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Analyzing Supply Chain Integrations and its Performances Metrics to Enhance Productivity

***Case company*:** Five Food Complex Industries around Addis Ababa

***By*: GETU ABDISA**

A Master's thesis submitted to the school of Graduate Studies of Addis Ababa University, Addis Ababa University Institute of Technology (AAiT), the School of Mechanical, and Industrial Engineering, for the partial fulfillment of the requirements for the ***Degree of Masters of Science in Industrial Engineering*** *(Industrial System Engineering Stream)*

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June, 2021 G.C

ADDIS ABABA UNIVERSITY
INSTITUTE OF TECHNOLOGY
School of Mechanical & Industrial Engineering Department
Industrial Engineering Chair
Master Science in Industrial Engineering (Industrial System Engineering Stream)

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As member of the board of examiners of the final Master's degree thesis, we certify that, we have read and evaluated the thesis prepared by **Getu Abdisa** under the title of "***Analyzing Supply Chain Integrations and its Performance Metrics to Enhance Productivity*** on five food complex industries around Addis Ababa" recommend that it has been accepted as fulfilling the thesis requirement for the degree of master of science in Industrial System Engineering.

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DECLARATION

I hereby declare that, the work which is being presented in this master's thesis (M.Sc.) entitled ***"Analyzing Supply Chain Integrations and its Performances Metrics to Enhance Productivity:*** on five Food Complex Industries around Addis Ababa P.L.C**",** is an original work of my own investigation, which has been not presented for Degree at any other University or Institution and all the resources, materials used for this research have been properly acknowledged.

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This is to certify that the above declaration made by the candidate is correct to the best of my acknowledge

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Getu Abdisa

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MLAC)

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SCI

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WVC

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WW

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ABSTRACT

To be competitive domestically & across the globe, coordinating various SC functional departments and inter-flows of its activities' integrations need to be synchronized. SCPM is activity to quantify efficiency, effectiveness, and resource utilization of SC operations' current case industries that resulted from poor SCIs. The major case firms' problems were lack of SC coordination, like suppliers, poor inter-flows of resources within SC functional - departments, resources utilization, and poor cost opportunities. To address these problems, case firms need management & resources utilization philosophy to be a success. Pre-dominantly, the objective of this study was to analyze SCI & SCPM to enhance overall SC productivity. In Literature Review, general concepts of SCI, SCPMs & their type, various tools, models, addressed areas by former scholars, and gaps such as the SCOR model used solely, improvement management tools not extensively incorporated in materials. However, the researcher merged it with a tool like MLAC & QMS relevant tool to make the analysis comprehensive.

Research framework, data type & method of collection (questionnaires, structured &semi-structured interviews, and discussions, review SC operations' reports) have been used. Relevant data analysis tools such as a combination of MS-excel solver & IBM 24 SPSS software, and efficiencies, downtime, and cost opportunity analysis were used. Having these, key SCI such as 10.1%, 57.8%, 30.8% (CIWS), 19.9%, 52.6, 21.4 % (SCIOI) and 16.5%, 51.4%, 26.6% (SCII) as low, medium and high respectively. This weak SC coordination resulted SCPM as 21.4%, 50.0%, 22.9% (response time), 19.7%, 36.6%, 38.1% (quality aspects) as low, medium and high from questioner analysis. Correlation and regression analysis have been examined to define the impacts of one variable on others. And also, cost utilization was 29% (PE),18%(AE), 43%(IFE), and 11%(EFE) respectively while, efficiency as 68.4%, 69.6%,77.3%, 68.9% and 70.4% (Figure 5:18) and SC operations downtime more than 19.5% that can affect overall SC productivity. A possible solution has been proposed via corrective measurements & implementation guideline models through SCOR-model, MLAC & QMS relevant tools to address the aim of the study. So, SC productivity of the case firms and similar companies can be enhanced after the proposed solution is wisely institutionalized.

KEY WORDS: supply chain, integrating supply chain, supply chain performance, supply chain productivity

CHAPTER ONE

1. INTRODUCTION

In business & industrial activities, SCI is defined by Mahone (1992) as the process of coordinating & collaborating separate functional SC operations to enabling the key elements of chains. The others scholar tried to define this approach with SCPMs, and evaluate the effectiveness of the SC system (A., 1995 and R.Paklan, 1992). Therefore, SCI significant tool to manage, inter-flows of the key elements of SCPM that are used to quantify the efficiency and effectiveness of activities in the industrial chains (R.Homberg, 2000; G.Neubert, 2004 & S.Hosseini, 2012). Having these pooling initiatives, effects of globalization, and fierce competitions have forced firms to focus their attention on entire integrations rather than on the effectiveness & efficiency of separate SC activities (Georgise, 2014). Effective of SCIs are becoming the critical factor for the processes of SC activities and overall success (Da Silva, 2007&S.Hosseini, 2012).

