



Addis Ababa University

College of Business and Economics

Logistics and Supply Chain Management Unit

**The Effects of Supply Chain Integration on Operational
Performance: The case of Ethiopian Commodity Exchange,
ECX**

A thesis submitted to Addis Ababa University school of commerce in
partial fulfillment of the requirements for the award of the degree of
Master of Arts in logistics and supply chain management

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Declaration

I, the undersigned, declare that this thesis entitled “*The Effects of Supply Chain Integration on Operational Performance: The case of Ethiopian Commodity Exchange, ECX*” is my original work and has not been presented for a degree in any other university, and that all the sources of materials used for this thesis have been duly acknowledged.

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Certification

This to certify that Takele Mulat has carried out his thesis work on the topic entitled “***The Effects of Supply Chain Integration on Operational Performance: The case of Ethiopian Commodity Exchange, ECX***” under my guidance and supervision. Accordingly, I hereby assure that his work is appropriate and standard enough to be submitted for the award of Master of Arts in Logistics and Supply Chain Management.

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List of acronyms and abbreviations

AA: - Addis Ababa

ANOVA: - Analysis of Variance

ECX: - Ethiopian Commodity Exchange

HQ: - Head Quarter

OP: - Operational Performance

SCI: - Supply Chain Integration

SI: - Supplier Integration

CI: - Customer Integration

ICT: - Information and Communication Technology

SC: - Supply Chain

SCM: - Supply Chain Management

SPSS: - Statistical Package for Social Sciences

WMS: - Warehouse Management System

Abstract

Over the recent years, supply chain Integration has emerged as a major field of interest that involves the strategic alignment of functions and processes within an organization.

The purpose of this study is to examine the current level of supply chain integration and to analyze its effect on ECX's operational performance. This research conceptualizes and develops the dimensions of supply chain integration (supplier integration, warehouse integration, ICT integration, customer integration and internal integration) and examines with operational performance (OP). The data collection instrument used was a questionnaire which was administrated to a total sample of 147 employees using stratified random sampling techniques. Measured from the dimensions of SCI, it can be concluded that the current level of SCI of the company is moderate. The company has a relatively better internal integration and ICT integration, but its supplier, warehouse and customer integrations are weaker. The result of the analysis also proved that there is strong and significant relationship between supply chain integration and operational performance. The results also indicated that supplier integration had the highest effect on OP, followed by ICT integration and warehouse integration. Customer integration had no direct effect on OP, though. Therefore, for improving OP, the current study recommends improving the components of SCI together as they are strongly interrelated.

Keywords: supply chain Integration, Internal Integration, Customer Integration, Supplier Integration, ICT integration, Warehouse Integration, Operational performance, ECX

Chapter One

Introduction

This chapter contains an overview of the whole part of the study. The contents included here are background of the study, statement of the problem, research questions, and research objectives, significance of the study, delimitation of the study, structure of the paper and definition of key terms /key concepts in sequence.

1.1 Background of the study

Technological advancement in this era and enhancement of communication and transportation lead to globalization which results the change of needs and requirements of customers. As customers need a suitable product in suitable place at suitable time with high quality and suitable cost, organizations would like to compete in recent hyper-market should match with the above mentioned customers' requirements (Saleh, 2015). So as to fulfill the customers' requirements, organizations should improve their operations. Supply chain management is a system that improves all activities which carried out by organization. To be able to grow and survive any organization has to identify its strengths and weaknesses, to reinforce on strengths and overcome weaknesses (Saleh, 2015).

Supply chain management requires integration and coordination for satisfying and responding to changes in consumer demand Lambert and Cooper (2000).

In this era of business world, customer is perceived as the 'king', which is becoming the driver of change in the market place. These characteristics of the business world pushed organizations to change their attitudes and lead organizations to rethink their strategies. Hence, business environment is characterized by its volatility. Therefore, adopting a more integrated approach to supply chain is for customer satisfaction (Eyong, 2009).

A greater level of interaction among supply chain members can be described in terms of building close and long-term relationships based on common understanding. Hence collaboration among them is needed in order to compete in today's business environments. Long-term relationships that are created between supply chain partners based on collaboration have to be underpinned by mutual understanding and willingness to maintain it (Abushaikha, 2014).

As supply chain integration is the extent to which service giving organizations strategically collaborates with its supply chain partners and collaboratively manage different types of processes. The main target of integration is to achieve effective and efficient flow of products and services, information, money and decisions, so as to provide the greatest value for customers Flynn, Huo and Zhao (2010). Supply chain integration affects business performance (Flynn et al, 2010 and Huo, 2012).

According to Didia and Nwokah (2015), supply chain integration will increase market share and business performance if properly worked on it.

Thus, it is important to study the effect of integration of supply chain processes and activities on the operational performance of organizations. Therefore, this study investigated the current level of supply chain integration and its effect on operational performance of ECX.

1.2 Background of the Organization

Eleni et al. (2005) indicated that a commodity exchange connotes a highly sophisticated market system, with an electronic-based, highly evolved system of trading in future commodity positions, exemplified by markets such as the Chicago Board of Trade, the Tokyo Grain Exchange, or the London Metal Exchange, among others. To many, a commodity exchange is an advanced market mechanism for use in industrialized countries, out of the reach or inappropriate to low-income countries. A commodity exchange is simply a central place where sellers and buyers meet to transact in an organized fashion, with certain clearly specified and transparent "rules of the game." In its wider sense, a commodity exchange is any organized market place where trade, with or without the physical commodities, is funneled through a single mechanism, allowing for maximum effective competition among buyers and among sellers. The

fact of having a single market mechanism to bring together the myriad buyers and sellers at any point in time effectively results in the greatest concentration of trading for a given good. This market mechanism, such as a price bidding system or an auction system, results in what is known as “price discovery,” that is, the emergence of the true market-clearing price for a good at a particular point in time due to the highest possible concentration and competition among buyers and among sellers (Eleni et al., 2005).

Ethiopian Commodity Exchange from the beginning of its establishment has joined the commodity supply chain to integrate with all of its supply chain members. The business type by itself a risk-full and requires an institutional response, at a basic level to cope with the fundamental problems of achieving self-coordinating market order in the trade of agricultural products (Eleni et al, 2005).

1.3 Statement of the problem

According to Flynn et al.(2010), supply chain integration is the degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages intra- and inter-organizational processes, in order to achieve effective and efficient flows of products and services, information, money and decisions, to provide maximum value to the customer.

One of the key elements to improve firm’s performance is supply chain integration. The key to supply chain integration is to develop uninterrupted link with upstream suppliers and downstream customers along with total functional synergy internally. Hence, integration could be achieved through interrelated activities. (Kumar et al., 2012)

An important face of integration is the level of integration which can be identified by the number of activities through one dimension. In today’s global competition, companies strongly need to adopt advanced practices to achieve a high integration within their supply chain. Hence knowing the level of supply chain integration is a key factor for each company to improve their integration (Lotfi, et al., 2013).

According to Lambert et al. (1998) efficiency of supply chain integration can be source of distinct competitive advantage for an organization to show better operational performance and enhances capability of managing relationships with other supply chain partners.

Several studies have found that integration across the supply chain has a direct and positive impact on organizational performance (Flynn, et al. (2010), Hou (2012), Hatani (2013) &Sohail, 2009).

Supply chain integration can be a reason for reduction in transaction costs which can be realized substantial savings (LaLonde, 1997).

By the year 2020, governments in the Greater Horn of Africa and Eastern Africa (GHA/EA) region have individually set targets for industrialization of the economies. Since the economies are dependent on the agricultural sectors in the respective countries, industrializations of this sector is a prerequisite for the industrialization of the other sectors in the economy. Improved agricultural marketing and trade will contribute immensely to the industrialization of the agricultural sector (Adrian, 2004).

In Ethiopia, the presence of high transaction costs, related to the lack of sufficient market coordination between buyers and sellers, the lack of market information, the lack of trust among market actors, the lack of contract enforcement, and the lack of grades and standards, implies that buyers and sellers operate within narrow market channels, that is, only those channels for which they can obtain information and in which they have a few trusted trading partners. Despite market liberalization in the early 1990s, the persistence of high transaction costs and contract risk have resulted in limited arbitrage and weak investments by private traders, leading to limited market volumes, weak responsiveness to price signals and high price volatility, all of which have a negative impact on smallholder producer livelihoods (Dessalew, 2011)

The initiative to establish agricultural commodity exchange in the country, the Ethiopian Commodity Exchange, was based on the above concept of industrializing the agricultural sector. If markets function as to reward quality, reduce transaction costs of market participation thus increasing returns to market activity, enable quick capital turnaround thus increasing market volumes, and reduce risk of market participation, then markets will serve the needs of buyers and

sellers and contribute to the well-being of all who participate in the market economy (ECX, 2006).

To help Ethiopia in attaining its national development goals through the adoption of technology and with integration, ECX is moving forward by taking the vision of becoming a leading exchange service in Africa (The WORLDFOILIO, 2016).

The common challenge occurs in almost all industries is continuous changing in customer needs and requirements due to tough competitions among the organizations. This lead to difficulties in integrating supply chain activities and processes, which delay providing products and services to customers in suitable place at suitable time and losing of competitive advantage (Saleh, 2015).

As knowing the level of supply chain integration is a key factor for each company to improve their integration (Lotfi, et al., 2013), ECX has many operational related performance problems which are described hereunder.

Bizualem and Saron(2018) studied factors determining farmers' decision to cooperative membership status in Ethiopia. In the study, they had found that the problems of ECX include: lack of information and transparency problem between farmers and traders, increasingly common practice among private exporters to register as suppliers through sister companies ensuring the possibility of reacquiring their own products by bidding higher price which increases the risk of marketing the chain non-competitive and the rigidity of the auction and export processes including the inability of buyers to test the quality of the product (especially coffee) in advance of sales again creating a higher quality export coffee beans (as an example) has created an illicit market that yields higher profit than exporting, albeit in local currency.

As Paul (2011) put that ECX has operational problems such as limited awareness about the operation and benefits of the exchange by every market player; traders, cooperatives, exporters, farmers, brokers, etc., limited capacity in terms of skills, infrastructure particularly of telecommunications and storage capacity, and also in terms of financial access by the market actors. Another challenge is the presence of a narrow spectrum of actors particularly of limited number of industrial members. According to Paul (2011), other problems of ECX are the low level of coordination, refusal of traditional brokers to accept the new system, limitations in the provision of facilities, especially internet services, problems related with laboratories like

insufficient sewerage system disruption of power supply that affect service delivery to customers and conflicts due to poor contractual agreement among suppliers and transporters.

According to Eleni (2017), continuous headache of inefficient warehouse sampling, grading, handling, storage, and logistics, which has long been the Achilles' heel of ECX and an operation outside of the core competence of any exchange. The other challenges are longer lead times, supply disruptions caused by global customs, foreign regulations and port congestion, political and/or economic instability in the country, and changes in economics such as exchange rates which in turn leads to increasing cost, reduces speed of delivery of product and flexibility of the company.

In the year 2017, the volume of traded commodities at ECX had shown a six percent decline from the same period of 2016 fiscal year (the Reporter, 2017).

The operational performance gap on this year is that there is a reduction both in quantity and revenue on the mid of this fiscal year (The reporter ,2019). According to the report, ECX planned to exchange a total of 290,640 tons of agricultural commodities but exchanged 255,763 tons.

