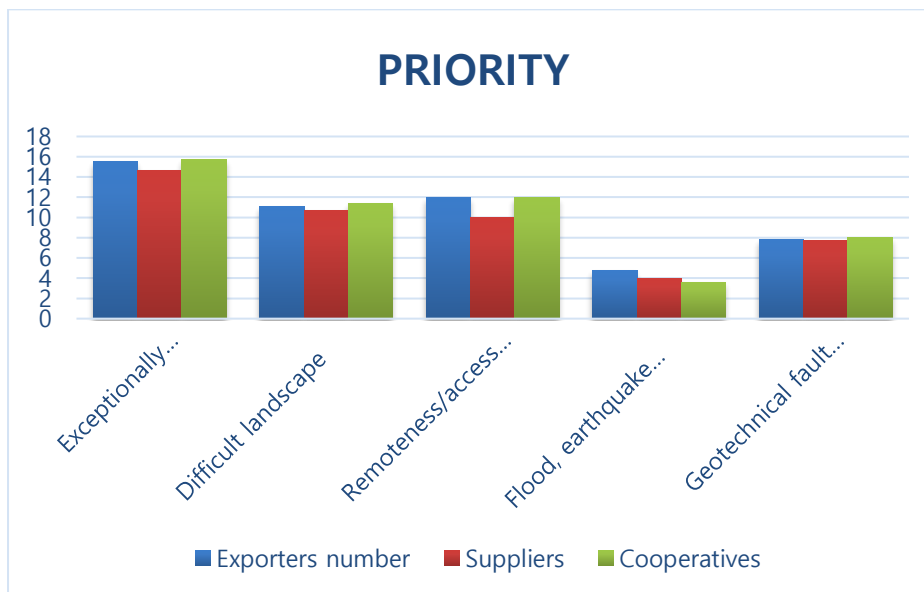


Figure 5.18: Physical/Environmental Risks Priority by Cooperative Unions, Exporters and Suppliers perspective

9 Farm Risk

In Farm Risks category we can see that none of risk factor are low risk and risks including Aging trees, Poor harvesting methods, shifting to other product, Contamination coffee and finally Lack of proper storage with adequate facilities represented by yellow color and need a close attention.

Table 5.22: Farm Risk by Cooperative Unions, Exporters and Suppliers perspective

No.	Risk Factor	MOV (EP)	MSV (EP)	PN (EP)	MOV (SP)	MSV (SP)	PN (SP)	MOV (CUP)	MSV (CUP)	PN (CUP)
1	Aging trees	3.14	2.99	9.39	2.58	1.54	3.97	2.94	2.95	8.68
2	Pest and disease (coffee wilt, coffee borer leaf rust, others)	4	4.64	18.56	3.14	4.26	13.38	3.9	4.44	17.32
3	Poor harvesting methods	3.25	3	9.75	2.97	2.1	6.237	2.9	3.2	9.28
4	Shifting to other product	2.45	4.11	10.07	2.54	3.87	9.83	2.12	3.65	7.74
5	Contamination coffee	1.55	4.5	6.98	2	4.15	8.3	2	3.90	7.8
6	Lack of proper storage with adequate facilities.	2.94	3.1	9.11	3.12	2.92	9.11	2.36	3.33	7.86
7	Low productivity	4.39	4.17	18.31	3.44	4.17	14.35	4.38	4.13	18.09

Pest and disease (coffee wilt, coffee borer leaf rust, others) and Low product quality risk will strongly affect the overall performance of the chain. Similarly, as indicated in Table, the top significant risks in the ECSC related to the Resource Risks are mainly due to the above red colored risks. Thus, this is an indication that this risk need an immediate action since they are high in the list and indicated in red color.

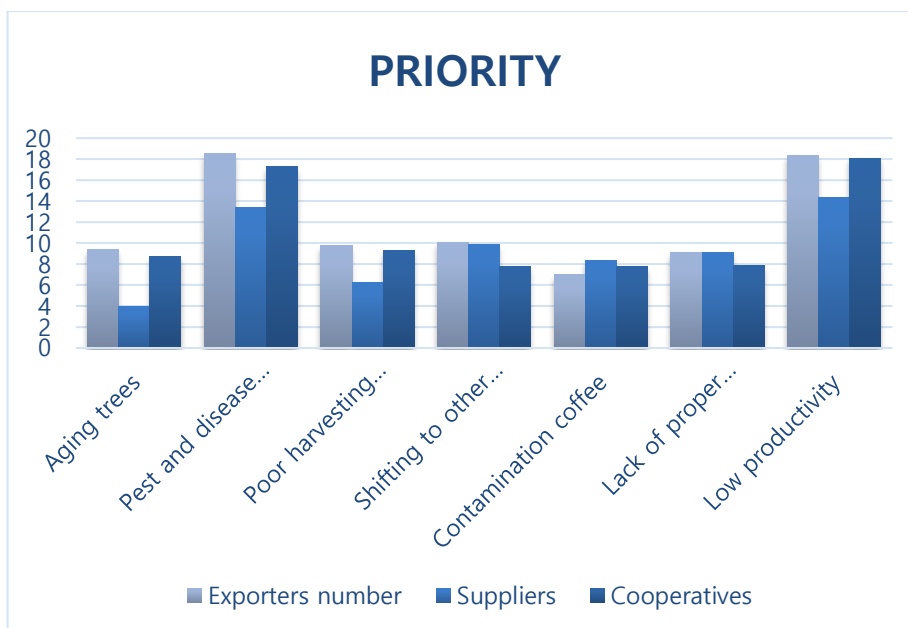


Figure 5.19: Farm Risk Priority by Cooperative Unions, Exporters and Suppliers perspective

Major risk factor (Cooperative Unions, Exporters and Suppliers perspective)

From the table below, we can see that major risk factors ranked based on Cooperative Unions, Exporters and Suppliers Perspective. Market volatility is higher (20.2) risk factor and ranked first and the minimum risk factor

Table 5.23 Major risk factor from Cooperative Unions, Exporters and Suppliers perspective

No.	Resource Risks	Exporters	Rank	Suppliers	Rank	Cooperative Unions	Rank
1	Market volatility	20.2	1	18	1	19	1
2	Cash flow problems	9.84	-	10.47	20	9.75	-
3	Poor product handling on site	17.13	4	16.88	2	17	4
4	Poor documentations	15.10	8	15.36	6	15	9
5	Poor provision of information to partners	12.22	16	12.92	11	12.68	15
6	Lack of technical and managerial skill of staff	15.29	7	13.85	9	14.52	11
7	Inadequate chain actors experience	6.88	-	11.29	16	7.04	-
8	Low harmony between chain actors	15.79	5	15.52	5	15.52	6
9	Poor communications and misunderstanding	14.89	11	14.36	7	15.52	6
10	Destructive relation among supply chain actors	14.04	13	11.90	14	13.58	13
11	Poor material management and planning	9.3	-	11.05	18	9.08	-
12	Corruption and lack of respect for law	12.78	15	11.66	15	12.93	14
13	Bureaucracy in government agencies	14.25	12	12.64	13	14.55	11
14	Corruption	17.38	3	16.63	3	17	4
15	Political unrest (blockade, Protests...)	15.02	9	13.30	10	14.88	10
16	Lack of clear understanding of contract document by all stakeholders	6.42	-	10.11	24	6.48	-
17	Theft	7.42	-	10.12	23	7.57	-

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18	Contraband	13.83	14	12.85	12	13.61	12
19	Shortage of equipment for production	12.04	17	11.17	17	12.25	16
20	Lack of maintenance for equipment	7.85	-	10.14	22	7.73	-
21	Transportation problem due (spare parts, fuel, maintenance system)	11.84	19	10.47	20	11.80	18
22	Low productivity	18.31	2	14.35	8	18.09	3
23	Exceptionally adverse climatic condition	15.54	6	14.63	6	15.75	8
24	Difficult landscape	11.08	20	10.66	19	11.38	19
25	Remoteness/accessibility of site	12	18	9.95	-	12	17
26	Pest and disease (coffee wilt, coffee borer leaf rust, others)	15	10	16.31	4	18.24	2
27	Shifting to other product	10.7	21	9.83	-	7.74	-

Source: Author computation

Lack of clear understanding of contract document by all stakeholders is ranked 24 and scored 10.11. The above risks have high impact on the coffee supply chain which represented by red color in each category and need an immediate mitigation action.