Most developing countries in Africa including Ethiopia have fallen from being Net exporters to importers of not only cash crops but also, processed foods (Amentae, 2016 & (Handayati, et al, 2015). The Ethiopian food complex processes industries are not out of these existing scenarios and below expected tips of achievements with managing SCI's activities that can affect SCPMs (Abate, 2018, and Yohannes, 2016). For instance: 37.8%, 46.3% as cooperativeness of SC with Stakeholders and customer order response respectively (MoI, 2016) while 29.6%, 33.4% as product flexibility & sale forecast information inter-flows (CSA, 2017/18) & (DAG, 2018).

In addition, the researcher explored various SCI problems such as poor SCI that cause low SCPM, resource utilization efficiency as 68.4%, 69.6%,77.3%, 68.9%, and 70.4% (Figure 5:17) for all case firms, which can affect SC productivity in case firms. Based on these achievements, the researcher conducted this study entitled ***"Analyzing Supply Chain Integrations and its Performance Metrics to Enhance Productivity:*** referencing five Food Complex Industries around Addis Ababa". The objective was to analyze SCI & its SCPM to enhance SC productivity via proposing possible scenarios.

To address the problems and aim of this research, an author applied scientific research methodologies such as reviewing relevant Literature and research gaps identification. Most of the Literature has been used the SCOR model solely and weak linking of improvement tools in

SCI, but an author merged SCOR-mode, Managerial Levers Achievement Coordination (MLAC), and QMS relevant management tools in this study to extend the analysis.

Then, necessary SCI & SCPMs secondary and primary data have been collected from case Industries through 1-6 scoring Likert scale questionnaires, structured and semi-structured interviews, review some case industries' operational reports documents, etc. The purposive data sampling method was used by taking five industries around Addis Ababa due to the various SC activities that take place in these areas.

Quantitative and qualitative data analysis was applied in this research using and MS - excel solvers merge with 24 IBM SPSS software package to analyze collected data. For instance: key SCI such as 10.1%, 57.8%, 30.8% (CIS), 19.9 %, 52.6%, 21.4% (SCIOI) and 16.5%, 51.4%, 26.6% (SCII), 16.8%, 54.7%, 23.3 % (CFI) as low, medium and high respectively. Due to these SCI's low achievement, SCPM estimated as 21.4%, 50.0%, 22.9% (response time), 18.6%, 58.1%, 20.5% (quality aspect) low, medium, high respectively. Correlation and regression analysis have been examined to define the impacts of SCI on the performance parameters (Appendix V). Unnecessary SC operational expenses such as 29% (PE), 18% (AE), 42% (IFE), and 11% (EFE) due to poor SCI which affects SC operational profitability, and SC operations' system downtime as 20%, 26.2% and 27.6% (Figure 5:18) productivity of the case firm. And also, various SC operations' potential negative factors have been explored through interviews and discussions in the case firms.

The possible solution and various relevant improvement tools and implementation guideline integrated models have been proposed to address the pre-defined aim of this research. The conclusion has been drawn and lists of recommendations forwarded to realizing this study and initiate how case firms' SC overall productivity can be enhanced.

Finally, based on the journey of the scientific approach that, "research is continuous activity", an author incited further investigation areas.

1.2 Statement of the Problem

Firms compete if they have embedded in an institutional arrangement that enables them coordinating, and strengthen the cooperation to pursue gradual improvements in the inter-flows of the SC activities & get high returns (Georgise, 2014; W.Mekuria, 2018). SCPM is used to quantify the SCI's performances and show areas that need to be interfered with to be facilitated the enhancement of SC productivity (S.Hosseini, 2012; Moti, 2018). However, most developing countries in Africa including Ethiopia have fallen from being Net exporters to importers of not only cash crops but also, food products due to weak SCIs. (Kenea, 2016; Mulugeta, 2018; Abate, 2018 & UNIDO, 2019). This is the result of low achievements of SCPMs & productivity.

In Ethiopia, on average, the collaboration of SC key elements in food complex industries with stakeholders was about 37.6%, while deliverance and customer order response was estimated as 46.3% (MoI, 2016) which is a low achievement. And also, (CSA, 2017/18; AACCSA, 2017) survey on SCI activities of this industry, that was 29.6%, 33.34% & 46.7% as product flexibility, Sale forecast information inter-flows from company to stakeholders, and order processes respectively. These are a symptom of poor SCI and can affect market competition of the sector.

The current case companies' also affected by SCI problems and ways of managing their various operations which lead firms to poor resources utilization and low SCPMs achievement. For instance: From analysis of questionnaires part of data, 19.9%, 52.6%, 20.9% (SCIOI), 16.5%, 51.4%, 26.5% (SCII) 16.8%, 54.7%, 23.3% (CFI) low, medium & high respectively. Due to these SCI's low achievement, SCPM estimated as 21.3%, 50.0%, 22.9% (response time), 18.6%, 58.1%, 20.5% (quality aspect) low, medium, high respectively. As quantitative data, the poor collaboration, coordination & SCI activities in the case firms also affected operational efficiency 68.4%, 69.6%, 77.3%, 68.9% and 70.4% all respective case firms (Figure 5:18) and SC operations' system downtime as 20%, 26.2% and 27.6% (Figure 5:18). These are symptoms of weak resource utilization and poor cost opportunity and SC activities that result in overall SC profitability & productivity. To manage the adverse effects of the above problems, procedural and scientific interventions need to be adopted via proposed possible solutions and implementation guidelines to coordinate SC operations in the case firms.