The half year report of ECX in the current fiscal year showed that there is a decline of 17% in quantity of transaction in comparison of last year's performance (the Reporter, 2019).

Such problems happened due to poor supply chain management in general and supply chain integration problems in particular. So through analyzing the level of supply chain integration, this study will help to identify improvement areas that can solve operational performance problems (Yaregal, 2017).

Therefore, it was worthy to study the topic of supply chain integration, thus the purpose of this research was to answer the following question: How does supply chain integration affect the operational performance of ECX?

1.4 Objective of the Study

1.4.1 General Objective

The general of the study is to investigate the effects of supply chain integration on the operational performance of ECX.

1.4.2 Specific Objectives

The specific objectives of the study are;

- To investigate the effect of supplier integration on the operational performance of ECX,
- To examine the effect of ICT integration on the operational performance of ECX,
- To investigate the effect of internal integration on the operational performance of ECX and
- To examine the effect of integration with customer on the operational performance of ECX.
- To investigate the effect of warehouse integration on the operational performance of ECX.

1.5 Research Hypothesis

The research has the following hypothesis.

H₀: Supply chain integration doesn't have effect on operational performance of ECX($\alpha \leq 0.05$).

The main hypothesis has the following sub-hypotheses:

H_{0,1}: Supplier integration doesn't have direct effect on operational performance of ECX($\alpha \leq 0.05$).

H_{0,2}: Internal integration doesn't have direct effect operational performance of ECX($\alpha \leq 0.05$).

H_{0.3}: Customer integration doesn't have direct effect on operational performance of ECX($\alpha \leq 0.05$).

H_{0.4}: ICT integration doesn't have direct effect on operational performance of ECX($\alpha \leq 0.05$).

H_{0.5}: Warehouse integration doesn't have direct effect on operational performance of ECX($\alpha \leq 0.05$).

1.6 Significance of the study

Studying supply chain integration and its effects on organizations performance is crucial topic for both the organizations and for academicians. This study can be taken as an initiative that explains the effects of supply chain integration on operational performance of ECX. The study is believed to its contribution for a better understanding of the role of supply chain integration in operational performance of commodity exchange to improve performance. Results of this study are expected to be important for future research, service industries, decision makers and academic contribution.

1.7 Scope of the study

This study tried to examine the effects of supply chain integration in Ethiopian Commodity Exchange service hence the scope was the organization in the HQ and its stakeholders that operate within ECX's platform in the fiscal year of 2018/19.

1.8 Limitation of the study

This study assessed the effect of supply chain integration on operational performance from the perspective of employees which could be deemed as a limitation. It would be more complete if the perspective of customers was also being incorporated.

The other limitation of the study was the place issue. The study covered the perception of employees in Addis Ababa only so that it might not reflect the perception of employees in other places of the country where branch offices and warehouses are located.

This study involved employees of the case company working in different departments (CEO, Audit, IT, HR...) this may have affected the results as the effect of supply chain integration may vary in each department.

Traditional data secrecy behavior of few employees and the bureaucratic nature of the organization since the start of the survey was the challenge of the study.

The questionnaires were administered on drop and pick later method that it was challenging in case of some respondents to commit their time and fill the questionnaires timely, adequately and appropriately.

1.9 Definition of concepts and terms

1.9.1 Conceptual definition

Operational performance: the response by the company to changes in market demand, on time delivery of products by the company to customer, the level of customer service by the company and level of lead time for fulfilling customer order (Frohlich&Westbrook, 2001; Beamon, 1999; Vickey, 2003).

Internal integration: the degree to which a manufacturer structures its own strategies, practices and processes into synchronized, collaborative processes to fulfill its customers' requirements and efficiently interact with suppliers (Zhao, et al., 2011)

Customer integration: is sharing of customer's demand information, aiding producers to understand customer's demand in a better manner and expecting customer's demand as well as

collaborating and cooperating with customers to design, to reach products with better quality, lower costs and greater flexibility in response to customer's demand (Biniyam, 2016).

ICT integration: is the merging of information and technology from heterogeneous sources with differing conceptual, contextual and typographical representation (Woods, 2016).

Supplier integration: the degree to which a firm can partner with its key supplier members (Stank, et al., 2001)

Supply Chain Integration: the degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages intra- and inter-organizational processes, in order to achieve effective and efficient flows of products and services, information, money and decisions, to provide maximum value to the customer (Flynn, et.al., 2010).

Warehouse integration: the degree which a warehouse system integrated with other processes and systems so as to facilitate the receipt, storage and retrieval of goods on the basis of industry accepted grades and standards ECX (2019).

1.9.2 Operational Definition

Operational performance: group of operational standards and benchmarks that are adopted and used by the organizations to achieve operational performance (Vaidya and Hudnurkar, 2012).

In this study operational performance was measured by the following dimensions: Flexibility, Time (Speed), Quality, and Cost. Specific items to measure are on no. 31-46 (Appendix IV).

Internal Integration: is the process of maintaining cross-functional cooperation and collaboration within the organization that intends to achieve organizational strategic goals (Flynn, et al., 2010). It was measured by specific items no. 1-6 (Appendix IV).

Customer Integration: is the process of building and maintaining a strong relationship and partnership with the customers. It includes sharing the knowledge, experiences, products, services, and suggestions with customers (Lotfi,et al., 2013). It was measured by specific items no. 19-24(Appendix IV).

ICT integration: is the merging of information and technology from heterogeneous sources with differing conceptual, contextual and typographical representation (Woods, 2016). It was measured by specific items no. 7-12 (Appendix IV).

Supplier integration: integration back down to the suppliers represents a change in attitudes from conflict to cooperation starting with product development, supply of high quality products, process and specification change information, technology exchange and design support (Baharanchi, 2011). It was measured by specific items no. 13-18 (Appendix IV).

Supply chain integration:is the coordinated collaboration between the organization and its partners of suppliers and customers depending on an effective management of incoming material, services, information and money (Nazzal, 2016). It was measured by the its dimensions specified by items no. 1-30 (Appendix IV).

Warehouse integration: the extent at which the warehouse system integrated with other processes for better accuracy, convenience, handling, control and having better layout systems so as to facilitate the receipt, storage and retrieval of commodities.

It was measured by the its dimensions specified by items no. 25-30 (Appendix IV)

1.10 Organization of the study

The paper was organized in a sequence of chapter one, chapter two, chapter three, chapter four and chapter five.

Chapter one introduced background of the study, statement of the problem, scope of the study, limitation of the study and definition of terms.

Chapter two examined literatures in the area of supply chain integration. The theoretical and empirical studies were discussed and based on that conceptual framework was drawn.

Chapter three focused on research methodology, sample size for the study, data sources and data types used in the research including data collection mechanism. The chapter had methods of data analysis and data interpretation ways. At the end of the chapter, ethical considerations used were explained.

Chapter four presented results and discussions. Explanations of the findings of data analysis, discussions and comparisons of output from the research with that of related literatures were illustrated.

Chapter five summarized and concluded the findings of the study and had recommendations to improve the performance of the study area. At the end of it, the chapter gave a view of future research direction.

Chapter Two

Review of Literature

2.1 Introduction

This chapter reviewed relevant literature on the key areas that the study covered. This chapter presented the theoretical underpinnings of the study. With a focus on the objectives and theoretical thresholds of this study, related and contemporary literatures on the concept of supply chain integration on operational performance were reviewed in this chapter. Empirical reviews had been described in relation with the study area and finally the conceptual framework of the study was drawn based on the reviews.

2.2 Theoretical Review

2.2.1. The Concepts of Supply chain integration

According to Omta (2007) supply chain integration is a process of collaboration in which companies work together in a cooperative manner to arrive at mutually acceptable outcomes. Zhao, et al. (2008) described supply chain integration as “the degree to which an organization strategically collaborates with its supply chain partners and manages intra- and inter-organization processes to achieve effective and efficient flows of products, services, information, money and decisions, with the objective of providing maximum value to its customers”. Supply chain integration is a key to the success of companies and supply chains (Jahre et al., 2007).

According to Zailani and Rajagopal (2005) supply chain integration a set of practices aimed to place coordination within the supply chain from raw material suppliers to the final user-customer to gain win-win situation. Trkman and Groznik (2006) asserted that coordination of any supply chain components is vital for the success of each chain. Li (2006) mentioned that

supply chain management challenges is produce a product to the right place at the right time at the lowest cost. Awad and Nassar (2010) declared firms must manage and control the integration of business, technology, people, and processes not only within the firm but with business partners.

Saleh (2015) reported a positive effect of the integrated supply chain elements (supplier, internal processes, and customer) on the operating performance components (cost, quality, time, and flexibility).

Internal integration had powerful impact on operational performance in the past, as it “helped to prioritize best practices depending on potential impact [and] advantages” Chaturvedi and Dutta (2005). Internal integration is the degree to which a manufacturer structures its own strategies, practices and processes into synchronized, collaborative processes to fulfill its customers' requirements and efficiently interact with suppliers Flynn, et al. (2010). Zhao, et.al. (2011) said that “internal integration stresses organizational structure, procedures, and practices, so it must be collaborative and synchronized to fulfill customer requirements”.

Supplier integration facilitates understanding and anticipation of the service provider's needs to better cope up with changing requirements and the mutual exchange of information helps service providers to enhance operational performance (Zhao et al., 2010).

Efficient integration with suppliers allows manufacturers to speed up product delivery processes, improve production planning and reduce inventory obsolescence using accurate information about customer demands and preferences (Swink, 2007)

Supplier integration helps manufacturers reduce mistakes and enhance product quality through information sharing and joint planning, which are directly related to the operational performance of manufacturers (Petersen, 2005).

Customer integration is referred to as the most important competency for achieving high-level firm performance Closs and Savitskie (2003).

Customer integration improved an organization's ability to link customers within the supply chain effectively Udin, et al. (2008). Customer integration is directly related to operational performance Biniyam (2016) and Otchere, et al. (2013).

According to Koufteros and Swink (2007) Product integration with suppliers and customers can enhance production capability of manufacturers by promoting product quality, flexibility and innovation in addition to product competitive advantage.

According to Fuentes, Jurado, Marín, and Cámara (2012), the operational benefit of a company is ensured by integrating ICT. Devaraj, et al. (2007), and Zailani, et al. (2012) mentioned that ICT integration enhances the operational performance of the company by helping to reduce costs, to deliver complete information rotation, and control of inventories, to maintain flexibility in shipping orders, and to have a quality service for customers.

2.2.2 The Concepts of Operational performance

According to Chopra and Meindl (2007) supply chain concepts and operational performance emerged from supply chain strategy which derived from overall business strategy. Every organization attempts to adopt different competitive strategy that fit to its strategy, then it seeks to afford the suitable capabilities and resources that help to achieve it (Chopra, 2007).

Every organization exists to achieve a particular goal. Organizational operational performance is the final achievement of an organization and contains a few things, such as the existence of certain targets, has a period of time in achieving these targets and the realization of efficiency and effectiveness (Blowfield and Dolan, 2010). Thus, organizational operational performance refers to ability of an enterprise to achieve such objectives as high profit, quality product, large market share, good financial results, and survival at pre-determined time using relevant strategy for action (Koontz and Donnell, 2003).

Neely et al. (1995) enlisted cost, time, quality, delivery and flexibility as the basic measures of operational performance.