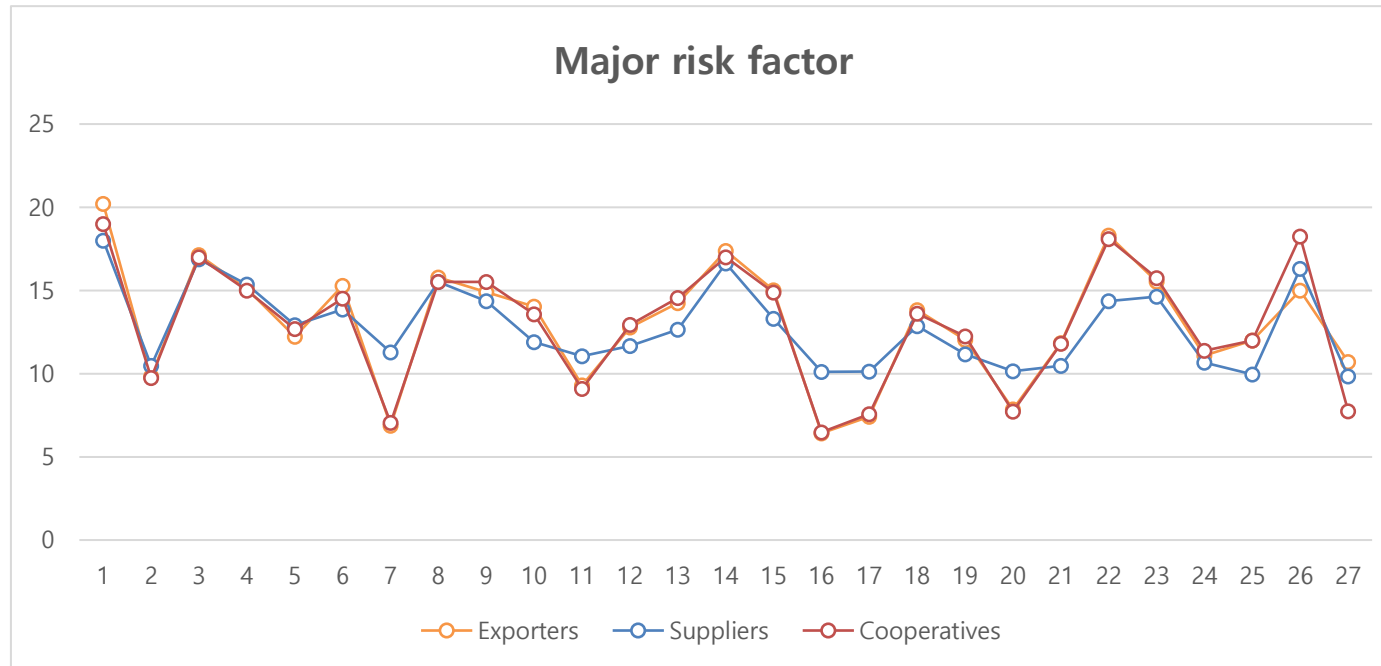


Figure 5.20: Major risk factor from Cooperative Unions, Exporters and Suppliers perspective

5.2.4 Cause and Effect Diagram

Root cause diagram was developed using major risk categories as seen on figure above. The figure 5.21 shows that, the major risk categories including, Financial and Economic Risks, Technical, Personal and Managerial, Resource, Governmental and Political, Contract and Legal, Safety and Security, Environmental risks and Farm risk are the main risk contributors to the vulnerability of the Ethiopian coffee supply chain.

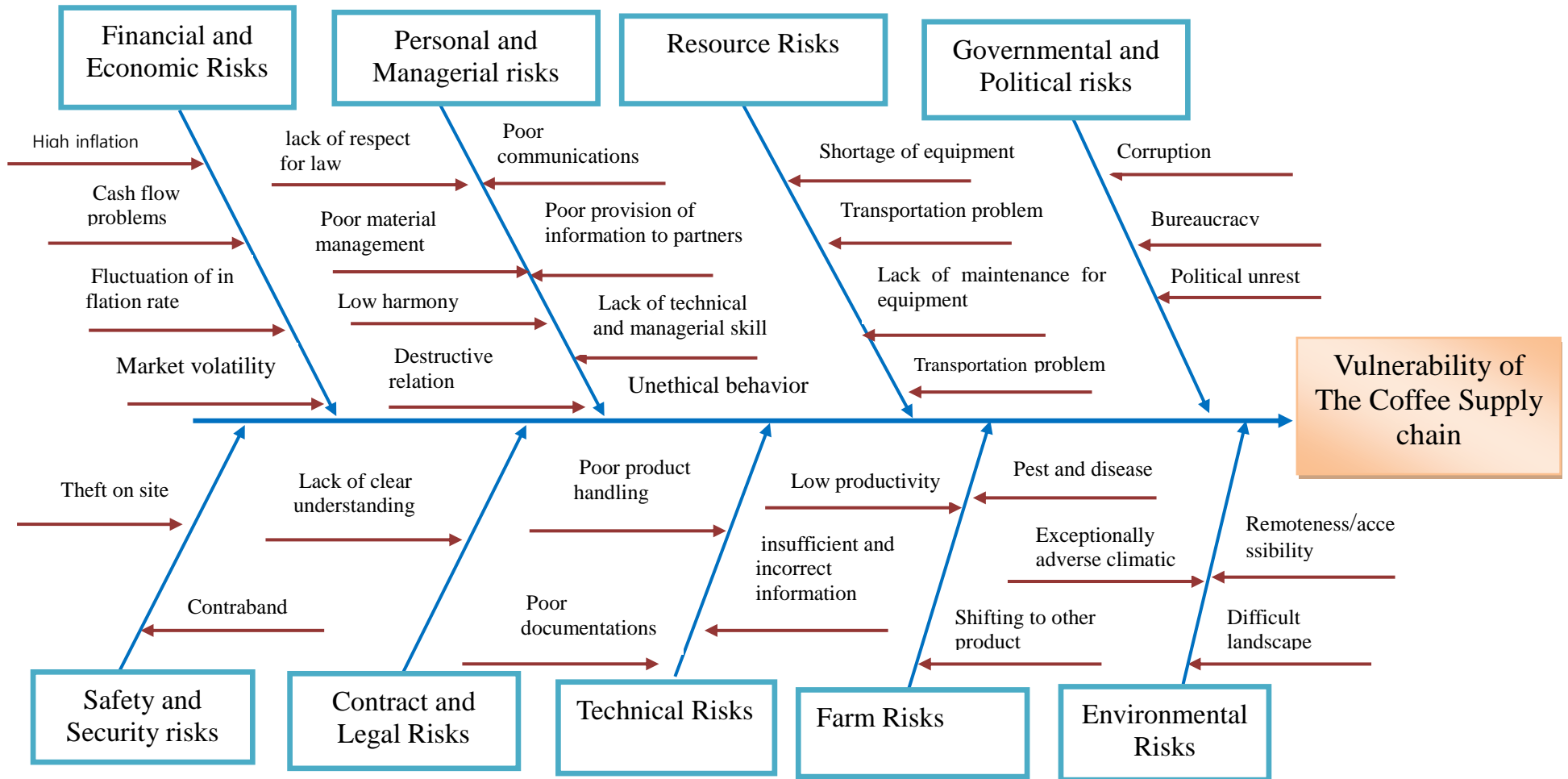


Figure 5.21: Fish bone diagram for major risks

Financial and Economic Risks

- ✓ High Inflation
- ✓ Market volatility
- ✓ Cash flow problems

Personal and Managerial risks

- ✓ Poor provision of information to partners
- ✓ Unethical behavior/practice
- ✓ Lack of technical and managerial skill
- ✓ Inadequate chain actors experience
- ✓ Low harmony between chain actors
- ✓ Destructive relation among supply chain actors

Governmental and Political risks

- ✓ Bureaucracy in government agencies
- ✓ Corruption
- ✓ Political unrest (blockade Protests...)