1.3 Research Question

The study investigated through finding possible answers for the following research questions:

I. What are the factors of the SCIs that can affect the productivity of the manufacturing processes in the current food complex industry?

II. How can these factors of SC integrations (i.e. internal, external, customers, suppliers, and information) can be managed and SC productivity can be enhanced?

III. What are the causes of unnecessary expenses, SC operations downtime, and weak efficiency on SC overall SC performances and productivity?

IV. What is the possible scenarios and implementation guideline integrated model to achieve good SCI which provides high SCPMs and SC productivity as the end?

Through finding the solutions for the above-raised research questions, an author analyzed the problems incorporated in these process industries' SC activities and developed possible scenarios and implementation guidelines models in which productivity can be enhanced.

1.4 Objective of the Study

1.4.1 General Objective

The general objective of this research is to analyzing SC integrations and its performances metrics to enhance SC productivity of identified food complex process industries around Addis Ababa through proposing possible scenarios.

1.4.2 Specific Objective

The specific objective of this study was the following activities those enabled researchers to address the predefined research questions:

- Classifying SCI, and collect corresponded relevant data through data collection instruments and analyze it to identify potential factors of SC productivities, pre-dominantly, in the case companies
- Analyzing various categories of SCPMs (SC quality, delivery time, costs, and flexibility aspects) and impacts and relationship of SCI on these parameters
- Analyzing resources utilization, capacity and efficiency, and effectiveness of case firms' SC operations' cost utilization

- Identify major causes for weak SCI that result in low SCPMs, poor resources utilization SC operations' downtime, and ways of managing all SC operations and proposing ways of enhancing its resources utilizations, cooperation, and competitiveness
- Propose possible solutions by developing intervention scenarios, implementation guideline integrated model through merging SCOR-model with MLAC and QMS) to eliminate SC integrations barriers and address the aim of the study

An author emphasized and focused on these and other supportive specific tasks, to internalize the SC integrations and SC performance measurements to enhance productivity pre-dominantly, for the specified case Industries and generically to all similar industries in Ethiopia.

1.5 Scope & Limitation of the Study

1.5.1 Scope

This research paper focused on five Ethiopian food complex process industries specifically those found around Addis Ababa. The investigation has been emphasized on analyzing SCIs (internals integration, external integrations of SC system, supplier's integration with the company, customer's integration with the company, and SC operational integrations. And also, the study focuses on evaluating SCPMs such as delivery time aspects (speed & dependability), unnecessary costs incurring in the SC system, and quality, flexibility, and reliability aspects of the production processes in the specified case firms. The other analyses those study has been focused on impacts and relationships between SCI (independent variables) and firms' SC performance metrics (dependent variables), SC operations downtime analysis, efficiency, and unnecessary SC activities' expenses in the case firms based on available data.

1.5.2 Limitation

There were various constraints such as weak SC operational activities' data organizing and managing system in some case firms, lack of the firms to be investigated, and fear of allowing the researcher to investigate various SC integrations & its performance measurements, understanding of industries' communities on the significance of the scientific research was considered as the major limitation. On the other hand, Time and resource constraints also limit

the study's range, and Covid19 also somehow experienced adverse effects on the phase of the data collection process.

1.6 Significance of the Study

Recently, in this full of global competition era, SC Productivity enhancement is an indispensable and vital business surviving approach to enable them to stay in the local and global market chain. To ensure these, analyzing SC integrations and their performance metrics can be used to enhancing any manufacturing and services delivery industries, especially, food complex manufacturing process industries.

Moreover, this research thesis could be used as a reference basis for the future improvement guidelines and manage different SC operational activities, costs, and resources in the real case and R& D within the industries as well as for academicians.

1.7 Beneficiary of the Study

Since this research paper intended to compressively include the various concepts in the manufacturing industries like SC integrations and performance metrics:

- Integration of internal & external operational system
- Integrations of SC information and customers and suppliers
- Performance measure (time aspects, costs aspects, quality and flexibility aspects in manufacturing processes)
- Resources utilization such as cost opportunity, efficiency, and quality in the different multi-dimensional aspects of SC operational activities pre-dominantly in the current case firms and generically get across the all food complex industrial activities

Moreover, the beneficiaries of this study can be the followings:

- Operational managers in the manufacturing system those their daily activities directly linked to the above-elaborated concepts
- Entrepreneurs who want to join the business world can use to penetrate the markets domestically and across the globe
- Researchers, academicians, and various parts those want to make these concepts more investigated its impacts on the real cases and advance their professional status

These and others profit-oriented like food complex industrial activities as well as professional advancement towards these concepts can be major beneficiaries of this investigation.