Cost

There are many indexes for improving operational performance of an organization one of the basic is reduction of its cost. The basic reason behind is to minimize the cost for the purpose of efficiency and effectiveness of strategies and policies. Proper cost management implies the optimal use of resources for the efficiency of organization in order to create value for customers. Due to this rationale the satisfaction of customer's and loyalty and long lasting wealth for the organization will be created. Effective way of managing cost is the result of managing decisions (Patterson & Anders, 2013).

Flexibility

Flexibility is the ability of the firm to develop flexible operations in hypercompetitive environment to meet the frequent changes in volume, product mix and schedules occur Rosenzweig, et al. (2002)

Speed/time

The traditional dimensions to measures performance are expressed by delivery time and lead time. Different scholars defined time, lead time, and cycle time. Cycle time is the time between one completion jobs or tasks to another, i.e. from starting one process or task to start the same process or task again. Lead time is the time that is required from setting the order by customer to deliver the product or service (company and supplier) including manufacture, transportation, processing, warehousing, and delivering the product or service to the final customer (Gimenez, et al., 2011)

2.2.3 The concepts on Relationship of SCI to OP

Cao et al. (2015) suggests that how successful the patterns of SCI would be related to the operational performance in different configurations. It argues that organizations perform better when they develop better configurations of interconnected elements (Sinha and Van de

Ven,2005). It is therefore suggested that a highly integrated supply chain in this sense is likely to perform well in the market place. Configuration theory underlines the necessity for a supply chain to be well integrated in order to deliver high operational performance. It is thus reasonable to extrapolate that the configuration theory provides a theoretical support for the causality from SCI to OP.

Broad range of literatures, which discuss an impact of SCI on such operational performance measures, such as operational costs and customer service (Chen,et al., 2004; Droge,et al., 2004; Vickery,et al., 2003), level of service to customer and quality (Stanley et al. 2001), financial performance measures of ROI, profits, and net income (Chen et al., 2004; Dixon et al., 1990), operational-oriented performance (Neely,et al., 1995), product development performance (Petersen et al. 2005); The operational performance measures of flexibility and delivery, which are deemed to be important elements for responsiveness capability of a firm (Danese, 2013; Hallgren,et al., 2009).

Supply chain integration has been regarded as having effect to supply chain management excellence due to its importance in achieving better Organizational operational Performance as a result of holistic and synergistic effect of the system (Childerhouse&Towill, 2011; Derwik&Hellström, 2017; Turkulainen, Roh,Whipple, &Swink, 2017). According to Alfallaluque&Dey (2012);Gorane& Kant (2017), it's theoretically true that, the higher the level of SCI of an organization the greater the performance of such organization.

2.2 Empirical Review

2.3.1 Review of Empirical Studies on Supply Chain Integration

Baharanchi (2009) investigated the relationship between different aspects of supply chain integration and some characteristics of the product (quality and innovation) in the automotive industry of Iran. Integration is measured by internal integration, integration with suppliers, and

integration with customers and product characteristics are measured in two aspects of quality and innovation. Findings showed that integration with suppliers and customers influences on products quality and innovation positively. Internal integration has the weakest relationship compared to other aspects of integration with product quality and has very weak relationship with product innovation.

Stanley and Gregory (2002) tried to investigate supply chain integration by taking multi-method empirical approach survey and case study. The findings revealed that supply chain integration practice seldom resembles the theoretical ideal and recognized that tensions existed between SCM's competitive potential and the inherent difficulty of SCI.

Togar, et.al. (2002) studied by stressing on the agenda of collaboration in supply chain integration. The study promoted the notion of mutuality and the focus of coordination in order to establish a comprehensive taxonomy of coordination modes. In the study, different modes of integration had been identified: logistics synchronization, information sharing, incentive alignment, and collective learning. The findings of the study knowledge of coordination was then proposed as an explicit understanding about key drivers of coordination modes that have positive impacts on supply chain integration

In line with a configurational perspective, Pamela and Thomas (2013) investigated whether plants adopting multiple integration practices (i.e. full SCI adopters) performed better than plants implementing only some selected SCI practices (i.e. partial adopters) and plants which did not implement any SCI practice (i.e. non-adopters). In addition, the study analyzed whether partial adopters showed a superior performance compared to non-adopters based on a sample of 317 manufacturing plants reveal that full adopters perform better than non-adopters, in terms of quality, delivery, flexibility and efficiency. The study revealed that among partial adopters, a particular SCI pattern, characterized by a high level of internal integration and supply chain planning, differs from non-adopters in terms of delivery, and shows results similar to full adopters in terms of quality and efficiency. More surprisingly, the other patterns of partial adopters did not significantly differ from non-adopters in any performance dimensions, and underperform full adopters in each performance. The study suggests that in order to maximize

SCI benefits companies should lever on multiple integration practices, and that in some cases focusing only on selected integration activities can be useless.

Prabir, et al.(2005) studied supply chain integration in European firms. The core of the study was to identify the underlying factors of supply chain integration in European firms with particular emphasis on the role of information sharing and interorganizational collaboration. The findings of the study were European firms were starting to be aware of the strategic importance of integration across theboundaries of the supply chain and most companies were quite cautious when it comes to sharing sensitive data.

2.3.2 Review of Empirical Studies on Operational Performances

Mark (2017) investigated on operational performance. The study examined two alternative views—universal and contingency—of the human resources (HR)-performance relationship in manufacturing settings. The survey included 97 plants primarily support a contingency approach to human resource management (HRM). An HR system focused on human capital enhancement was directly related to multiple dimensions of operational performance (i.e., employee productivity, machine efficiency, and customer alignment), but subsequent analysis revealed that this main effect was predominately the result of linking human-capital-enhancing HR systems with a quality manufacturing strategy. Other manufacturing strategies alsomoderated the operational performance relationship.

Segura and Cirtita(2012) studied on measuring downstream operational performance. The study aimed at determining if performance metric systems would improve inter-firm performance. The survey completed by 73 members of the council of supply chain management professionals consisting of high-level managers representing US companies by questionnaire. Mean, standard deviation, validity, reliability, factor analyses were applied. It found that downstream supply chain integration does not affect positively by downstream supply chain metrics. While it positively affected inter-firm operational performance.

Luthje and Arlbjorn(2012) studied global operations and their interaction with operational performance. The study was aiming at: exploring whether operational performance affected differently depending on the choice of globalization strategy. Based on in-depth literature reviews and explorative case studies – two offshoring and two outsourcing projects. A model explaining the choice of localization and globalization strategy (the OLI model) was applied as a basic framework. Data collected through in-depth interviews with persons responsible for the offshoring and outsourcing projects. It addressed that different practice of managing operational performance in offshoring and outsourcing strategies. The OLI model provides an increased consciousness of the managerial challenges related to operational performance based on the chosen globalization strategy

2.3.3 Review of Empirical Studies on the Associations between Supply chain integration and Operational Performances

Wantao, Mark A.Jacobs ,David and Harvey (2013) conducted a study to test the concept of supply chain integration on firm's performance by investigating the relationships among internal integration, external integration (i.e. with customers and suppliers), customer satisfaction, and financial performance using survey data collected from 214 manufacturing firms in China. The results suggested that internal integration significantly influences both dimensions of external integration, customer and supplier integration; and that supplier integration is significantly and positively related to performance. The study shows that internal integration is an enabler for external integration which suggests that companies need to progress from good internal practices and processes to effective management of external processes. Particularly this study positions the benefits of integration as accruing from learning and performance being correlated to information flows.

Huo (2012) study entitled “The impact of supply chain integration on company performance: an organizational capability perspective”. The study simultaneously examined the impact of three

types of supply chain integration (SCI) on three types of company performance from the perspective of organizational capability using data collected from 617 companies in China. The result showed that internal and external integration directly and indirectly enhance company performance.

After surveying 251 manufacturers in Hong Kong, Yam, et al. (2010) tested the relationships among information sharing, product co-development, product innovativeness, and performance. The findings indicated a direct, positive relationship between supplier and customer integration and product performance. The study verified that sharing information with suppliers and product co-development with customers directly improves product performance and suggested by the study, extensive effort on supplier and customer integration should be made to directly augment current product performance and product innovation at the same time.

Daniel and Jan (2012) investigated the integrations of both information and material flows between supply chain partners and their effect on operational performance. They used data from 232 Australian firms and found that logistics integration has a significant effect on operations performance. In their study, they concluded that information technology capabilities and information sharing both have significant effects on logistics integration. The study argued with effect of long-term supplier relationships has both direct and indirect significant effects on performance.

Zelbst, et al. (2009) studied the impact of supply chain linkages on operational performance in the study, a total of 145 manufacturing and services sector managers were surveyed. The measurement scales were assessed for reliability and validity and further assessed within a measurement model context. Study hypotheses were then tested using a multiple regression approach. It found that power, benefits, and risk reduction linkages were positively and significantly impact operational performance. Power identified as the dominant linkage for manufacturers, and risk reduction as the most important within the services sector.

Dametew (2016) studied supply chain linkage on Production, knowledge, Technology and Resource integration using secondary data from articles and websites (analyzed using AHP). The result indicates that SCI has also positively linkage on Production, knowledge, Technology and Resource integration so as to improve quality performance in a supply chain.

Daniel, Mesbahuddin, Andy, Yeung, and Cheng (2011) conducted a study by taking collected from 232 manufacturing firms in Australia. The results showed that different supplier management practices have different unique effects on different operations performance measures. The study arrived at a conclusion that supplier integration has a positive relationship with quality performance. Long-term relationship and integration have positive relationships with delivery, flexibility, and cost performance.

According to the study by Kim, et al. (2002) on SCI, they concluded that supply chain strategies and practices depend on not only the nature of the business, the competitive environment, and technological intensity of the product, but also on product and market characteristics. The study paper examined the effect of SCI on the relationship between diversification and a firm's competitive performance. The research result argued that coordinated use of SCI and diversification strategies has a significant effect on firm performance.

Chin, et al. (2013) study titled: "Mediating Effect of Operational Cooperation between Supply Chain Practices and Firm Performance" aimed that the operational cooperation reinforces the strength of firms to overcome with uncertainty and solid competition through supply chain collaboration. The data were collected from 201 small manufacturing firms. The findings showed that the relationship between supply chain practices and firm performance were intermediate through the operational cooperation.

The study paper by Vickery, et al. (2004) examined the effects of integration practices on time-based performance and on overall firm performance (financial and market share). On the study, integration practices are grouped into two categories: external integration, which reaches across firm boundaries to involve suppliers and customers and internal integration, which comprises more tactically oriented, integration practices that match design requirements and process capabilities. The researchers found that the internal and external integration were significantly related to both market share and firm's performance (after controlling for all other effects). Thus the study suggested that the use of external and internal integration practices has a synergistic effect on firm performance.

Zelbst, et al. (2009) study titled: "Impact of supply chain linkages on operational performance", aimed at examining the impact of supply chain linkages on operational performance. A total of 145 manufacturing and services sector managers were surveyed. It found that power, benefits, and risk reduction linkages were positively and significantly impact operational performance.

Germain,et al. (2011) studied how internal and downstream integration and their interaction affect performance within a firm. The results indicated that internal and downstream integration and their interaction affect performance — that is, the higher the internal integration, the stronger the relationship of downstream integration with performance. The results suggested that superior performance derives from the firm simultaneously integrating functions, decision-making, and processes both within the firm and across the supply chain.