Safety and Security risks

- ✓ Theft
- ✓ Contraband

Environmental Risks

- ✓ Exceptionally adverse climatic condition
- ✓ Remoteness/accessibility of site
- ✓ Difficult landscape

Technical Risks

- ✓ Poor product handling
- ✓ Poor documentations
- ✓ insufficient and incorrect information
- ✓ Poor material management and planning
- ✓ Corruption and lack of respect for law
- ✓ Poor equipment management and planning

Contract and Legal Risks

- ✓ Lack of clear understanding of contract document by all stakeholders

Farm Risk

- ✓ Pest and disease (coffee wilt coffee borer leaf rust others)
- ✓ Low productivity

Resource Risks

- ✓ Shortage of materials for production
- ✓ Shortage of equipment for production
- ✓ Lack of maintenance for equipment
- ✓ Transportation problem due (spare parts fuel maintenance system)

+ Financial and Economic Risks

Due to high inflation rate in recent years, price declination and problem in cash distribution resulted challenge for most farmers to meet their basic household needs. This causes farmers to shift to other cash crops such as chat and exporters to leave the sector.

+ Technical Risks

Poor coffee handling during harvesting, storing and transporting is the main cause for poor quality coffee. Poor documentation, poor material and equipment planning and insufficient/incorrect information are among major technical risks.

+ Personal and Managerial

According to respondents the main causes for personal and managerial risk are poor provision of information to partners, unethical practice and inadequate experience. These risks lead to low harmony and destructive relation among chain actors.

+ Resource Risks

Shortage of material like seed for replantation, shortage of land for plantation and natural fertilizer are among the main cause for resource risk for farmers and shortage of production equipment and transportation is becoming the challenge for processors, cooperative unions and suppliers. This transportation related problems arises from lack of capacity, lack of spare parts for vehicles, difficult land scape and lack of proper maintenance.

+ Governmental and Political Risks

The resent political unrest in the country is the main reason for this risk factor to be among the major risk factor which cause suppliers and cooperative unions unable to deliver the product.

+ Contract and Legal

Lack of clear understanding of contract document which have a direct link to personal risks is the only risk factor from contract and legal category. This risk is caused by lack of educational background, unclear contract draft and lack of clear guide line.

+ Safety and Security

Illegal trade in smuggling coffee out of the country and for internal consumption deprive

the Ethiopian government of tax revenue and foreign currency. In Recent years theft of coffee from store and during transit become a major concern for coffee processors and suppliers.

Environmental Risks

Farm remoteness and difficult land scape creates a major problem for farmers to sale and collectors to collect the coffee. Exceptionally adverse climatic condition is cause for low productivity and poor product coffee quality especially for Arabica coffee since its sensitivity for small climate change.

Farm Risk

Among other risks low or poor productivity and pest and disease like coffee wilt, coffee borer leaf rust are the main causes for farm related risk.

5.2.5 Casual Loop diagram

Since the cause and effect diagram does not represent an initial overall causal loop diagram (CLD) for 32 major risk factors in coffee supply chain has been developed. A CLD is a system thinking tool which helps the stakeholders to conceptualize the real world for understanding the patterns of behavior and interactions between all the, therefor by using system dynamics (which is casual loop diagram) we can identify how different factors affect one another components (variables) of the system (Maani, 2013)

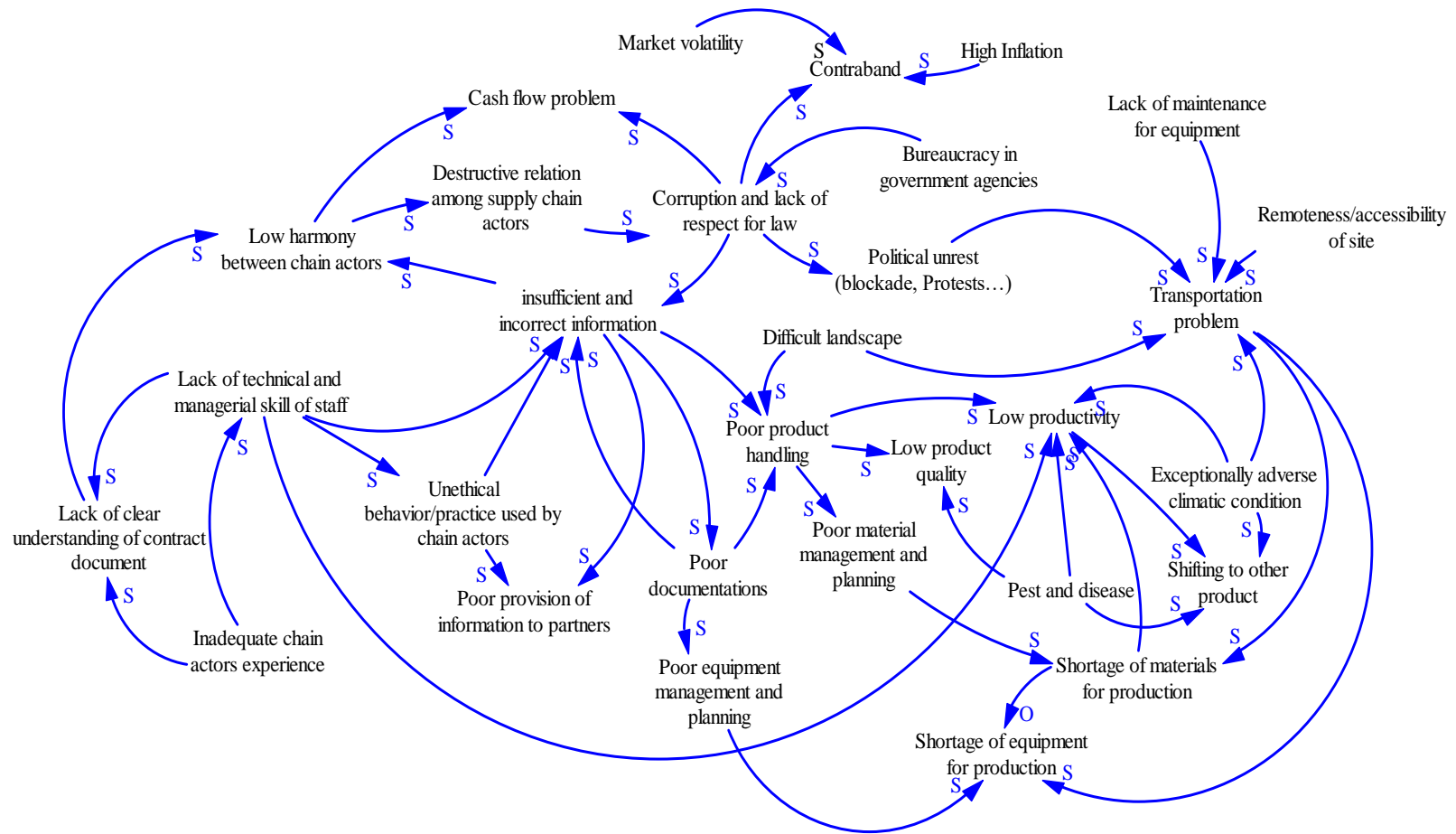


Figure 5.22: Relationships between a set of major risk variables (or factors)

In a CLD, the arrows indicate the direction of influence that connects the different variables (what affects a particular variable and what does this variable affect/cause), and ‘S’ and ‘O’ signs indicate the type of influence. The ‘S’ indicates that a pair of variables change in the same direction. An ‘O’ symbolizes that change is taking place in an opposite direction, but in our case out of 32 major risk factors 30 of them are change in the same direction.

A conceptual model of Ethiopian coffee supply chain major risks was developed from information (variables) obtained in relevant literature and from interviewing with experts. The variables were linked to each other through arrows indicating causes and effects of the different variables. The resultant CLD described the current coffee production situation of the coffee chain (as was found through literature study and interview with experts).

The final CLD has been organized into one FTD which is productivity since it is affected by five risk factors and two cause tree diagrams for inefficient and incorrect information, and lack of technical and managerial skill because the two risk factors affect four risk factors each. These risk factor representing a major theme.