1.8 Organization of the Study

This thesis is composed of six chapters which are constructed systematically and flow of information coherently and logically to attract the reader or scientific community as the following.

The first chapter consisted of the introduction which includes a background of the study, statement of the problem, research questions, objective, significance, Scope & limitation of the study. The Second chapter encompassed the extensive review of various literatures which included generic concepts of SC and its historical developments, SCI and its types and practices, SC Performance metrics and its evolution, its models. And also, this chapter contains various areas that have been addressed by formers scholars, methodologies that have been applied in the various former papers, challenges that have been faced in various previous kinds of literature, a summary of analysis in some former related research papers, conclusion and research gaps from the reviews. The third chapter deals with research design, study framework, needed data and methods of data collections, sampling techniques, analysis of reliability and validity of the data. The fourth chapter focused on an overview of the food complex sector globally, the African & Ethiopian context on SCI & various its performance measurements, and activities. And also, chapter fifth focused on the main analysis of this study such as respondents' demographic, SCIs, and SC performance metrics analysis those related to circumstances of overall firms' productivity enhancement. It also contained various SC operational analyses such as unnecessary expenses & downtime, efficiency and effectiveness, resource utilization analysis, major findings of the study, and possible proposed solutions.

Finally, the last and sixth chapter also, covered the conclusion, lists of recommendations, and directions of further investigation areas.

CHAPTER TWO

2. LITERATURE REVIEW

2.1 Introduction

To conduct scientific investigations, a Literature review is a critical phase to digging out the existing body of knowledge on the specified research question (Dowson, 2009; Kothari, 2004and Sanders, 2007). The ultimate goal of this chapter is to insight further research areas and shows an interface of the former investigations and current contributions in the scientific journey. Having this fundamental scientific procedure, this review chapter includes different relevant Literature Reviews. This chapter focused on generic concepts on SC, and SC integrations and performance metrics. The other is on various relevant areas that have been used in the former research papers like models of SC performance metrics models activity-based cost model (ABC), balanced scorecard model (BSC), and supply chain operations reference mode (SCOR) & key performance indicators (KPI), methods or approaches, tools of data analysis, and some findings reviewed, and research gaps have been identified to demarcate the former studies and current one.

2.2 Generic Concepts and Definitions of Terminologies

2.2.1 Supply Chain

The SC is a sequence of decision making and execution processes (materials, information, and finance flows that aim to meet final customer requirements, which take place without and between different strategies along a continuum from production phases to final consumption (Lee C. M., 1998)& (Pienaar, 2009). It has three main elements (M.H., 2006):

Supply: is focused on the raw materials supplied to manufacturing, including how?

When and, from what location? The power of the suppliers has an impact on the supply chain operational activities and conveniences of the system.

Manufacturing: This focuses on converting these raw materials into finished and useable items /products/ through value adding processes based on the specifications of customers.

Distributions: which is focused, on ensuring that the products reach the end users on through an organized network of distributors, warehouse, and retailers in the business process?

Figure 2:1Key elements of SC adopted from (JNU, Jaipure, 2013)

And also, according to (C. A. Da Silva and H. M. de Souza Filho, 2007), SC were also not only include the producers of the products and its suppliers but also, can be depending on the logistics flows, transporters, warehouses in the phase of the production system, retailors and consumer themselves.