Most of SCI studies hold the same view that SC integration level has a positive influence on performance outcomes (Frohlich,et al., 2002; Vickery,et al., 2003; Ganesan and Saumen, 2005). Armistead and Mapes (1993) indicate that the level of SC integration improves quality and operating performance through a field study of 38 firms' managers in the UK. Narasimhan and Jayaram (1998) propose that SC integration impacts customer responsiveness and manufacturing performance via the key linkage between sourcing and degree of manufacturing goal achievement through empirical validation of key causal linkages in a supply chain. Johnson (1999) shows, through a survey of industrial equipment distributors, that strategic integration results in enhanced economic reward for the firm. Frohlich and Westbrook (2001) empirically identified that manufacturers with the broadest arcs of SC integration should have the highest levels of performance improvements. Specifically, they found a strong relationship from the largest arcs of supplier and customer integration to market share and profitability. Braganza (2002) suggests that integration of several functions at different organizational levels achieve above average financial and performance results.

The above empirical studies and reviews show that SCI is positively related to firm's performance but Nathalie and Marianne (2008) concluded that more SCI does not always improve performance.

2.4 Literature gap

The literatures reviewed above specially the empirical studies have not directly investigated the effect of supply chain integration on commodity exchange operational performance. Above all, numerous studies that have been conducted to determine the effect and relationship between supply chain integration and operational performance used secondary data in order to analyze the data. For instance the studies by Dametew (2016) who studied supply chain integration and its linkage for improving performance using secondary data from articles and website,

Huo (2012) examined the impact of supply chain integration (SCI) on three types of company performance from the perspective of organizational capability using secondary data,

Zelbst, et al. (2009) study titled: "Impact of supply chain linkages on operational performance", aimed at examining the impact of supply chain linkages on operational performance using secondary data, and

Chin, et, al. (2013) study titled: "Mediating Effect of Operational Cooperation between Supply Chain Practices and Firm Performance using secondary data.

However, this study depends mainly on primary data which allows the researcher to get firsthand information on the business. Hence, this study is believed to fill this gap.

2.5 Conceptual framework

Among the different authors who proposed a framework relating supply chain integration and operational performance, this study adapted the works of Bete-Georgise et al., (2014); Kumar et al, (2017); Mose(2015), Hussein et al., (2014) and Mansoori et al, (2014) and drawn it as follows.

SCI-Independent variable

Operational performance-dependent variable

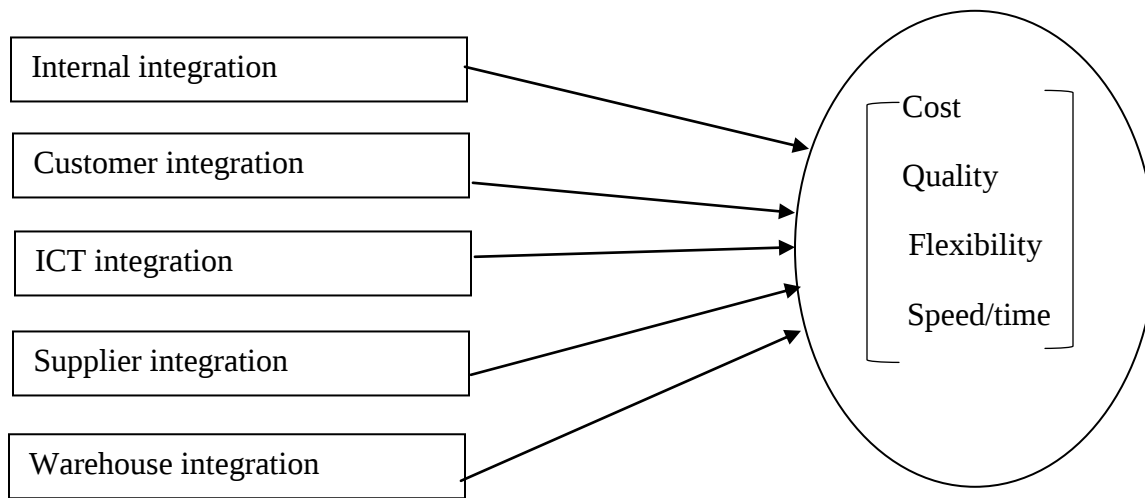


Fig 1 conceptual framework of SCI

Chapter Three

Methodology of the study

3.1 Description of the Study Area

This study was conducted as a case study at ECX, Addis Ababa city. It had focused on analyzing the level of supply chain integration and its effect on the operational performance of ECX based on the perception of employees. Hence, the area of study was the Ethiopian Commodity Exchange in the HQ.

3.2 Research Approach

Mixed approach combines or associates both qualitative and quantitative forms. It involves the use of quantitative and qualitative approaches and the mixing of both approaches in the study; which is more than simply collecting and analyzing both kinds of data resulting greater strength than either of each approach Creswell,et al.(2007).

As the objective of this thesis was assessing the effects of supply chain integration on the operational performance of Ethiopian Commodity Exchange, mixed approach of qualitative and quantitative was used because of the sources of data included documents, surveys and other quantitative data.Hence the mixed approach was preferred to entertain both types of data in data collection, analysis and inferences for better triangulation, to get better picture of phenomena Venkatesh,et al.(2013).

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3.3 Research Design

The casual research design was used in this study because it aimed at investigating the cause/effect relationship between SCI elements and Operational performance of ECX.

The Causal research is quantitative in nature as well as preplanned and structured in design. For this reason, it is also considered conclusive research. As causal research attempts to explain the cause and effect relationship between variables (Fluidsurveys Team, 2014).

The research design was chosen because it helped to see the relationships between the dependent and independent variables and it also allowed to measure the effect of SCI on OP.

3.4 Unit of analysis

According to Sekaran (2003), unit of analysis is the major entity that is to be analyzed in study.

According to Chaiporn (2005) by making employees as unit of analysis one can explore a perception or attitude as a predictor of employees.

For this study, employees of ECX working in HQ were chosen as the unit of analysis who were available at the time of distributing the questionnaires and who had filled it because it was not be the firm as unit of analysis rather employees' perception was to be studied.

This was so because the main aim of this thesis was to explain the effects of SCI on operational performance of ECX based on the perception of those employees.

3.5 Population of the Study

Population as an aggregate or totality of all the objects, subjects or members that conform to a set of specifications Polit and Hungler (1999).

According employees' data as of January 2019 (Appendix I), the total number of employees working in Addis Ababa directly related to exchange is 269.

Bedlu (2018) had used all employees of the organization as the population for his study entitled "The effects of SCI on operational performance of MW plastic products manufacturing company in Sebeta".

This study used the whole number of employees, 269, as population size.

3.6 Sampling Design

Sample Size Determination

According to Malhotra and Peterson (2006) and Zikmund (2003), the larger the sample size of a research, the more accurate the data to be generated.

Yamane (1967) provided a simplified formula to calculate sample sizes at 95% confidence level and $P = .5$ as:

$$n = N / (1 + N * e^2)$$

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

As it is given above that the population size is 269.

Sample size of this study would be: $n = 269 / (1 + 269 * .05^2) = 161$

Finally, the sample size formulas provide the sample size needed to be obtained. Many researchers commonly add 10% to the sample size to compensate for persons that the researcher is unable to contact (Glenn, 1992).

As Tanburn(2015) described, likely inaccuracies in the assumptions, it may be wise to sample more than the minimum and to be safe, add 10-15% to a sample.

The study added 10% to the computed result so as to entertain the increase number of respondents so as to get greater precision and power for drawing meaningful conclusion.

Thus the sample size of the study was: $161 + 16 = 177$.

Sampling Technique

The information required for the study needs employees who work in the HQ of the organization. The sample samples needed to have the right proportion of people from every concerned department or division.

According to Hamed (2016) stratified sampling is where the population is divided into strata (or subgroups) and a random sample is taken from each subgroup to ensure that every stratum is adequately represented. Probability or random sampling has the greatest freedom from bias (Hamed, 2016).

Hence, stratified probability sampling technique was used for the study because it allowed each division/department to get proper representation.

The sampling was done by classifying the population into eleven strata based on the departments and sections in the company which are directly related with the operations of ECX. Then the samples were selected randomly from each stratum according to their proportion to the total population.

Taking the employee data (Appendix I), the study took the proportional allocation of samples for each stratum (department) as:

$$n_i = p_i * n, \quad p_i = N_i / N$$

where p_i is percentage share of each department from the total number

N is population size

N_i is the total population of each department/strata

n is the sample size of the study

Taking the above formula and points, the study had the following sample size from each stratum.

$$n_1 = 177 * 17 / 269 = 11, \quad n_2 = 177 * 17 / 269 = 11, \quad n_3 = 177 * 44 / 269 = 29, \quad n_4 = 177 * 16 / 269 = 11$$

$$n_5 = 177 * 14 / 269 = 9, \quad n_6 = 177 * 24 / 269 = 16, \quad n_7 = 177 * 5 / 269 = 3, \quad n_8 = 177 * 33 / 269 = 22, \\ n_9 = 177 * 22 / 269 = 14, \quad n_{10} = 177 * 26 / 269 = 17 \text{ and } n_{11} = 177 * 51 / 269 = 34$$

Table 3.1: Sample size from each department

Division/Department	Total population	Sample size
CEO	17	11
Compliance	17	11
Facilities Management	44	29
Finance	16	11
HR	14	9
IT	24	16
Audit	5	3
Market Operations	33	22
Quality Operations	22	14
Strategy & Corp communication	16	17
Warehouse Operation	51	34
Total	269	177

Source: own
survey
(2019)

3.7 Data Sources, Types and Collection Procedures

Generally, the data sources would be either primary, secondary data sources or both.

In this study, the primary source of data was used to meet the objectives cited.

Primary Data Sources: such data sources are those had been gathered from sample respondents which would be chosen through sampling from the total study population. Structured questionnaire was used to collect primary data.

In order to gather data, both of data collection methods were used.

As a primary data collection method, the research had used standard self-administered and close ended questionnaire that were filled by employees. For the purpose of facilitation of the study and to get pertinent information from the survey, the researcher had distributed the questionnaires to the target employees and collected them.

For secondary data collection mechanism, the research used data that had been collected from journal articles, books, online websites and others as a secondary data collection method.

3.8 Data Analysis

The data of this study was analyzed by computer through package software (SPSS: Statistical Package for Social Sciences).

In the data analysis the statistical methods to be employed were:

- Using descriptive statistics in form of frequency and percentage, the demographic background information of the respondents in ECX was analyzed and presented.
- Measures of central tendency such as mean and standard deviation were used to assess the practice of supply chain integration.
- For the purpose of investigating the effect of supply chain integration on operational performance, regression analysis was used to observe influence of independent variables on a dependent variable, operational performance. The regression model was checked for normality and fit for the analysis. The analysis was done as in the subtopic below.

Regression Analysis

As Wooldridge (2015; Gujarati (2003); Campbell and Campbell (2008) explained, regression analysis is the determination of relationship between variables, which is used to generate a predicted value or estimates of variables and cause-effect inferences.

Wooldridge (2015), a multiple regression analysis is conducted when there are two or more independent variables.

The study sought to determine the effect that exists between Supply Chain integration and operational performance. The study conducted a regression analysis to explain how much the independent variables explain the dependent variable (OP).