Low Productivity

productivity of coffee is usually the single largest contributor to the production performance of coffee beans which can increases living standard of farmers and raise national productivity as well.

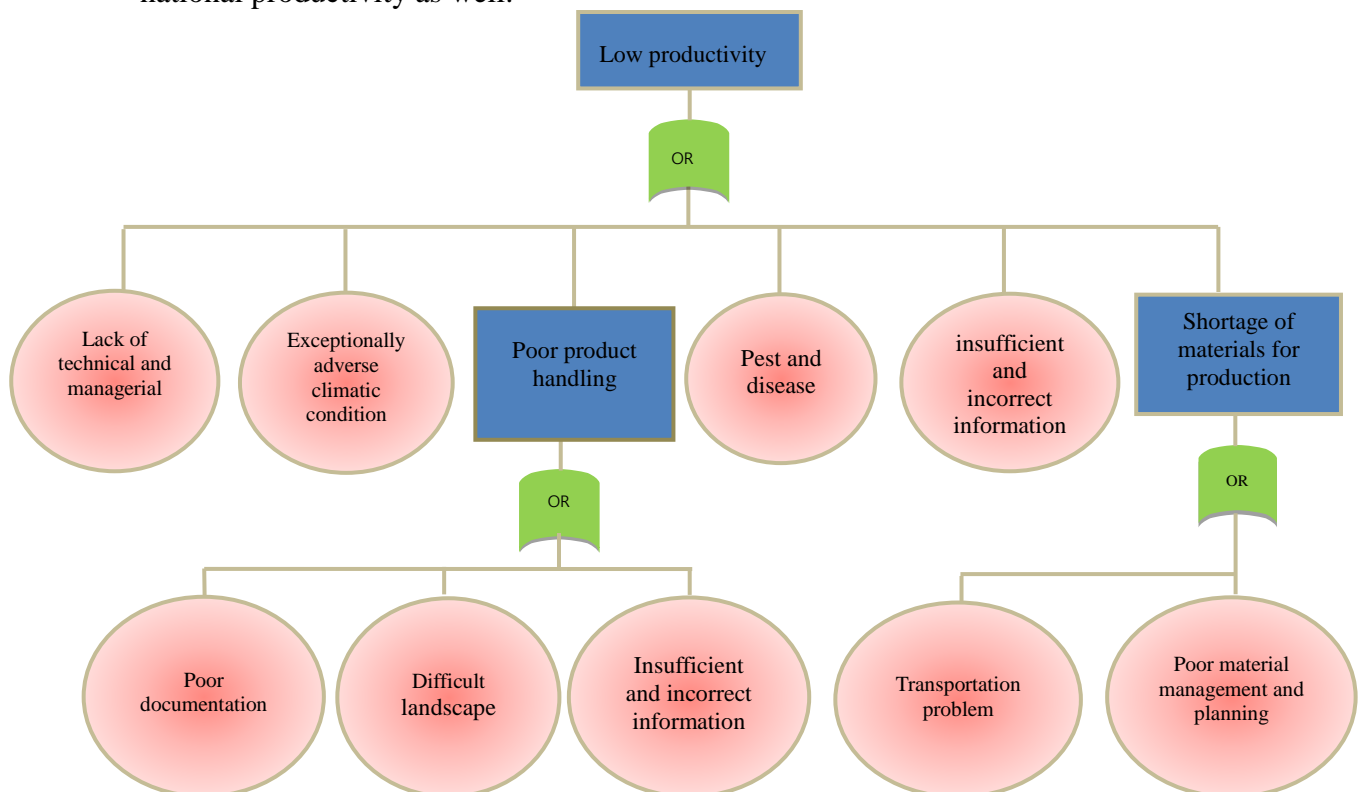


Figure 5. 23: Fault Tree Diagram *Source: Author computation*

However, the productivity of coffee cherries is affected by many different factors including Lack of technical and managerial skill of staff, Exceptionally adverse climatic condition, Pest and disease, Poor product handling and Shortage of materials for production.

Therefore, if root cause factors like insufficient and incorrect information, Difficult landscape, Poor documentations, soil fertility, Poor material management and planning and Transportation problem are changed, the quality of the coffee cherries will also be changed (see Figure 5.23).

✚ Lack of technical and managerial skill

If Lack of technical and managerial skill of farmers and managers in the coffee sector change factors in first level like insufficient and incorrect information, Lack of clear understanding of contract document, Low productivity and Unethical behavior/practice will change in the direction.

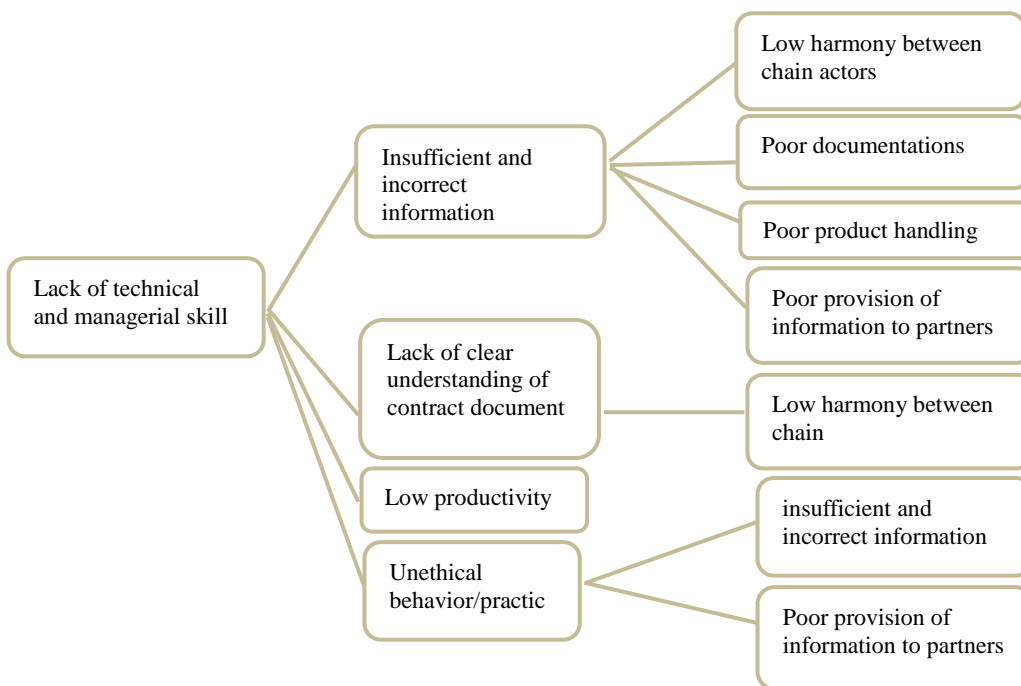


Figure: 5.24 Cause Tree Diagram for Lack of technical and managerial skill

Source: Author computation

Changing or improving these factors in second level will eventually improve Low harmony between chain actors, Poor documentations, Poor product handling, Poor provision of information to partners, Low harmony between chain, insufficient and incorrect and Poor provision of information to partners. Therefore, if the government focuses in improving the technical and managerial skill of farmers and managers will also improving the above ten factors (see Figure 5.24).

Insufficient and incorrect information

If Insufficient and incorrect information along coffee supply chain improved, then factors in second level like Low harmony between chain actors, Poor documentations, Poor provision of information and Poor product handling will be improved.