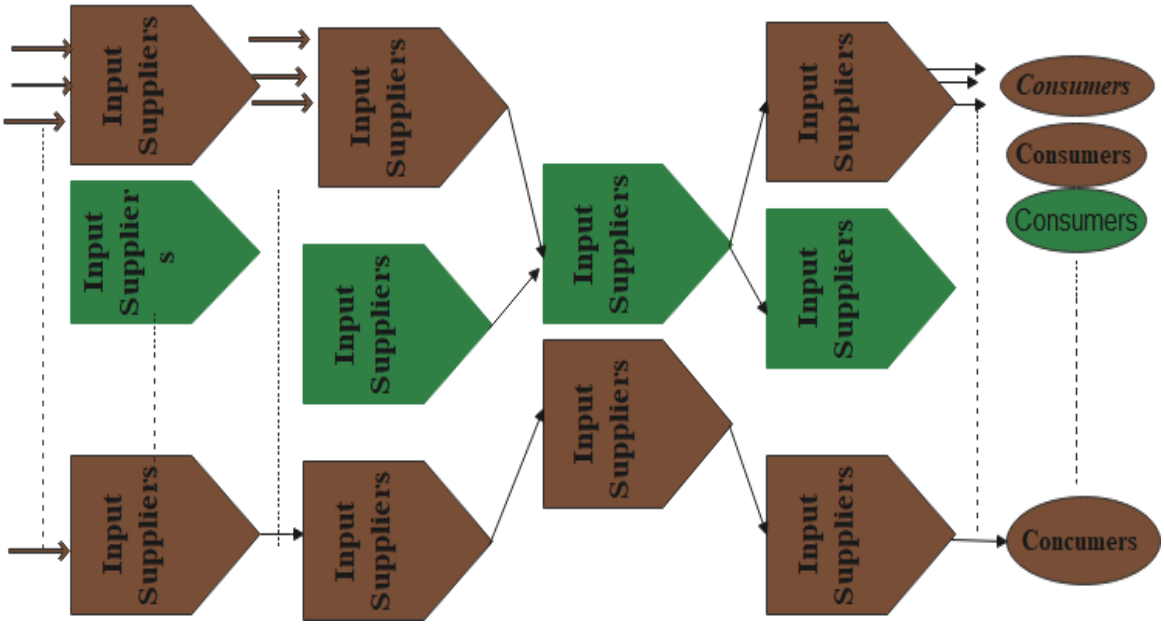

Figure 2:2 Generic schematic SC adopted from (Jack G. A.J Vander Vorst and Carlos A. da Silva, 2007)

2.2.3 Supply Chain Management & Its Historical Developments

The term SC management was first mentioned by the management consultants Oliver and Webber, James P. Womack in early 1980 to shift the attention of business owners to cross-functional integration. Council of Supply chain Management Professional also defined this business managing oriented activity as "encompasses of the planning activities and management of all activities involved in sourcing, procurement, conversion, and all logistics management activities".

According to formers scholars (S., 2000) definition, management (SCM) is a network of connected and integrated organizational activities, directly involved in the upstream and downstream flows of products, services, finances, and information from sources to end-users of the processes of the system. The other scholars tried to articulate the generic definition of this management philosophy in the former articles as integrated planning within the SCM across functions, spaces, and time to improve the performances of individual industrial processes in the chain as well as entire business processes (Hand field, 1999), (S., 2000)). Food complex industrial process which is needs the flows of materials, information and other necessary elements of industrial processes activities. SCM is also integration functions primarily responsible for linking major business functions and processes within and across the companies into a cohesive and high-performing business model in an industrial process (K. Bichou and R. Gray, 2004) & (J. S. Keebler and R. E. Plank, 2009). An author agrees with these former researchers' statements about the fundamental definitions of SCM especially, to wards to the business model and flows of necessary components. But, further synthesizing of the issues on linking the business function is expected.

2. 2.4. SC Integrations Philosophy, Types, and Practices

Integration is the process of coordinating separate functional processes to enabling the key elements of chains to interact seamlessly (Rosse, 1998)& (Wright, 2016). According to (C.Soosay, 2007) SC integrations are generally described as co-operation between various functions. SC integrations now a day extensively considered as the core element of a successful SC of the manufacturing and service delivery process as defined previously by (Cooper, 1997):

"SC is the mechanism of analyzing the key business process from end-user to through original suppliers that provide products, services, and information that add value for the customer and other stakeholders". An author agrees with this fundamental concept of the SC integrations and is critical for the analysis of the SC, and evaluation of various major negatively factoring the productivity of the production system in the case firms. But, further incorporation and detailed comprehension of the key element again need extra all-encompassing articulation and pointing out the way of addressing the organizational problem to make firms more competitive.

(Mujuni Katunzi, 2011; Georgise, 2014 & Kamal, 2014). Articulated and perceived that integrating business processes within and across the organizational environment is an essential element of SC in the manufacturing system. These are means of integrating business processes

and stimulating information and knowledge exchanging, SC stakeholders' intent to curtain the flows of materials, finances, and information related to the bull-whip effects. As this, and various former articles, supply chain integrations in the business scenarios comprised.

Suppliers' SC integrations: This is a cross-functional team of retailor products and services agreements with key suppliers in business management approaches (Serdarasan, 2013). It aims to arrange for and manage supply sources for various goods and services. Analyzing supplier's integrations or flows of key entities in the supply chain is a process (Niemann, 2017) & (Maloni, 2006) :

- ✓ Evaluations and selections of suppliers for various products
- ✓ Negotiations of pricing and delivery teams with suppliers & the placements of replenishment orders
- ✓ sharing of demand and supply plans with suppliers and communication regarding new products, and orders with suppliers

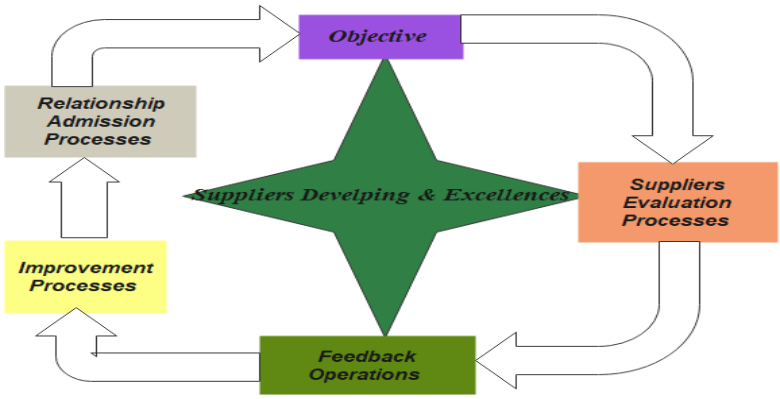

Figure 2:3 Suppliers integrations & its cycle in the business processes (Adopted from Gimenez, et al, 2005)

Customer's SC integrations: According to the researcher (Anvier-James, 2012), this is a competency that enables firms to after long-lasting distinctive value-added offering to those customers who represent the greatest value to the firms. To penetrate the market, customer integrations in the SC are very vital activity to enhance the SC and performances of the firms. An author intended to the extent in this element of SCI within this study through merging it with management tool like MLAC to improve its functionality.