3.9 Variables of the study

Based on theoretical literature and related studies in the area of supply chain integration on firms' performance review, the researcher identified the following dependent and independent variables.

Independent Variables: The identified five variables that contribute to ECX's operational performance (supplier integration, internal integration, warehouse integration, ICT integration and customer integration) each variable was measured by 6 items and the total were 30 items (from item 1 to item 30) in the questionnaire and defined as follows.

ICT integration: the sharing of accurate information across members of supply chain, the timely sharing of information across supply chain, coordination in the flow of information among partners and level of utilization of information among supply chain partners (Investopedia, 2016).

Internal integration: integration among internal functions, periodic interdepartmental meetings among internal functions, use of cross functional teams and integrative inventory management Narasimhan& Kim (2002).

Flynn, et al. (2010) defined internal integration as "the degree to which a manufacturer structures its own strategies, practices and processes into synchronized, collaborative processes to fulfill its customers' requirements and efficiently interact with suppliers".

Supplier integration: defined as the level of information exchange with suppliers through internet, establishment of quick ordering system with major supplier, level of strategic partnership with major supplier and stable procurement through network with major supplier Narasimhan& Kim (2002); Morash& Clinton (1998).

Warehouse integration: the degree which a warehouse system integrated with other processes for better accuracy, convenience, handling, control and having better layout systems so as to facilitate the receipt, storage and retrieval of commodities (ECX, 2019).

Customer integration: defined as the follow-up with customer for feedback, level of computerization for customer ordering, frequency of periodic contact with customer and level of linkage with customer through information network Narasimhan& Kim (2002); Morash& Clinton (1998).

Dependent variable: The researcher identified operational performance as dependent variable.

Operational performance: defined as the speed of response by the company to changes in market demand, on time delivery of products by the company to customer, the level of customer service by the company and level of lead time for fulfilling customer order (Frohlich&Westbrook, 2001; Beamon, 1999; Vickey, 2003).

Based on the reviews, operational performance has dimensions of flexibility, quality, cost and time/speed. Each of the dimensions was measured by 4 items and a total of 16 items in the questionnaire

3.10 Measurement and instrumentation

Narasimhan and Kim(2002) have identified supplier integration, customer integration,information integration and internal integration measurement factors.

The instrument used in the study was questionnaire. The standard questionnaire used to collect the necessary information regarding the study was adopted from the work ofSaleh (2015) who studied SCI impact on operational performance. According to Saleh (2015) the tool he used was very suit for assessing SCI as he developed using different related researches and reviewed by academic panel of judges and professionals in the area.

The variables were measured as follows.

ICT integration: measured through the level of sharing of accurate information across members of supply chain, the timely sharing of information across supply chain, coordination in the flow of information among partners and level of utilization of information among supply chain partners (Investopedia, 2016).

Internal integration: measured through data integration among internal functions, periodic interdepartmental meetings among internal functions, use of cross functional teams and integrative inventory management (Narasimhan& Kim, 2002).

Supplier integration: measured through the level of information exchange with suppliers through internet, establishment of quick ordering system with major supplier, level of strategic partnership with major supplier and stable procurement through network with major supplier (Narasimhan& Kim, 2002; Morash& Clinton, 1998).

Warehouse integration: measured through the degree which a warehouse system integrated with other processes and systems so as to facilitate the receipt, storage and retrieval of goods on the basis of industry accepted grades and standards (ECX, 2019).

Customer integration: measured through follow-up with customer for feedback, level of computerization for customer ordering, frequency of periodic contact with customer and level of

linkage with customer through information network (Narasimhan& Kim, 2002; Morash& Clinton, 1998).

Operational performance: measured through the speed of response by the company to changes in market demand, on time delivery of products by the company to customer, the level of customer service by the company and level of lead time for fulfilling customer order (Frohlich&Westbrook, 2001; Beamon, 1999; Vickey, 2003).

In the questionnaire, the Likert-type scale method was used with a range of responses: ‘Strongly Disagree’, ‘Disagree’, ‘Neutral’, ‘Agree’, and ‘Strongly Agree’, with a numeric value of 1-5, respectively. The usage of this particular scaling method ensured that the research study illustrated the ability to assess the responses and measure the responses quantifiably so that a pattern or trend may be produced in order to assess research hypotheses.

3.11 Validity and reliability

Validity

According to Malhotra (2010), there are three types of validity test: content validity, internal validity, and construct validity.

Validity is defined as a measure of truth or falsity of the data obtained through using the research instrument. It is classified as internal and external validity of the measuring instrument Burns & Grove (2001).

Construct validity ensures the measures being used correspond to the research concepts. Construct validity is achieved through triangulation of multiple data sources, a chain of evidence, and key informant reviews (Yin, 1994).

On this survey, the questionnaire employed by Saleh (2015) was used. Saleh studied The Impact of Supply Chain Integration on Operational Performance at Jordanian Pharmaceutical Manufacturing Organizations. Saleh used two methods to confirm the content validity. First: content validity, multiple sources of data (literature such as previous studies, expert interviews) were used to develop and refine the model and measures. Second: Face validity, panel of judges was carried out to modify the finale version of the questionnaire (Sekaran, 2003).

Reliability

The reliability of a measuring instrument is defined as its ability to consistently measure the phenomenon it is designed to measure (Ho, 2006).

The most common technique used in literatures to assess the scale's reliability and stability is the use of the Cronbach Alpha Statistics (Sekaran, 2003). In this particular study, reliability of the independent and dependent variables was assessed using Cronbach's Alpha Statistics. According to Sakaran (2005) if Cronbach's Alpha is at or over 0.70 in a study, it will be considered as reliable scale but any scale with Cronbach's Alpha less than this standard will be eliminated and considered as unreliable.

Table 3.2 Reliability test

Variables	Number of Items	Cronbach's Alpha
Customer integration	6	0.782
Internal integration	6	0.86
Supplier integration	6	0.80
ICT integration	6	0.813
Warehouse integration	6	0.816
Cost	4	0.711

Quality	4	0.756
Time/Speed	4	0.827
Flexibility	4	0.70
Operational Performance	16	0.883

Source: own survey (2019)

As shown above in table 3.2 that Cronbach's Alpha coefficient value for independent variables were ranging from 0.70 and 0.86 and for dependent variable was 0.883 which means that Cronbach's Alpha coefficient value is acceptable and reliable

3.12 Ethical Consideration

At the time of data collection process, appropriate ethical clearance was issued supported by a letter from Addis Ababa University School of commerce.

Before filling questionnaires, confidentiality was ensured for the information by not recording the name of the respondent or other identifiers. While conducting the research, respondents were informed that the data collection process was carried out whenever they were willing to cooperate. In addition to this, any information that was collected via the instrument would never be used for any other purpose other than its academic intent i.e. the data would be kept confidential. The respondents were also made to know that before it is publicized, they will be provided a copy of the publication.

Chapter Four

Data Analysis, Results and Discussion

4.1 Introduction

It has been discussed in previous chapters that this study attempted to examine the supply chain integration and its effect on operational performance in the case of Ethiopian Commodity Exchange. Hence, the findings of the study presented and discussed in this chapter. The questionnaire was developed in five scales (Likert scale) ranging from one to five; where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree. Exclusion of the "Neutral" responses from the original data set makes a substantial difference in the analysis results making the absolute midpoint 2.5 in a 5 scale Likert Ryan(1980). The study used a cut-point of 2.5 in the mean values of the Likert's scale results in the questionnaire. A total of 177 questionnaires were distributed to employees and 147 (83.05 %) questionnaires were obtained valid and used for analysis. The collected data were presented and analyzed using SPSS (version 20.00) statistical software.

The analysis of the data was as follows: first the study variables were analyzed and described from statistical point of view by using means, standard deviations, and then Regression Analysis was also used to test the effect of independent variables on dependent variable.

4.2 Demographic Profile of the Respondents

Table 4.1 Demographic information

Dimensions		Frequency	Percent
Gender	Male	93	63.3
	Female	54	36.7

Academic Qualification	Certificate	13	8.8
	Diploma	27	18.4
	First Degree	77	52.4
	Master Degree	30	20.4
Years of Service	< 2 Years	26	17.7
	3-5 Years	38	25.9
	6-8 Years	58	39.5
	9-11 Years	25	17.0
Department/division	Audit	2	1.4
	CEO	6	4.1
	Compliance	8	5.4
	Facility Management	24	16.3
	Finance	8	5.4
	HR	7	4.8
	IT	14	9.5
	Market operations	19	12.9
	Quality operations	12	8.2
	Strategy and corporate comm.	14	9.5
	Warehouse operations	33	22.4

Source: Own survey (2019)

Academic Qualification

Based on the results on table 4.1, most of the respondents hold Bachelor degree (first degree) with 77 (52.4 %) respondents, while 30 (20.4 %) respondents hold Master Degree. The least academic qualification is certificate with 13 respondents (8.8 %).

This shows that most of the respondents have good academic qualification so as to understand the concepts of the variables and answer the research questionnaire which has positive effect on quality of data collected.

Years of Service

The respondents were asked to indicate the duration they had served in the organization. The findings show on table 4.1 that a majority (39.5 %) indicated 6-8 years followed by 25.9 % who indicated 3-5 years. Only 17.7 % reported less than two years in the organization, implies that more than 56.5 % of the respondents served more than 5 years in the organization. This indicates that the majority of the respondents have good experience regarding the company and their response can be considered genuine which has direct relation with data quality.

4.3 Supply Chain Integration of ECX as Perceived by The respondents

Here, the analysis tried to describe the supply chain integration of ECX as perceived by the respondent employees, as presented above, through means and standard deviations.

The following table was derived from survey results of table 4.2 to 4.6 (appendix II).

Table 4.7 Mean and STD of supply chain integration of ECX as Perceived by the Employees

No	Items	N	Mean	Std. Deviation
1	Supplier integration	147	2.945	0.764
2	Internal integration	147	3.04	0.817
3	ICT integration	147	3.035	0.838
4	Customer integration	147	2.955	0.805
5	Warehouse integration	147	2.966	0.814
Supply chain integration		147	2.988	0.808

Source: Own survey (2019)

Table 4.7 shows that supply chain integration in ECX is low as its mean is 2.988. The employees show their disagreement on supply chain integration.

According to the results on table 4.7, mean value of independent variables is between 2.945 and 3.04 with standard deviations between 0.764 and 0.838. The overall mean of the variables is 2.988 with standard deviation 0.808, which mean there is agreement among employees of ECX on moderate implementation of supply chain integration in the company. Based on the Means of independent variables, internal integration is relatively highly implemented with mean value of 3.04. Customer integration shows the least implemented integration dimension with mean value of 2.945. Supplier integration is also the least implemented dimension with mean value of 2.955.

According to Flynn, *et al.* (2010) any supply chain with lower external (customer and supplier) integration cannot have a higher supply chain integration. But asZhaho, *et al.*(2011) described, companies with a lower level of internal integration will less likely have adequate capability to integrate with external partners, whereas companies with a high level of internal integration are more likely, and in a better position, to integrate theirprocesses with customers' or suppliers' processes. Therefore, though the company's supply chain integration is moderate in general and its external integration in particular, the company has a good position for improving its integration as it has a relatively better internal integration.