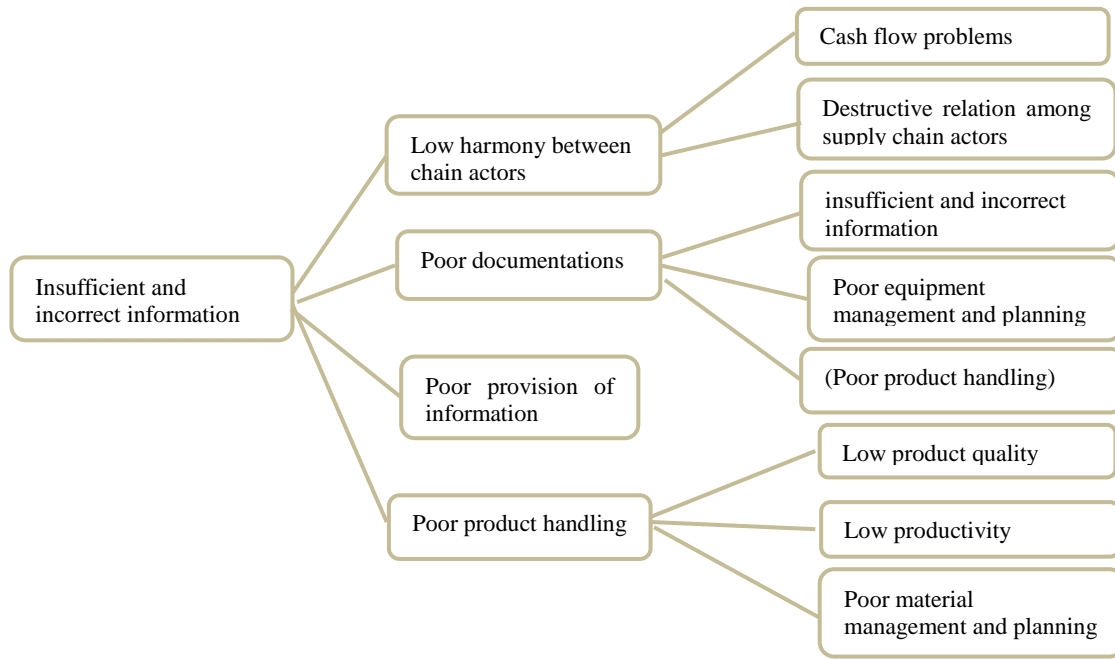


Figure 5.25: Cause Tree Diagram Insufficient and incorrect information

Source: Author computation

Changing or improving these factors in second level will eventually improve Cash flow problems, Destructive relation among supply chain actors, insufficient and incorrect information, Poor equipment management and planning partners, (Poor product handling), Low product quality, Low productivity and Poor material management and planning, (see Figure 5.25).

5.3 Proposed Mitigation Actions

The ultimate purpose of risk identification and analysis is to prepare for risk mitigation. Mitigation includes reduction of the likelihood that a risk event will occur and/or reduction of the effect of a risk event if it does occur. This section discusses the possible risk mitigation planning and describes approaches to reducing or mitigating risks.

The risk mitigation process forms a closed loop in the framework for SCRM. For each risk type, the probable mitigation strategy is suggested. The risk mitigation option could vary depending upon the nature of risk and decision making. Risk transfer, risk sharing, risk avoid and risk accept are the decision-making options and they depend very much on the behavior of the Risk and Managers in the organization.

Table 5.24: Proposed Mitigation

No.	Risks	Most Affected	Proposed risk Prevention/Reduction Action
1	High Inflation	Farmers	Incentive action/tax reduction
2	Market volatility	Exporters/Farmers	Contractual agreements
3	Cash flow problems	All	Contractual agreements
4	Poor product handling	Farmers	Capacity building/Process Standardization/ Trainings
5	Poor documentations	Cooperatives/Exporters/Suppliers	Capacity building/ Outsourcing/ Trainings
6	Insufficient and incorrect information	All	Capacity building/ Recruitment of good managers
7	Poor provision of information to partners	All	Stricter guidelines /Contractual agreements
8	Unethical behavior/practice used by	All	Prosecution of fraudulent activities/Stricter

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	chain actors		guidelines/ Contractual agreements
9	Lack of technical and managerial skill of staff	Suppliers/Cooperative/Exporters	Capacity building/ Recruitment of good managers/ Trainings
10	Inadequate chain actors experience	Suppliers/Cooperative/Exporters	Capacity building /Recruitment of good managers/Outsourcing/ Trainings/Mentoring/Stricter guidelines
11	Low harmony between chain actors	All	Contractual agreements
12	Destructive relation among supply chain actors	All	Prosecution of fraudulent activities/Stricter guidelines/ Contractual agreements
13	Poor material management and planning	Suppliers/Cooperative	Capacity building Recruitment of good managers
14	Corruption and lack of respect for law	All	Prosecution of fraudulent activities/Stricter guidelines/ Contractual agreements
15	Poor equipment management and planning	Suppliers/Cooperative	Capacity building/ Recruitment of good managers//Outsourcing/trainings/Mentoring
16	Bureaucracy in government agencies	All	Trainings/ Clear Contract guidelines
17	Corruption	All	Trainings /Prosecution of fraudulent activities
18	Political unrest (blockade, Protests...)	All	
19	Lack of clear understanding of contract document by all stakeholders	All	Trainings/ Clear Contract guidelines
20	Theft	Suppliers/Cooperative	Insurance/Stricter guidelines
21	Contraband	Exporters	Stricter guidelines/ Contractual agreements /Prosecution of fraudulent activities
22	Shortage of materials for production	Suppliers/Cooperative	Capacity building /Contractual agreements
23	Shortage of equipment for production	Suppliers/Cooperative	Capacity building/out sourcing
24	Low product quality	Suppliers/Cooperative	Product

			standardization/Process Standardization
25	Lack of maintenance for equipment		Capacity building
26	Transportation problem due (spare parts, fuel, maintenance system)	Suppliers/Cooperative	Catastrophic Insurance
27	Low productivity	Farmers	Capacity building/Process Standardization
28	Exceptionally adverse climatic condition	Farmers	Insurance
29	Remoteness/accessibility of site	Farmers/Suppliers	Alternate options
30	Difficult landscape	Farmers/Suppliers	Insurance
32	Pest and disease (coffee wilt, coffee borer leaf rust, others)	Farmers	Insurance
32	Shifting to other product	Suppliers/Cooperative	Capacity building/ Extra tax on other product

Contractual agreements

A supply chain contract is a coordination mechanism to integrate chain partners and also can improve both operational efficiency and supply chain coordination which mitigate Cash flow problem, Contraband, Destructive relation among supply chain actors, Shortage of materials for production, Unethical behavior/practice used by chain actors, Poor provision of information to partners.

Coffee market volatility (Demand and pricing uncertainties) are associated with many causes; For example, exchange rate movements, uncertainty of supply and demand, political turmoil, environmental influences and the changing preferences of consumers. A risk sharing contract incorporates not just quantity flexibility but also includes a price flexibility option (to mitigate price volatility); by negotiating the costs for the committed quantity through contract negotiation.

- ✓ Revenue sharing contracts are suitable for low price uncertainty to accommodate demand volatility between the coffee supply chain.
- ✓ Support from the private sector includes services that were embedded in trading relationship such as no interest advance payment on coffee purchases.

+ Trainings/Mentoring/ Outsourcing

Effective training can turn risk into a competitive advantage. Training should be viewed as a business decision that requires input from various positions within the organization. Rolling out a training program is not the individual responsibility of human resources. Rather, it's a by-product of collaboration and involvement from stakeholders in the coffee supply chain, business leaders, training managers and subject matter experts.

Identifying areas of risk that could adversely impact the business is a critical part of planning high consequence training.

- ✓ Investments in technical assistance. Good practices in production, harvesting, and wet-milling are essential for delivery of quality coffee to the processor-exporters.
- ✓ Extensions programs can be deployed to assist households in coffee production and post-harvest management, estimating and monitoring coffee production and carrying out training on various social subjects such as gender promotion.

Outsourcing includes Consider shifting some jobs to contract or custom labor; may provide a lower cost alternative, Specific tasks can be assigned to contract workers, may outsource human resource administration.

+ Recruitment of good managers

Farmers' cooperative unions and exporters can reduce and if possible avoid the major risks by recruiting managers those focuses on considering all five Steps in the Risk Management Framework and assessing the effectiveness of various risk management and mitigation strategies on firm and supply chain performance, then supply chain risk management will continue to improve for the firm.

+ Prosecution of fraudulent activities/ Stricter guidelines

- ✓ All actors in the coffee chain, institutes and specially the government should coordinate in combating corruption and fraudulent activities in the sector through strict guidelines and by prosecuting the participants.
- ✓ Since coffee sector is the main source of foreign currency, the government should

organize an institution which only focuses in combating fraudulent activities and in anti-corruption training programs in the coffee sector.