Information integrations (II): This is one of the most important elements in SCM cooperation in industrial activities. According to (Moharana, et al, 2012), the SC integration type was a

fastening tool that holds tighter different key parameters of SC in structures, processes, and entire SC operational activities in the real case. This information flows take place through SC there is a multitude of information flows such as (Trkman, Peter, 2010):

- ✓ Demand information flows in the SC integrations
- ✓ Forecasting information flows in SC integrations
- ✓ Productions and scheduling information flows in the SC integrations
- ✓ Design and marketing information flows in the processes of SC integration

Operational integrations

Is the level of aiming at synchronous operations of SC? According to (T. Kobayashi, 2003), the SC operational integration (SCOI) is focused on the key issue in this level is how to balance and coordinate the restrictions, such as resources, information, capacity, and time, through integration and coordination within each firm.

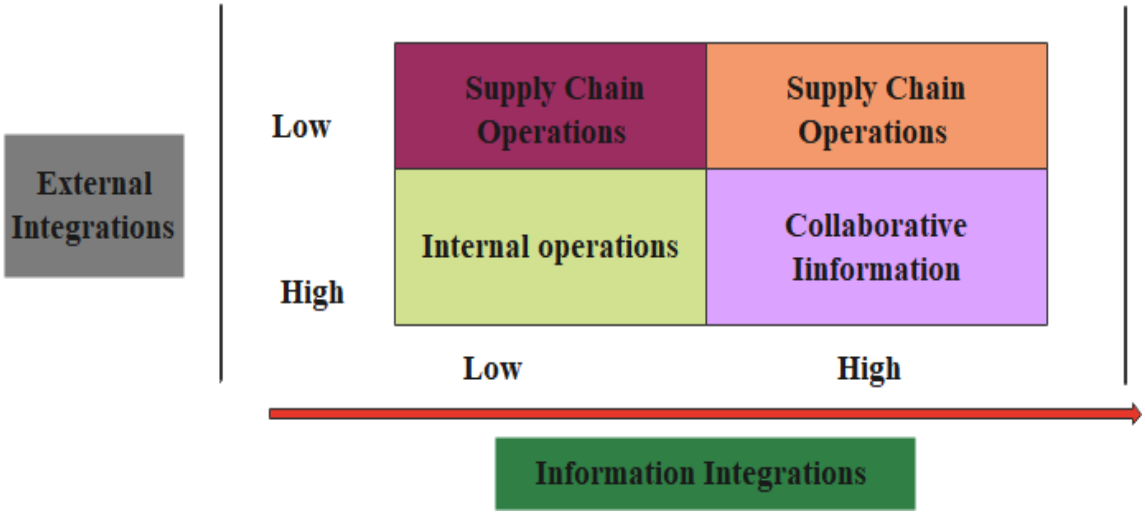

Figure 2:4 SC operational integration matrixes (adopted from Erengue, S.S., Simpson, N.C., 1999)

Demand integrations in SC processes

Demand integration in the SC is a concept that aims to integrate supply and demand processes to insure customer value creations and delivery (Rainbird, 2004).