Based on the comments from the survey that the company doesn't play a great role in determining and improving the supply chain integration and shows that the organization has not understood the strategic importance of supply chain integration.

4.4 Operational Performance of ECX as Perceived by the Respondents

This section presents information on the measures that were used to measure organization performance. The results were presented as follows that were derived from survey results of table 4.8 through 4.11 (appendix II).

Table 4.12 Mean and STD of Operational performance of ECX

No	Measures	N	Mean	Std. Deviation
1	Cost	147	2.98	0.739
2	Time/Speed	147	2.948	0.775
3	Quality	147	2.96	0.802
4	Flexibility	147	3.0225	0.730
	Operational performance	147	2.978	0.762

Source: own survey (2019)

As shown on table 4.12, the overall mean value of the four measures of operational performance is 2.978 with standard deviation 0.762, which indicate that there is an agreement among ECX employees in the HQ that there is a moderate operational performance. The average mean value of operational performance measures is between 2.948 and 3.0225 with standard deviation between 0.73 and 0.802. As shown on the table above there is a relatively higher operational performance regarding flexibility measure with mean value of 3.0225. With a mean value of 2.948 the company has the lowest operational performance measure regarding to time/speed.

4.5 The Effect of SCI on Operational Performance of ECX

To assess the effect of Supply chain integration on operational performance of ECX, the study applied regression analysis.

The results of the regression were presented as follows:

A. Linearity Test

The plot on Appendix III shows there is a linear relationship between operational performance and the independent variables.

B. Multi collinearity Test

Tolerance and VIF (Variance Inflation Factor) and tolerance are used to test multi-collinearity. As Gujarati (2003) described, a multi collinearity test can be conducted using tolerance or VIF factor and by rule of thumb, $VIF \leq 10$ or tolerance > 0.2 are acceptable to say there is no multi collinearity problem.

Table 4.14 Multi collinearity test

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	.503	.141		3.565	.000		
Customer Integration	.072	.055	.087	1.313	.191	.481	2.079
ICT Integration	.122	.048	.160	2.534	.012	.537	1.862
Supplier Integration	.326	.063	.384	5.204	.000	.391	2.556
Warehouse Integration	.172	.046	.220	3.755	.000	.621	1.611
Internal Integration	.139	.040	.190	3.440	.001	.699	1.432

a. Dependent Variable: Operational performance

Source: Own survey (2019)

The above table leads to a conclusion that there is no multi collinearity effect and the inter relationships among independent variables doesn't cause concern. Therefore, as the indication of statistics that the predictors are not highly correlated and it was not the problem of the study.

C. Normality test

This test of assumption can be proved by drawing histogram or Q-Q plot. In (appendix III) the histogram follows a normal distribution reveals the residuals are normally distributed and hence the data used were normal.

D. Homoscedasticity

The scatterplot of the residuals on Appendix III looks like a shot it out of a shotgun—it does not have an obvious pattern, there are points equally distributed above and below zero on the X axis, and to the left and right of zero on the Y axis. Hence the figure depicted that residuals are equally distributed.

Table 4.15 ANOVA test

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	21.494	5	4.299	65.540	.000 ^b
	Residual	9.248	141	.066		
	Total	30.742	146			

a. Dependent Variable: Operational performance

b. Predictors: (Constant), Internal Integration, Customer Integration, Warehouse Integration, ICT Integration, Supplier Integration

Source: Own survey (2019)

In the table 4.15, we have the F value of 65.540 which is significant with $p < 0.001$. This informs us that independent variables taken together as a set are significantly related to the dependent variable. Hence, the multiple regression model is overall statistically significant.

The above assumption tests showed that the regression used was fit for the study and the tests for hypotheses and results were discussed below.

Table 4.16 Coefficient of determination

Model Summary^b				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.836 ^a	.699	.689	.25610

a. Predictors: (Constant), Internal Integration, Customer Integration, Warehouse Integration, ICT Integration, Supplier Integration

b. Dependent Variable: Operational performance

Source: Own survey (2019)

H₀: Supply chain integration doesn't have effect on operational performance of ECX ($\alpha \leq 0.05$).

The results in the table 4.16 above shows positive coefficient implies that SCI has a positive influence on operational performance. Hence there is no evidence to accept the null hypothesis. The result leads to a conclusion that supply chain integration has direct effect on operational performance of ECX.

The coefficient of determination, adjusted R² is 0.689, meaning that 68.9% of the variation in operational performance (OP) is explained by the variations in supplier, internal, customer, warehouse and ICT integrations. Which means that the remaining 31.10% of the variation in operational performance cannot be explained by SCI dimensions.

This result goes in line with different previous studies, such as Barbara, et.al. (2009), Chavez et.al. (2015) and Huo (2012) who found that supply chain integration had a significant impact on business and organizational performance.

Table 4.17 Coefficients

Coefficients ^a					
Model		Unstandardized Coefficients		Standardized Coefficients	Sig.
		B	Std. Error	Beta	
1	(Constant)	.503	.141		.000
	Customer Integration	.072	.055	.087	.191
	ICT Integration	.122	.048	.160	.012
	Supplier Integration	.326	.063	.384	.000
	Warehouse Integration	.172	.046	.220	.000
	Internal Integration	.139	.040	.190	.001

a. Dependent Variable: Operational performance

Source: Own survey (2019)

In the following sub-sections, the hypothesis for each SCI items were tested and discussed.

4.5.1 The effect of supplier integration on the operational performance of ECX

H_{0.1} Supplier integration doesn't have direct effect on operational performance of ECX ($\alpha \leq 0.05$).

Table 4.17 shows that there is a positive direct effect of supplier integration on operational performance, since (Beta= 0.384, t=5.204, sig. 0.000, $p < 0.05$). Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted, which indicates that supplier integration has direct impact on operational performance of ECX at ($\alpha \leq 0.05$).

Thus, supplier integration has direct effect on operational performance of ECX that goes in line with previous researches for example (Kumar, et al., 2017) studied effect of SCI on operational performance and concluded that supplier integration directly affects operational performance.

However, Stank, et al. (2001) reported no direct association between supplier integration and operational performance (Flynn, et al., 2010), other scholars such as (Swink, et al., 2007; Stank, et

al., 2001) also found a negative association between supplier integration and operational performance

4.5.2 The effect of internal integration on the operational performance of ECX

H_{0.2} Internal integration doesn't have direct effect operational performance of ECX ($\alpha \leq 0.05$).

Table (4.17) shows that there is a positive direct effect of internal integration on operational performance, since (Beta= 0.190, t=3.440, sig. 0.001, $p < 0.05$). Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted, which indicates that internal integration has direct impact on operational performance of ECX at ($\alpha \leq 0.05$).

Thus, internal integration has direct effect on the operational performance of ECX. The result is consistent with the research of Ellinger (2000) proclaimed that reward system and the departmental internal relations influenced positively on the organization's performance. Similar results of research by (O'Leary-Kelly and Flores, 2002; Rosenzweig, et al., 2003; Vickery, et al., 2003) reveals that internal integration directly affects operational performance.

4.5.3 The effect of customer integration on the operational performance of ECX

H_{0.3} Customer integration doesn't have direct effect on operational performance of ECX ($\alpha \leq 0.05$).

Table (4.17) shows that there is no direct effect of customer integration on operational performance, since (Beta= 0.087, t=1.313, sig. 0.191, $p > 0.05$). Therefore, the null hypothesis is accepted implies that customer integration doesn't have direct effect on operational performance of ECX at ($\alpha \leq 0.05$).

Hence, customer integration has no direct effect on operational performance of ECX that contradicts against most studies that recommends and concludes that customer integration has direct effect on operational performance.

The contradiction comes from the socioeconomic behavior of the country that customers are not considered very important by most firms. The perception of employees at ECX in the HQ may arise from the fact that most business firms in Ethiopia don't care about customer integration. Refuting a theory of customer integration has direct impact on performance is difficult one at this level but the researchers believed that the above reason may be a cause of it.

The researches of Wantao, et al. (2015), Cousins and Menguc(2006); Homburg and Stock (2004); Koufteros, et al.(2007), for instance contradicts with the above one concluded that customer integration has direct effect on operational performance.

4.5.4 The effect of ICT integration on the operational performance of ECX

H_{0.4} ICT integration doesn't have direct effect on operational performance of ECX ($\alpha \leq 0.05$).

Table (4.17) shows that there is a positive direct effect of ICT integration on operational performance, since (Beta= 0.160, t=2.534, sig. 0.012, $p < 0.05$). Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted, which indicates that ICT integration has direct effect on operational performance of ECX at ($\alpha \leq 0.05$).

ICT integration has direct effect on operational performance of ECX.

The result was identical with that of made by Ketokivi and Schroeder(2004); Vehovar(2007); SanJose, et al. (2009) and Campo, et al.(2011) who arrived on conclusion that ICT impacts directly on firm performance.

Few researches reported different result. Brynjolfsson and Hitt (2000); Boothy, et al. (2010) and Cao (2010) found that ICT integration has no direct effect on operational performance.

4.5.5 The effect of warehouse integration on the operational performance of ECX

H_{0.5} Warehouse integration doesn't have direct effect on operational performance of ECX ($\alpha \leq 0.05$).

Table (4.17) shows that there is a positive direct effect of warehouse integration on operational performance, since (Beta= 0.220, t=3.755, sig. 0.000, $p < 0.05$). Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted, which indicates that warehouse integration has a direct impact on operational performance of ECX at ($\alpha \leq 0.05$).

Warehouse integration has direct effect on operational performance of ECX.

No research found that directly applied warehouse integration and its effect operational performance but numerous research in the area of warehouse management and operational performance are available that proved warehouse integration has direct effect on operational performance. Among those studies, a case study on distribution center by Nee(2009) reported that warehouse management system has direct effect on operational performance can be listed as example.

Chapter Five

Conclusions and Recommendations

5.1 Introduction

This chapter provides the conclusion of the study and recommendations. The other topic included here is suggestions for area of future research.

5.2 Conclusions

Relying on the results of the study and the summary of findings, the study concludes that there is a significantly positive relationship between SCI and operational performance. Hence, firms are expected to enhance their supply chain integration so as to gain better operational performance.

The analysis result represents that the mean score values for supply chain integration dimensions were above the average mean value showing that supply chain integration of ECX is moderate.

The mean value result in the internal integration part that different departments in the company collaborate with the company development program is the least value of 3.00. Thus the employees agree that among internal integration items, the employees are less aligned with other departments.

ICT integration has better results compared to others except internal integration. But the results in the survey related to information exchange with major suppliers, exporters and customers through ICT network and the ordering system with major suppliers and exporters is very poor result compared to other items.

So as to enhance operational performance, ECX should find mechanisms to focus on supply chain integration practices especially on its internal and ICT integrations.

5.3 Recommendations and Areas of Future Research

Recommendations

Based on the conclusions dawn above, some recommendations are proposed as a means of alleviating the problems founded as follows.

- Internal integration is a primary activity in any organization. ECX should have to give a critical emphasis on alignment among departments and creating continuous interdepartmental contact among internal functions. Above all, the enterprise should have to equip itself with modern technologies like enterprise resource planning systems (ERP) which benefits the company through better integration.
- ICT integration within upper and downstream of SC partners is a major activity in SCI. The firm should have to work closely with SC partners keep itself from the issues that affect its business.
- Without customer integration it is impossible to survive in the market. Linking the customer through information network with the company to measure customer satisfaction and creating an access of information sharing is crucial even if the result shows no direct effect of operational performance and customer integration.
- Long term strategic supplier integration for core commodities is important which are effectively categorizing based on their level of significance.
- The findings of the study indicate that internal integration and ICT integration have contributed much more to the operational performance of ECX. So efforts should be made to better integrate within the warehouse as well since it is core to the business having a direct impact on its performance.