- ✓ The highest degree of transparency, accountability, legal compliance as well as the principles of good governance, sound financial management, sustainable development, gender equality and equal opportunities should be applied. The government have to exercise zero-tolerance towards corruption.

Capacity building

Forming sustainable value chain links between smallholder farmers and buyers of coffee products typically requires long-term support in building the capacities of producer organizations.

- ✓ provision of technical assistance to members, for both conventional and organic production;
- ✓ provision of short and long term credit to members for coffee production, the renewal of coffee plantations following the crisis, and for upgrading wet-milling infrastructure;
- ✓ Quality and productivity enhancement, including construction of a cupping laboratory, soil and water analysis, training program for extension agents, and construction of an organic fertilizer production plant.
- ✓ Addressing indicators of poverty beyond coffee, including provision of health and educational supplies to house hold farmers, as well as support for education and training in cooperative leadership.
- ✓ NGOs and non for profit lending organizations can provide technical and financial support aimed to address the negative implications of the coffee crisis through the building of relationships in certified coffee markets.

(1) Human capital: networking building with external stakeholders, development of technical skills for coffee production.

Strong professional management supported by strong institutional linkages.

Strong technical capacity for coffee production, processing, and certification.

(2) Social capital: reciprocity in value chain relationships with coffee buyers, investments in governance skills.

Significant support to membership through provision of social services enhances the sense of belonging.

(3) Physical capital: investments in machinery and infrastructure for primary

production and value addition.

Substantial addition to infrastructure for coffee storage and processing.

(4) Financial capital: loan repayment and provision of member finance.

Considerable loan repayment giving greater financial stability and reduced indebtedness

Effective provision of essential longer-term loans

Process and Product standardization

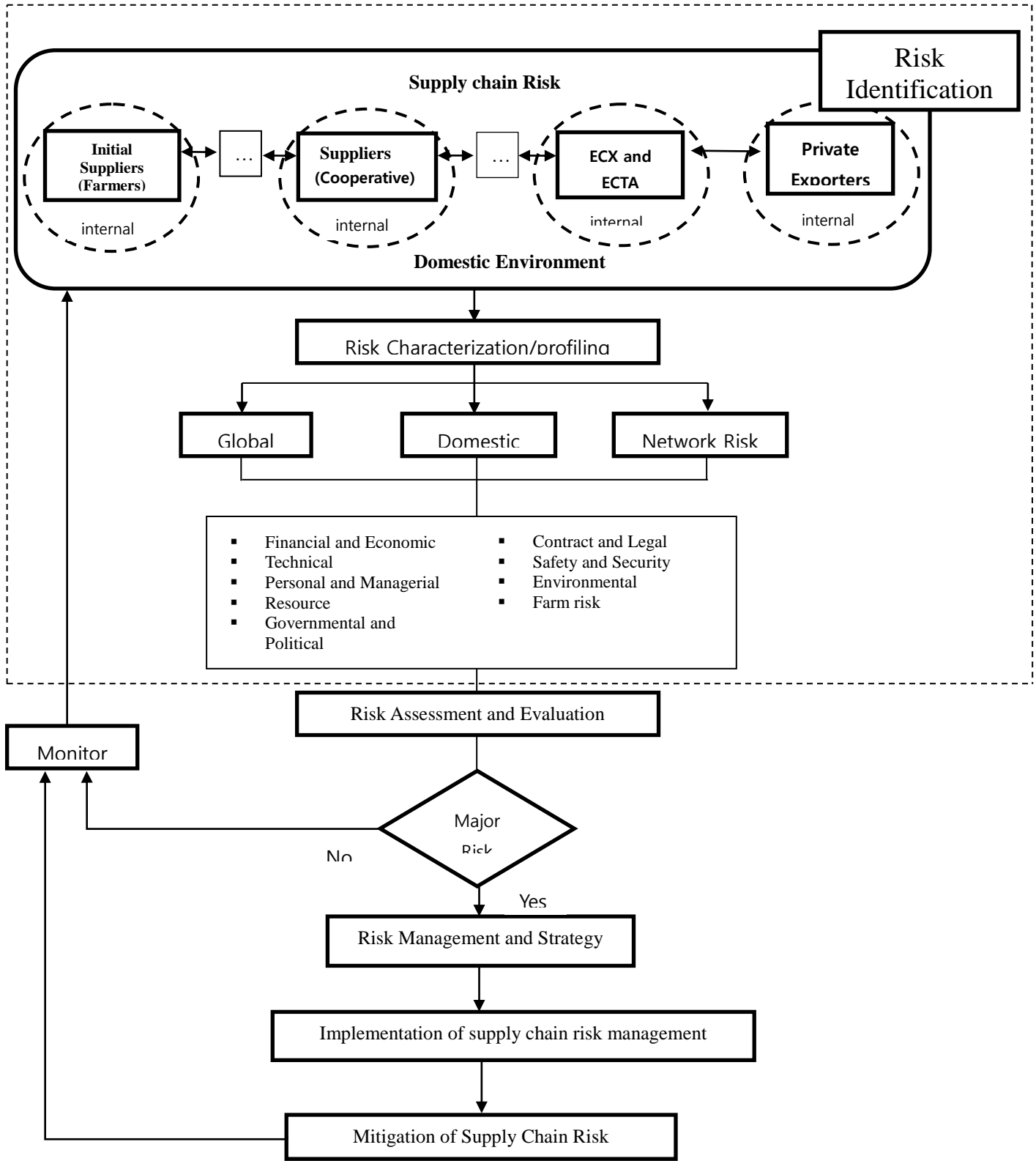
The risk in coffee sector can be mitigate and managed through internal Standard Operating Procedures, which provide a coherent and coordinated approach to risk management by clearly specifying the tasks and responsibilities of each personals and staff in processing, handling, stoking and transporting coffee. By applying Process and Product standardization the following risks can be mitigate;

- ✓ Low product quality risk
- ✓ Low productivity risk
- ✓ Poor product handling risk

Insurance

Farmers, suppliers and cooperative unions need to work with licensed insurance providers and create a plan to use insurance to mitigate risk like Transportation problem, Exceptionally adverse climatic condition, Difficult landscape and Pest and disease. And in addition, mapping the coffee supply chain and its risks should help to determine places where it makes sense to Implement insurance.

5.4 Proposed Framework for Risk Management and Mitigation for Ethiopia coffee Supply Chain



The proposed Mitigation framework was developed based on ISO/IEC32010, 2009 discussed in the literature section. The frame work contains five steps which are risk identification, risk assessment and evaluation, risk management and strategy

Figure 5.26: Risk management and Mitigation Framework

which contain four risk management strategies (Avoidance, control, Flexibility and Coordination), implementation of supply chain risk management; this step shows the enablers (Complexity Management, Information Systems and Organizational Learning) that can be used for implementation of risk management and finally step five Mitigation of supply chain risks.

Step 1: Risk Identification

Risk identification is taken at both domestic and global levels and in the context of Financial and Economic Risks, Technical, Personal and Managerial, Resource, Governmental and Political, Contract and Legal, Safety and Security and Environmental risks. The global environment includes various supply chain partners, and how the environments in these different chain actors interact with each other.

In this first step of the risk management framework, the goal is to create what can be referred to as a “profile” for each of the risks identified. The risk profile holds elements of the specific risk within the wide category, whether the risk is, quantitative and/or qualitative, and affects domestic and/or global operations (Table 5.24).