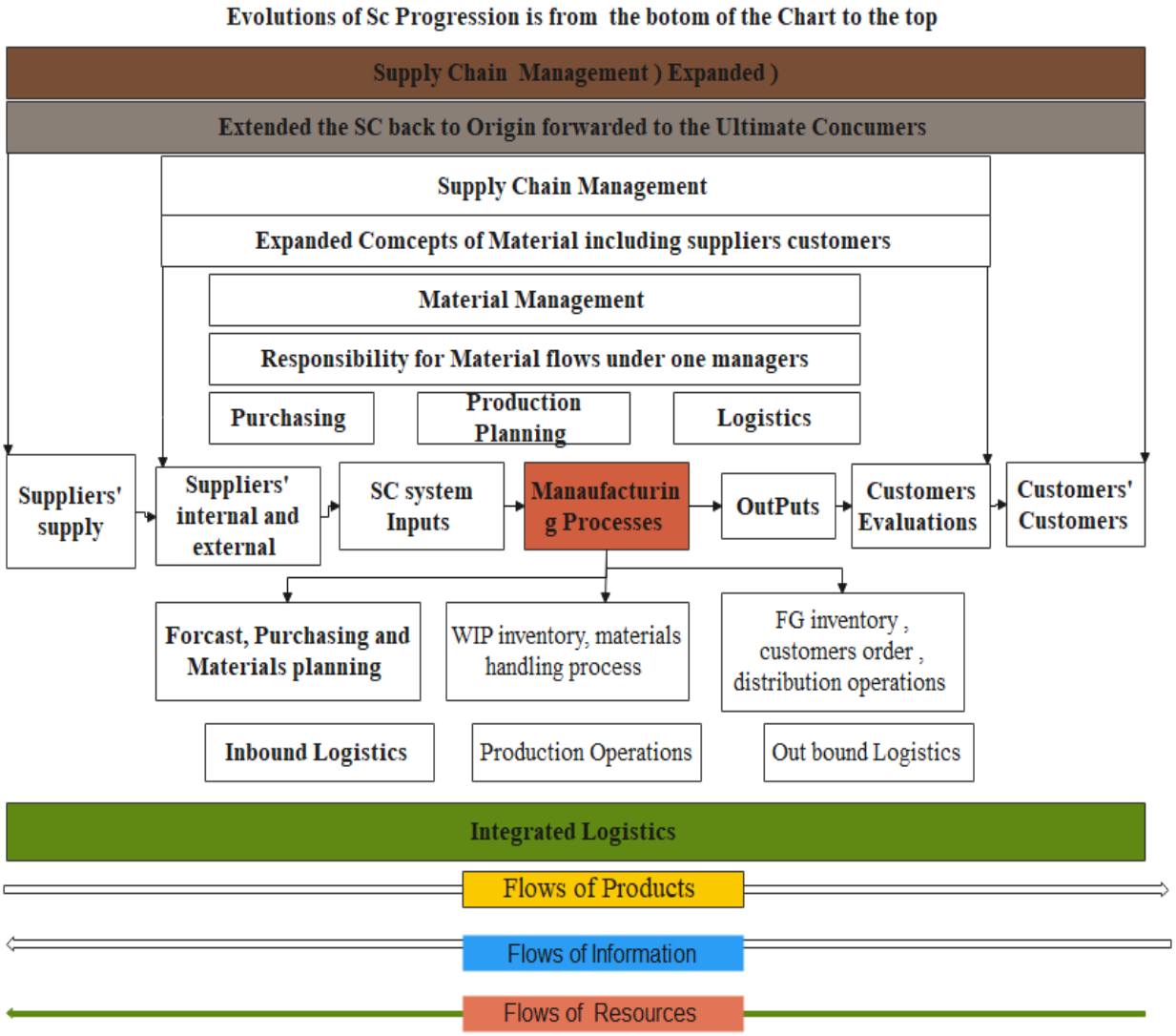

Figure 2:5 Evolution of SC integration (sourced from Richard E. & William R. Crandall, 2015)

2.2.2 Main Types of Supply Chain integrations

To make smooth, the flows of key parameters written the above of figure 2.5 through the firms, the material manager was charged with making sure the production schedule closely aligned with what the marketing forecast specified and that the purchasing of the firm was buying what the production group needed to make the products those have demanded (Power D. , 2005). And also as other's scholar's definitions, it can be addressed through analyzing SC of flows of material, finances, information, and other supportive component entities in the manufacturing & service delivery profit-oriented firms (Awad, 2010).

2.2.2.3 Internal SC Integrations

Former Scholars defined the internal SC integration (ISCI) in the context of business circumstances. According to (S.R., 2015), internal supply chain integration refers to the chain of functions within a company those results in providing products to the end-users. Coordination of this function involves the holistic performances measurements of activities across departmental boundaries in the manufacturing and services delivery firms (Liu, 2013& G.Steven, 2005). An author agreed with the generic and fundamental definitions of the internal SC integration (ISCI), but, still, there is an expectation towards its impacts on the performances and productivity of the real case of industrial processes over the integration of the other. The following figures highlight the internal SC integration.

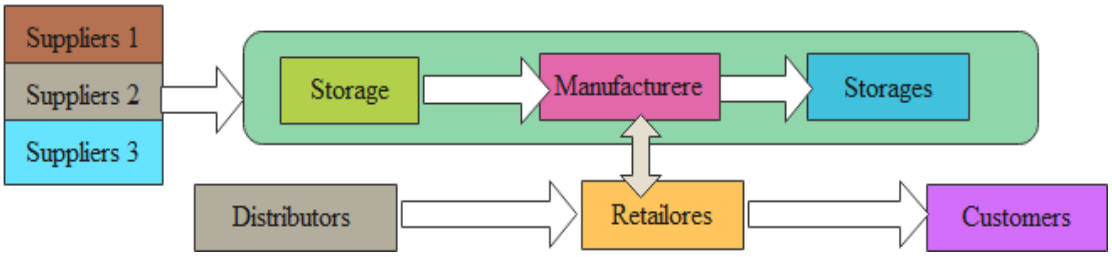

Figure 2:6 Internal SC integrations adopted from Stevenson (2005)

2.2.2.4 External Supply Chain Integrations

Some Scholars and researchers conceptualized these elements of SC integration as efforts to collaborate, share information, and align processes with external SC partners in the processes of manufacturing and services delivery (Lii,P.&Ku,F.I, 2016). It is sometimes divided into two main categories as follow (Harrigan, 1985):

- Customers integrations in the processes of supply chain analysis
- Suppliers integrations in the processes of supply chain analysis

2.2.2.5 Supply Chain Vertical Integration

Supply chain vertical integration is the process of a company expanding its operations either Backwards or Forwards (Forlund, 2010) & (Lee.H.L., 2000):

- Backward vertical integrations (BVI) processes: in the SC business operations which is into an industry that produces inputs for the company's products
- Forwards vertical integrations (FVI) processes: in the SC business processes which is into an industry that uses distributes or sells the company's products.