Future Research Directions

Future research is needed to extend the findings of this study. This study has addressed only effect of SCI on the operational performance of the case company, ECX. Hence the following are recommendations for future research.

- ✓ The research recommends to add other variables including the addition of a variable to an intermediary such as the impact of the external environment, also it is possible to add that can give clearer results.
- ✓ This study focuses on operational performance of ECX hence recommends future studies by considering other factors like profit.
- ✓ The study recommends to incorporate all branch offices in the country as the scope was the HQ in the study so as to know the perception of all employees.
- ✓ This study is dedicated to a commodity exchange, so it is advisable to study the supply chain integration on other service giving organizations.
- ✓ It is recommended that to restudying the same topic on the company over a period of time to evaluate the progress resulting from the application of supply chain integration.
- ✓ Finally, the research recommends to conduct similar studies from the perspective of suppliers and customers.

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Appendix I

Employees data (email from ECX and edited with MS paint)

Addis Ababa University

Inbox

Wed, Feb 13, 2019 at 8:22 PM

Mekdes Sisay

<Mekdes.Sisay@ecx.com.et>

To: "tklmlt@gmail.com" <tklmlt@gmail.com>

Cc: Ermias Ashine <Ermias.Ashine@ecx.com.et>

[Reply](#) | [Reply to all](#) | [Forward](#) | [Print](#) | [Delete](#) | [Show original](#)

1. Total employees #877 Staff (updated on January 2019)
2. Head office #218 Saris #51 staffs
3. Cleaner, Guards Outsource staff
4. **11 Departments**

CEO	17 Staffs
Compliance	17 Staffs

Facilities Mgt	44 Staffs
Finance	16 Staffs
HR	14 Staffs
IT	24 Staffs
Audit	5 Staffs
Market Operations	33 Staffs
Quality Operations	22 Staffs
Strategy & Corp Communication	16 Staffs
Warehouse Operations	51 Staffs

With best

Regards,



ETHIOPIA COMMODITY EXCHANGE
የኢትዮጵያ የምርት ገበያ



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Appendix II

Table 4.2 Mean and STD of Supplier integration items

No	Items	N	Mean	Std. Deviation
SIQ1	ECX has effective communications with suppliers on research activities and new service development.	147	2.97	0.697
SIQ2	ECX and its suppliers have transparent information about each other's' inventory status.	147	2.89	0.786
SIQ3	ECX and its suppliers provide each other with each other's' plan.	147	3.20	0.708
SIQ4	ECX and its suppliers share technical information with each other if required	147	2.91	0.776
SIQ5	ECX has long-term relationships with its suppliers	147	2.89	0.812
SIQ6	ECX shares demand forecasts with major suppliers	147	2.81	0.797
Supplier integration		147	2.945	0.764

Table 4.3 Mean and STD of Internal integration items

No	Items	N	Mean	Std. Deviation
IIQ1	There are effective communications between different departments regarding a new commodity introduction or new process	147	3.01	0.781
IIQ2	Departments have transparent information about the operational status of each other	147	3.01	0.807
IIQ3	Different departments in your company collaborate with the company development program (s).	147	3.00	0.819
IIQ4	Different departments in your company share technical information with each other quickly if required	147	3.02	0.823
IIQ5	Departments at ECX collaborate with the company development programs	147	3.08	0.832
IIQ6	ECX utilizes periodic interdepartmental meetings among	147	3.12	0.840

	internal functions			
Internal integration		147	3.04	0.817

Table 4.4 Mean and STD of ICT integration items

No	Items	N	Mean	Std. Deviation
ITQ1	There is high level of data integration among internal functions of the company	147	3.24	0.894
ITQ2	Departments have transparent information about the operational status of each other	147	3.31	0.890
ITQ3	There is strong timely information exchange with major suppliers, exporters and customers through ICT network.	147	2.81	0.734
ITQ4	ECX has well computerized system for major customer ordering	147	2.84	0.820
ITQ5	There is quick ordering system with major suppliers and exporters	147	2.79	0.742
ITQ6	Exporters can collect their contracts from regional warehouses without facing communication problems.	147	3.22	0.925
ICT integration		147	3.035	0.838

Table 4.5 Mean and STD of customer integration items

No	Items	N	Mean	Std. Deviation
CIQ1	ECX has effective communication with its customers on research and development activities	147	3.02	0.754
CIQ2	ECX and its customers have transparent information about each other's' policies and strategies	147	3.08	0.790
CIQ3	ECX shares its plan with its customers.	147	3.03	0.871
CIQ4	ECX and its customers share technical information with each other if required.	147	2.80	0.721
CIQ5	ECX has a systematic way to constantly measure customer satisfaction	147	2.75	0.628

CIQ6	ECX has high level of linkage with customers through information networks	147	3.05	0.886
Customer integration		147	2.955	0.805

Table 4.6 Mean and STD of warehouse integration items

No	Items	N	Mean	Std. Deviation
WIQ1	ECX has effective warehouse control system.	147	3.02	0.735
WIQ2	The inventory system in the warehouses is well integrated.	147	2.90	0.825
WIQ3	ECX has inventory accuracy (full visibility of its inventory).	147	2.95	0.757
WIQ4	The warehouse layouts of ECX are well integrated that they are convenient for exporters.	147	2.94	0.778
WIQ5	ECX has proper handling system of the commodity at the warehouse (store layout, stacking, bin no, inventory management)	147	3.04	0.985
WIQ6	The warehouse at the ECX are optimized for picking routes for customers.	147	2.89	0.778
Warehouse integration		147	2.966	0.814

Table 4.8 Mean and STD of flexibility items

No	Items	N	Mean	Std. Deviation
FQ1	ECX chooses suppliers who are flexible in responding to requests of the company when needed	147	2.96	0.650
FQ2	ECX is characterized by openness to new ideas at work	147	3.10	0.797
FQ3	ECX gives its customers pay facilities after checking their financial status	147	3.12	0.772
FQ4	ECX has the ability to respond to and accommodate periods of poor supplier performance	147	2.91	0.692
Flexibility		147	3.0225	0.730

Table 4.9 Mean and STD of quality items

No	Items	N	Mean	Std. Deviation
QQ1	ECX is committed to provide exchange service according to local and international standards	147	3.05	0.792
QQ2	ECX produces various forms of services to suit customers' needs	147	3.01	0.899
QQ3	ECX is committed to proper storage conditions according to the standardized specifications to maintain the quality of received commodities	147	3.02	0.707
QQ4	ECX chooses commodity suppliers on the basis of high quality	147	2.76	0.799
Quality		147	2.96	0.802

Table 4.10 Mean and STD of time/speed items

No	Items	N	Mean	Std. Deviation
TSQ1	ECX is committed to provide fast service to its customers	147	2.86	0.759
TSQ2	Suppliers are committed to supply orders by the agreed timetables	147	2.95	0.725
TSQ3	ECX bears the differences in transportation costs in order to meet the deadlines	147	2.88	0.781
TSQ4	ECX is characterized by quick exchange of information with stakeholders	147	3.10	0.834
Speed/time		147	2.948	0.775

Table 4.11 Mean and STD of Cost items

No	Items	N	Mean	Std. Deviation
CQ1	ECX is seeking to reduce the wasteful use of resources	147	2.92	0.636
CQ2	ECX is working to reduce defective commodities	147	3.02	0.772
CQ3	ECX is arranging its internal processes in a manner to shorten performing activities	147	3.01	0.717
CQ4	ECX is working to reduce inventory to minimum level to the extent that does not hinder the continuation of work	147	2.97	0.819

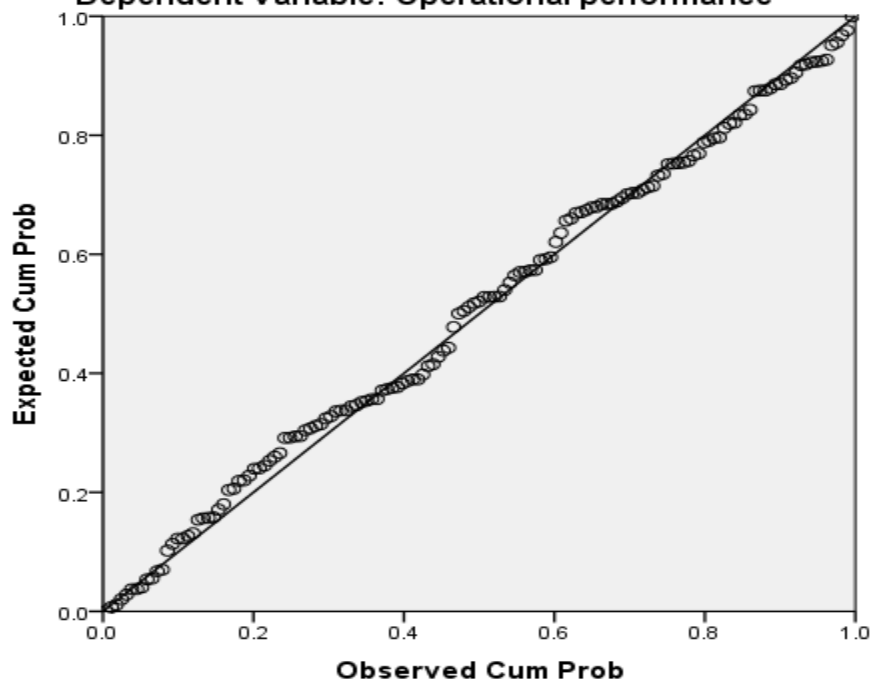
Cost	147	2.98	0.739
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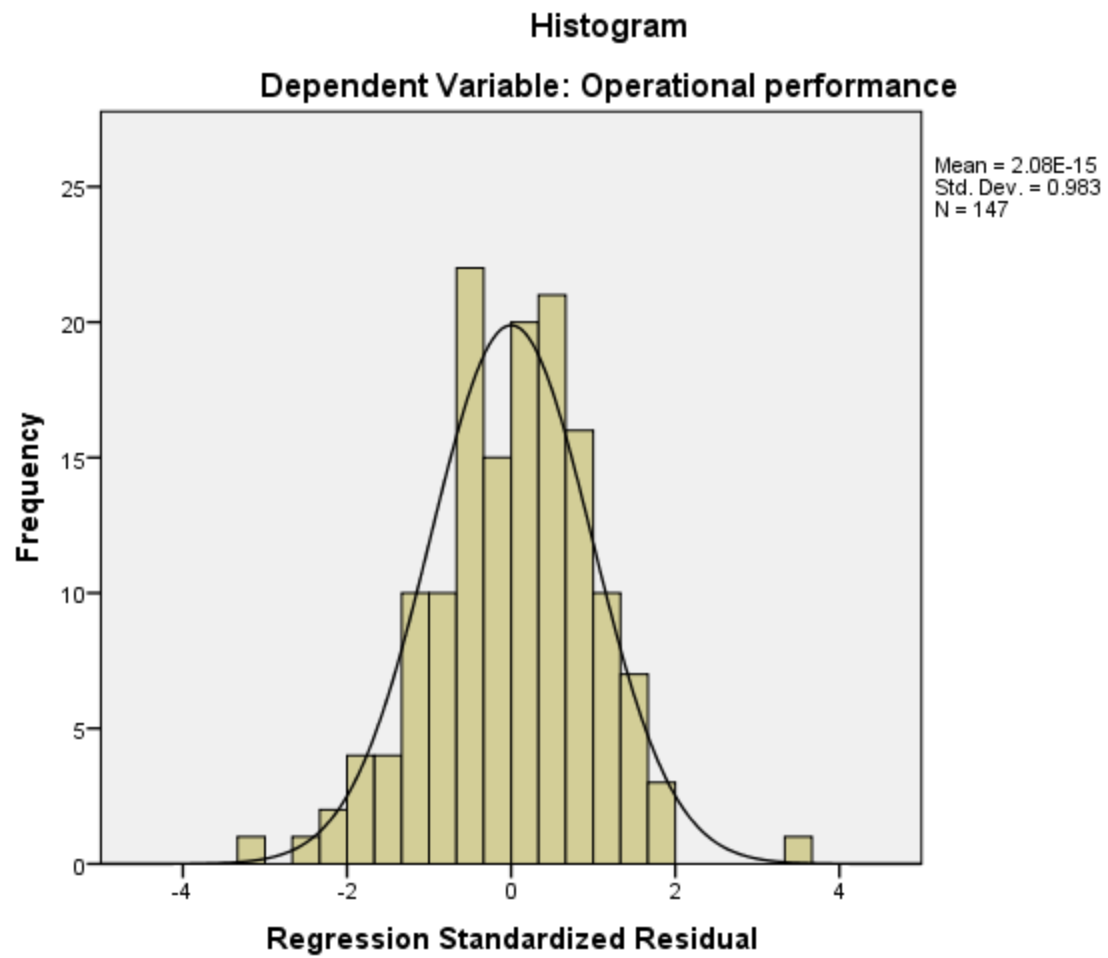
Appendix III