Table 5.25: Creating Risk Profiles

Broad Risk Category	Description(s) of Specific Risk(s)	Quantitative/Qualitative	Domestic/Global/Both
Financial and Economic Risks			
Technical Risks			
Personal and Managerial			
Resource Risks			
Governmental and Political Risks			
Contract and Legal			
Safety and Security			
Environmental Risks			
Farm risk			

Step 2: Risk Assessment and Evaluation

Table 5.26: Risk Assessment and Evaluation

Process identification	Potential failure	Potential of failure	Severity Rating (S)	Potential cause of failures	Occurrence rating(O)	Risk priority number RPN=S*O	Recommended Actions	Responsibility and target data	Action taken
What is the process/function	What can go wrong	What is the impact if failure happen	A rating corresponding to the seriousness of a potential failure (1-5)	What cause the failure to happen	A rating corresponding to the Rate a failure can occur (1-5)	For a given potential failure, how bad the outcome is multiplied by how likely it would actually happen	What action can be taken to reduce occurrence or improve or impact	Who is responsible for the actions taken and when shall it be completed	What action taken
Transportation	Loading performed gone badly	Coffee damaged	4	Lack of experience	3	12	Review and improve loading method		
	Improper transportation	Coffee is damaged/contaminated	2	Lack of awareness	2	4	Review and improve transportation and handling method		
				Negligence					
Loading performed gone Badly	Coffee damaged	3	Lack of experience	4	12	Review and improve unloading method			

Step 3: Risk Management Strategy Selection

After assessing and evaluating the risks, the next step is to select right strategies to manage the risk. Risk management strategies are aim toward reducing the likelihoods of losses associated with risk events. The assessment of risk in Step 2 provides the list of critical risks for which risk management strategies need to be planned. The following are the possible risk management strategy.

Table 5.27: Selected Risk Management Strategies

List Risks	Major risks	Selected Risk Management Strategies
Financial and Economic Risks		
Technical Risks		
Personal and Managerial		
Resource Risks		
Governmental and Political Risks		
Contract and Legal		
Safety and Security		
Environmental Risks		
Farm Risk		

Step 4: Implementation of Supply Chain Risk Management Strategy

Implementation of strategies for risk management requires certain structural, and/or procedural changes in harmony with the supply chain. Strategy implementation requires commitment, discipline, leadership, creativity, and superior execution skills (Freedman 2003). And identifies reducing complexity as one of the key activities in strategy implementation.

One way of managing complexity in supply chains is to make them more flexible. Upton (1994) defines flexibility as “the ability to change or react with little penalty in time, effort, cost or performance.” Flexibility must be a key component of any supply chain system to achieve time objectives (Hise 1995). Flexibility is important in any supply chain because it plays a facilitating role in the coordination process and provides a unique ability to help firms manage the high levels of environmental and operating uncertainty. Firms that achieve higher levels of flexibility significantly outperform their less flexible counterparts (Fawcett, Calantone, and Sheldon 1996). Flexibility positively impacts not only the firm’s ability to extend its global reach but also its ability to enhance comparative performance relative to leading industry competitors.

Other important factors affecting strategy implementation are organizational learning, information systems, and performance metrics. Organizational learning facilitates risk identification and assessment. Organizational learning – promoting an ongoing stream of dialogue and inquiry, analyzing mistakes, seeking feedback, communicating, and questioning – affects customer service levels (Ellinger, Ellinger and Keller 2002).

Information technology is important to the implementation of all risk management strategies and for effective management of supply chains and performance measurement (Bowersox 1995). The process of risk management – from identifying risks, through selecting appropriate risk management strategies, and making necessary structural changes in the supply chain – is an information-intensive process. The challenge is the ability to filter data for the most important information.

Step 5: Mitigation of Supply Chain Risks

Even after planning risk management strategies, all risks cannot be avoided. It is important to plan for situations that assume a risk that could be seriously harmful could happen. While risk management strategies are used to proactively address the probability of expected events, risk mitigation planning provides a firm with a more mature decision-making process in facing potential unexpected losses caused by unexpected events.

Enablers of risk mitigation

Information is a basic enabler for tight coordination in a supply chain. Risk like Poor communications and misunderstanding between the coffee chain actors can be easily reduced through information sharing and agility should be a main focus among Ethiopian coffee supply chain actors in order to adapt different conditions and environment.

If a supply chain actor wishes to establish its trustworthiness then it must, first find ways for the other partners to see them as trustworthy of demonstrating their commitment to the relationship. second, in order to determinedly reduce mistrust in existing relationships, supply chain actors must continually draw their attention to the benefits, which arise due to a certain degree of trust between parties.

Collaborative relationships among the coffee supply chain partners a key enabler to manage and mitigate risks and requires attention by all stockholders and by the government. To persuade supply chain partners to behave in ways that are best for everybody, companies have to create or modify financial incentives. Aligning incentives and revenue sharing policies in a coffee supply chain requires a special participant of cooperative unions, suppliers and exporters.

Managers in the coffee should consider two things when they begin to construct a supply-chain risk management strategy. First, they must create a shared, organization wide understanding of supply-chain risk and secondly, they must determine how to adapt general

risk-mitigation approaches.

Since risk impact in other particular point in the network affect all actors in the coffee supply chain, actors in the coffee chain should not only focus on their own risks: they must also focus on risks in other links in their supply chain.

There are many different forms of supply chain risks which can be divided into different classes according to how its recognition impacts on the coffee chain and its environment, in this thesis the risks divided in nine groups. Improved understanding about coffee related risks in a coffee supply chain helps to make better decisions and decreases the risks of both a single actor and a whole network. The government should play a major role in improving knowledge about risks in the coffee supply chain.

Coffee sector in which supply chains works are very dynamic, and risks to a coffee supply chain may change due to changes in the different conditions of the environment and so continual monitoring of risks assumes by Ethiopian commodity exchange, Ethiopian coffee and tea authority, cooperative unions, suppliers and exporters is importance.

There is an arrow in the Framework that a feedback exists from Step 5 to Step 1. If the incentive system is such that it rewards only those who achieve the objectives irrespective of the risks, then managers will focus only on the objectives. If, however, managers are rewarded for considering all five Steps in the Risk Management Framework and assessing the effectiveness of various risk management and mitigation strategies on firm and supply chain performance, then supply chain risk management will continue to improve for the firm.

CHAPTER SIX CONCLUSION AND RECOMMENDATION

6.1 Conclusion

This study was initiated with the general objective of analyzing the Ethiopian coffee supply chain risk. The result of the assessment of the supply chain risk indicated that farmers, suppliers, exporters and cooperative are the main actors and ECX involved in the supply chain of Ethiopian coffee.

The study shows that all exporters, Suppliers, Cooperative unions and ECTA does not have a formal risk assessment program, this indicates that the sector is vulnerable to different kinds of risks.

Eighty-one risks are identified through literature review and questioner and categorized into nine groups which are; Financial and Economic risks, Technical risks, Personal/managerial risks, Governmental/political risks, Resource risks, Safety and security risks, Contractual or legal risks, Environmental/physical risks and Finally Farm risks.

The categorized risks analyzed using FMEA tool and the result shows that 32 risk factors are in a red zone which require an immediate action to mitigate those risks. By using system dynamics tool the relationship of the 32 major risk factors was represented and the result shows that risk like insufficient and incorrect information and lack of technical and managerial skill are the main cause for most risk factors.

Depending on the chain actor's perspective major risks are prioritized according to their risk priority number, but Out of 32 major risk factors Cash flow problems, Inadequate chain actors experience, Poor material management and planning, Lack of clear understanding of contract document and Lack of maintenance for equipment are not ranked as major risk factor by all stakeholders. Based on the risk behavior, mitigation decision option was proposed. Finally, Since the supply chain actors does not have risk assessment program; a risk management and mitigation framework were proposed.

6.2 Recommendation

Based on the result found through analysis and conclusion the following recommendation was drawn.

- The risk identified could impact the coffee supply chain actor individually and as well as collectively therefor, the supply chain actors and the government should give a close attention.
- Actor (Suppliers, Cooperative unions, Exporters and ECTA) in the supply chain should organize a risk assessment department in their company which assess and manage risks.
- Based on the result, personal and managerial risk should be given a special attention, since it involves 6 out of 32 major risk factors.
- All the supply chain actors including Ethiopian commodity exchange, Ethiopian coffee and tea authorities should work in coordination to manage the coffee supply chain risks.
- Most of risks identified as a major risk can be easily managed and possibly prevented through creating awareness about the risks, through training and capacity building, therefore the government and the chain actors should focus in these programs.
- Formal contracts should be introduced between the supply chain actors to lower the uncertainty in the chains.
- The government should provide the sector with process standardization in order to minimize poor coffee quality.

6.3 Future Work

Based on the findings from this study, a number of suggestions are put forward for further research.

1. The developed framework highlights the guidelines for implementing supply chain risk assessment. But this framework does not address the implementation barriers, therefore, further research needed to study the implementation barriers with the context of Ethiopian coffee supply chain.
2. Based on system dynamics (casual loop) in depth investigation and analysis can be done for identified major risk factors by using a quantitative data.

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Appendix A

ADDIS ABABA UNIVERSITY
INSTITUTE OF TECHNOLOGY
SCHOOL OF MECHANICAL AND INDUSTRIAL ENGINEERING

Dear Participants;

I would like to extend my deep appreciation if you could spend a few minutes answering the attached questionnaire

I am aware that you are under tremendous business pressure and have very little time for attending this kind of request, but I can guarantee that you will not take more than a few minutes from your time to answer this questionnaire.

I hope you can give your contribution to this research which is an MSc thesis that is being conducted in Addis Ababa Institute of Technology Department of Industrial Engineering. With your participation, I hope to understand, identify, explore and rank the major risk factors which can cause a great danger to the Ethiopian coffee sector.

Thank you for your kind cooperation.
Sincerely,

Semere G/leul
Tel: +251-911-745-802
Email: semugebre@gmail.com

Appendix B

Part I: Personal Details

1. position of the respondent/Role _____
2. professional background _____
3. Educational background _____
4. Experience of the respondent in Coffee market (Years) _____

Likelihood of occurrence (Level of probability): The level of probability of occurrence of risk/loss that might affects the supply chain objectives

Rating	Description	Likelihood of Occurrence
1	Rare	Highly unlikely, but it may occur in exceptional circumstances. It could happen, but probably never will.
2	Unlikely	Not expected, but there's a slight possibility it may occur at some time.
3	Possible	The event might occur at some time as there is a history of casual occurrence in similar institutions.
4	Likely	There is a strong possibility the event will occur as there is a history of frequent occurrence in similar institutions.
5	Almost Certain	Very likely. The event is expected to occur in most circumstances as there is a history of regular occurrence in similar institutions.

Risk Consequence (Severity)

The magnitude of the potential loss is rated from 1 to 5 depending on its impact.

Rating	Description
1	Negligible
2	Minor
3	Moderate
4	Significant
5	Severe

Please rate on the scale 1 to 5 with the following questions which are related to Risk occurrence, Risk consequence of the risk.

1 Financial and Economic Risks

No.	Financial and Economic Risks	Occurrence (O) (1-5)	Severity (S) (0-5)
1	High Inflation		
2	Market volatility		
3	Fluctuation of interest rate		

4	Increase of tax rate		
5	Currency exchange risks/Lack of currency		
6	Delay of bank service		
7	Bankruptcy		
8	Insufficient insurance amount and occurrence		

2 Technical Risks

No.	Technical Risks	Occurrence (1-5)	(O)	Severity (S) (0-5)
1	Poor product handling on site			
2	Mistakes during production			
3	Unclear specifications			
4	Defective workmanship and rework			
5	Poor documentations			
6	insufficient and incorrect information			
7	Insufficient supervision			
8	Late internal approval process			

3 Personal and Managerial Risks

No.	Personal and Managerial Risks	Occurrence (1-5)	(O)	Severity (S) (0-5)
1	Poor provision of information to partners			
2	Lack of personal training and management support			
3	Lack of technical and managerial skill of staff			
4	Inadequate chain actors experience			
5	Low harmony between chain actors			
6	Poor communications and misunderstanding			
7	Destructive relation among supply chain actors			
8	Labor problem and dispute (workers strike)			
9	Clashes (staff)			
10	Poor material management and planning			
11	Poor equipment management and planning			
12	Corruption and lack of respect for law			
13	Protest and interference			

4 Government and Political Risks

No.	Government and Political Risks	Occurrence (1-5)	(O)	Severity (S) (0-5)
1	Excessive procedure by government agencies			
2	Government intervention/political			
3	Changes in laws and regulations			
4	Lack of cooperation from government			
5	Custom and Export restrictions			
6	Change in priority and focus by the Government			

7	Monopolistic chain actor		
8	Political unrest (blockade, Protests...)		

5 Contractual and Legal Risks

No.	Contractual and Legal Risks	Occurrence (O) (1-5)	Severity (S) (0-5)
1	Contract modifications		
2	Mistakes and discrepancy in contract documents		
3	Inappropriate type of contract used		
4	Contract flaws		
5	Unfair and unreasonable requirement or inappropriate risk allocation in contract		
6	Ambiguous conditions of contract (Insufficient details in contract documents)		
7	Lack of clear understanding of contract document by all stakeholders		
8	Long court case		
9	Absence of alternative dispute resolution clauses in the contract		

6 Safety and Security

No.	Safety and Security	Occurrence (O) (1-5)	Severity (S) (0-5)
1	Accident and injuries in production site		
2	Accident and injuries during Transportation		
3	Theft		

7 Resource Risks

No.	Resource Risks	Occurrence (O) (1-5)	Severity (S) (0-5)
1	Shortage of materials for production		
2	Shortage of equipment for production		
3	Low product quality		
4	Transportation problem due (spare parts, fuel, maintenance system)		
5	Wastage of material		

8 Physical/Environmental Risks

No.	Physical/Environmental Risks	Occurrence (O) (1-5)	Severity (S) (0-5)
1	Exceptionally adverse climatic condition		
2	Remoteness/accessibility of site		
3	Flood, earthquake...		
4	Geotechnical fault (contaminated soil)		
5	Low productivity		

9 Farm Risk

No.	Risk Factor	Occurrence (O) (1-5)	Severity (S) (0-5)
1	Aging trees		
2	Pest and disease (coffee wilt, coffee borer leaf rust, others)		
3	Poor harvesting methods		
4	Shifting to other product		
5	Contamination coffee		

Mention if other risk factor existed

No.	Risk Factor	Occurrence (O) (1-5)	Severity (S) (0-5)
1	Cash flow problems		
2	Delay in payment to Supplier/collector/Exporter		
3	Absence of price index		
4	Change in bank formalities and regulations		
5	Poor judgment in estimating time and resource		
6	Underestimation of quantities		
7	Inaccurate prediction of equipment production rate		
8	Change in scope of work		
9	Unethical behavior/practice used by chain actors		
10	Low speed of decision making		
11	Absenteeism (forearm, staff)		
12	Poor labor planning		
13	Bureaucracy in government agencies		
14	Corruption		
15	Third party delays		
16	Local laws		
17	Vandalism		
18	Contraband		
19	Epidemic/deadly diseases		
20	Availability/shortage of labor		
21	Unavailability of Supplier/collectors		
22	Lack of maintenance for equipment		
23	Difficult landscape		
24	Lack of proper storage with adequate facilities.		

Appendix C

Major Risk Factor Relationship

No.	Risks	Affected by
1	High Inflation	
2	Market volatility	
3	Cash flow problems	
4	Poor product handling	
5	Poor documentations	
6	Insufficient and incorrect information	
7	Poor provision of information to partners	
8	Unethical behavior/practice used by chain actors	
9	Lack of technical and managerial skill of staff	
10	Inadequate chain actors experience	
11	Low harmony between chain actors	
12	Destructive relation among supply chain actors	
13	Poor material management and planning	
14	Corruption and lack of respect for law	
15	Poor equipment management and planning	
16	Bureaucracy in government agencies	
17	Corruption	
18	Political unrest (blockade, Protests...)	
19	Lack of clear understanding of contract document by all stakeholders	
20	Theft	
21	Contraband	
22	Shortage of materials for production	
23	Shortage of equipment for production	
24	Low product quality	
25	Lack of maintenance for equipment	
26	Transportation problem due (spare parts, fuel, maintenance system)	
27	Low productivity	
28	Exceptionally adverse climatic condition	
29	Remoteness/accessibility of site	
30	Difficult landscape	
32	Pest and disease (coffee wilt, coffee borer leaf rust, others)	
32	Shifting to other product	