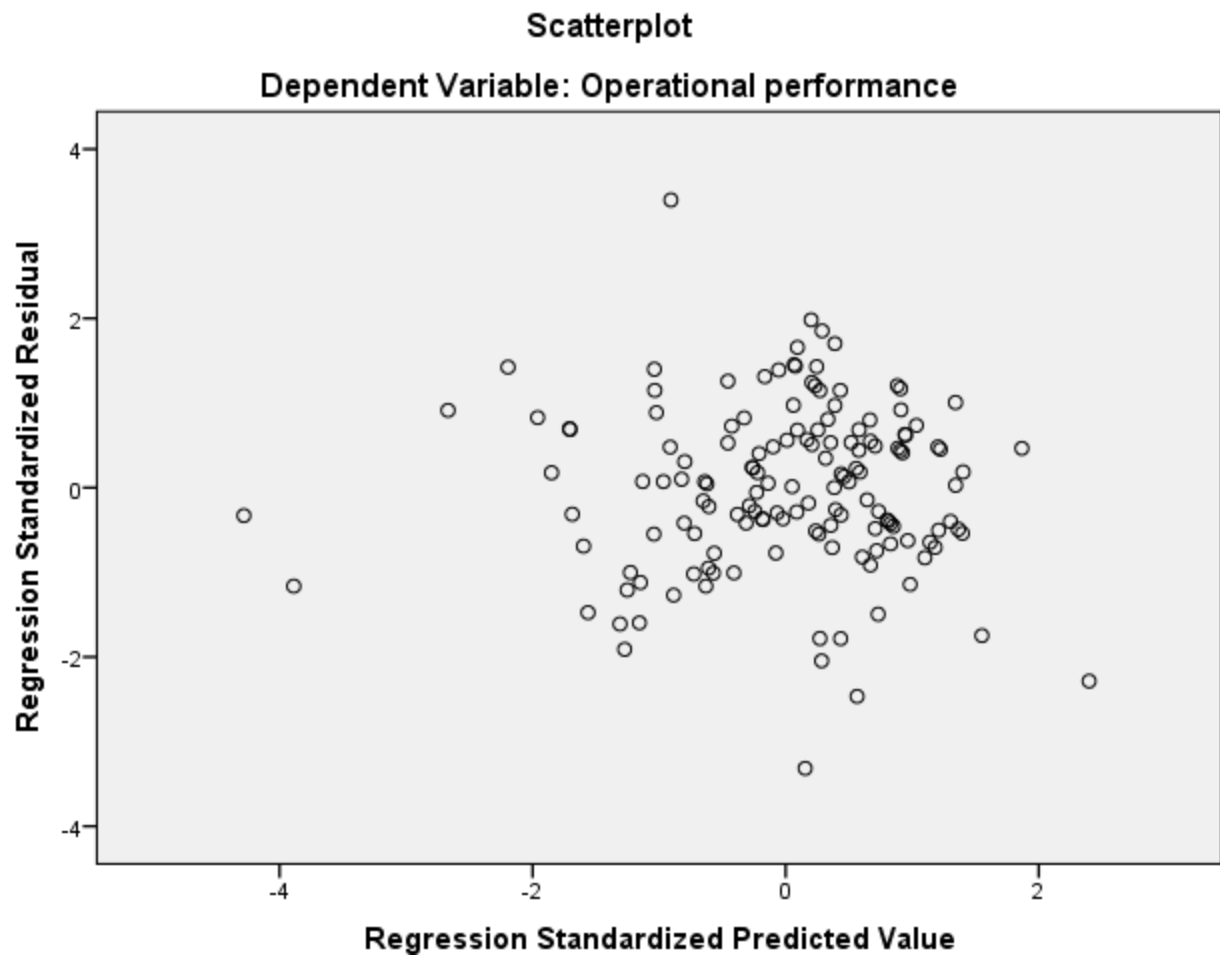
SPSS generated output

Normal P-P Plot of Regression Standardized Residual

Dependent Variable: Operational performance







Appendix IV

Questionnaire



Addis Ababa University

College of Business and Economics

Logistics and Supply Chain Management Unit

Questionnaire to be filled by employees of Ethiopia Commodity Exchange

Dear respondent, this questionnaire is prepared for academic purpose to fulfill the requirements of Master of Arts in the field of Logistics and supply chain management in titled “*The Effects of Supply Chain Integration on Operational Performance: The case of Ethiopian Commodity Exchange, ECX*”. The information obtained on this questionnaire will be kept confidential and not to be used for another purpose. Hence, I request you kindly to fill genuine information.

Thank you for your cooperation!

General directions

You have the right not to participate on this survey

You are not required to write your name

Try to address all the questions

Put a (✓) mark for close ended questions

Contact Address

Dear respondent, if you have any question, comment or suggestion on this survey, don't hesitate to contact me through the following address lines. I will be at your convenience any time.

Takele Mulat cell phone: 0911-168395 email: tkmlt@gmail.com

Dr. Tariku Jebena (research advisor) email:tarikujebena@gmail.com

Section 1: Demographic information

1.1 Gender Male ☐ Female ☐

1.2 Academic Qualification

Certificate ☐ Diploma ☐ First Degree ☐ Master Degree ☐ PhD ☐

1.3 Years of service

<2 Years ☐ 3-5 Years ☐ 6-8 Years ☐ 9-11 Years ☐

1.4 Department

CEO ☐ Compliance ☐ Facilities Mgt ☐ Finance ☐ HR ☐ IT ☐

Audit ☐ Market Operations ☐ Quality Operations ☐ Strategy & corporate Comm. ☐

Warehouse Operation ☐

Section 2: Information related to SCI on operational performance

Part A: Supply chain Integration

The statements below are related to the assessment of the level of integration of ECX supply chain. Please put a √ on the appropriate column to indicate the extent to which you agree or disagree with each statement. The item scales are five-point Likert type scales with [1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree] based on how you feel about the statement.

A.1 Internal integration		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	There are effective communications between different departments regarding a new commodity introduction or new process.					
2	Departments have transparent information about the operational status of each other					
3	Different departments in your company collaborate with the company development program (s).					

4	Different departments in your company share technical information with each other quickly if required					
5	Departments at ECX collaborate with the company development programs					
6	ECX utilizes periodic interdepartmental meetings among internal functions					

A.2 ICT integration		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
7	There is high level of data integration among internal functions of the company					
8	Departments have transparent information about the operational status of each other					
9	There is strong timely information exchange with major suppliers, exporters and customers through ICT network.					
10	ECX has well computerized system for major customer ordering					
11	There is quick ordering system with major suppliers and exporters					
12	Exporters can collect their contracts from regional warehouses without facing communication problems.					

A.3 Supplier integration		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
13	ECX has effective communications with suppliers on research activities and new service development.					

14	ECX and its suppliers have transparent information about each other's' inventory status.					
15	ECX and its suppliers provide each other with each other's' plan.					
16	ECX and its suppliers share technical information with each other if required					
17	ECX has long-term relationships with its suppliers					
18	ECX shares demand forecasts with major suppliers					

A.4 Customer integration		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
19	ECX has effective communication with its customers on research and development activities					
20	ECX and its customers have transparent information about each other's' policies and strategies					
21	ECX shares its plan with its customers.					
22	ECX and its customers share technical information with each other if required.					
23	ECX has a systematic way to constantly measure customer satisfaction					
24	ECX has high level of linkage with customers through information networks					

A.5 Warehouse integration	Strongly	Disagree	Neutral	Agree	Strongly
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		disagree				agree
25	ECX has effective warehouse control system.					
26	The inventory system in the warehouses is well integrated.					
27	ECX has inventory accuracy (full visibility of its inventory).					
28	The warehouse layouts of ECX are well integrated that they are convenient for exporters.					
29	ECX has proper handling system of the commodity at the warehouse (store layout, stacking, bin no, inventory management)					
30	The warehouse at the ECX are optimized for picking routes for customers.					

Part B: Operational performance

The statements below relate to the dependent variable of operational performance gained through supply chain integration as independent variable. Follow the instructions given for your responses.

B.1 Cost		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
31	ECX is seeking to reduce the wasteful use of resources					
32	ECX is working to reduce defective commodities					
33	ECX is arranging its internal processes in a manner to shorten performing activities					
34	ECX is working to reduce inventory to minimum level to the extent that does not hinder the continuation of work					

B.2 Quality		Strongly	Disagree	Neutral	Agree	Strongly
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		disagree				agree
35	ECX is committed to provide exchange service according to local and international standards					
36	ECX produces various forms of services to suit customers' needs					
37	ECX is committed to proper storage conditions according to the standardized specifications to maintain the quality of received commodities.					
38	ECX chooses commodity suppliers on the basis of high quality					

B.3 Time/Speed		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
39	ECX is committed to provide fast service to its customers					
40	Suppliers are committed to supply orders by the agreed timetables					
41	ECX bears the differences in transportation costs in order to meet the deadlines					
42	ECX is characterized by quick exchange of information with stakeholders					

B.4 Flexibility		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
43	ECX chooses suppliers who are flexible in responding to requests of the company when needed					
44	ECX is characterized by openness to new ideas at work					
45	ECX gives its customers pay facilities after checking their financial status					

46	ECX has the ability to respond to and accommodate periods of poor supplier performance					
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Thank you very much once again!