Figure 2:7 Supply chain vertical integrations (sourced from Lee, H.L., 2000)

This element of SC management (SCM) can be manifested either through vertical financial ownership, and complete control over assets achieved via merging, an internal development extending companies boundaries, or through vertical contracting which includes exclusive dealing, resale price maintenance (Mahoney, 1992). An author agrees with these inter-relationship types of interflows of SC in the business processes and intended to extensive analysis towards to all integrations and performances metrics to enhance its activities as well through merging it with management tools such as MLAC.

2.2.2.7 Downstream Supply Chain integrations

All organizations are on a journey to transformations in the process of manufacturing systems from traditional, forecasting-based push SC into broader, end-to-end demand-driven networks (Khim, 200b). The goal is to use downstream SC integrations in the business processes analysis to sense and translate actual demand for the products. This is into operations plans, processes, and intercommunications of industrial activities to external stakeholders in the structured and well organized for minimal wastes and optimize working capitals and resources (Zaillian, 2005) and (Msimangira,K.A. Venkantraman,S., 2013). The change involves moving the organization through four stages of maturity, from market-focused to value-driven system. As companies progress down this path, firms can see various stages of evolutions as depicted in the following Figure 2.8.

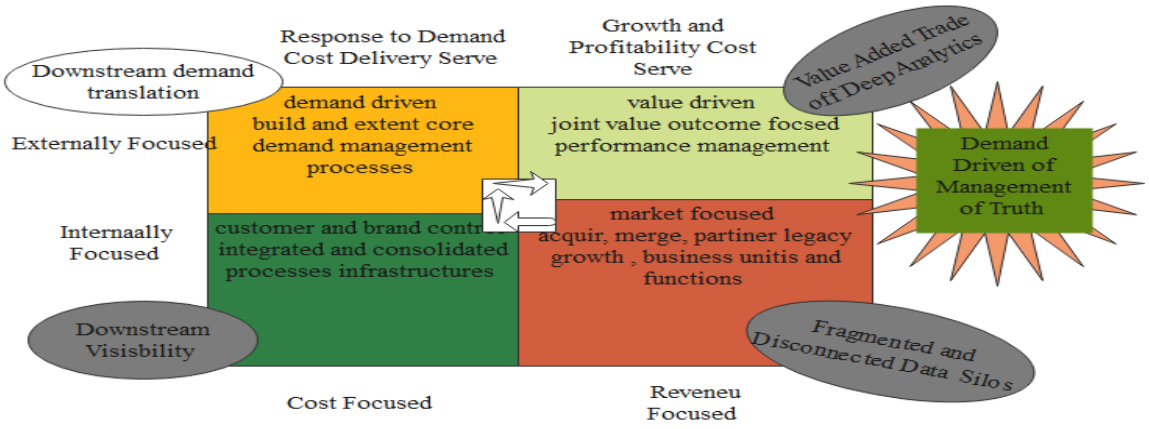

Figure 2:8 Downstream SC integration analysis (Sourced from AMR Research, 2007)

2.3 Supply Chain Performances Metrics

According to (Rosse, 1998; R.Homberg, 2000), and Irum S. et al, 2013), SC performances measurements (SCPMs) is a system that provides a formal definition of SC performance measurements models based on mutually agreed up on goals, measurements method that that specify the procedures, responsibilities, and accountabilities of the SC participants and regulations of the measurements system by SC participants. And also various scholars define SC performances measurement in different literature as below:

"When you can measure what you are speaking about, and express it in number, you know something about it". - Lord Kelvin, 1824-1907.

(Bowesox, 1996), also, define this performance measurement as "you cannot manage what you cannot measure". Performances measurement can be defined as the process of qualifying the following in the manufacturing as well as services delivery (Arzu Akyuz et al, 2010):

- effectiveness of the operational tasks in the system
- the efficiency of the industrial activity in the system

The other researcher (Gopal, 2012) & (Mostert, 2017) defined SC performances measurements as metrics used to quantify efficiencies of the activities in the manufacturing and services delivering system. (Neely A, 1995), also defined SCPM should be linked with strategies in the system which provides the necessary information for management feedback for the decision-making process in the SC industrial operational activities. An author agrees with these generic definitions of the SCPM, and extensive via continuous improvement tools.

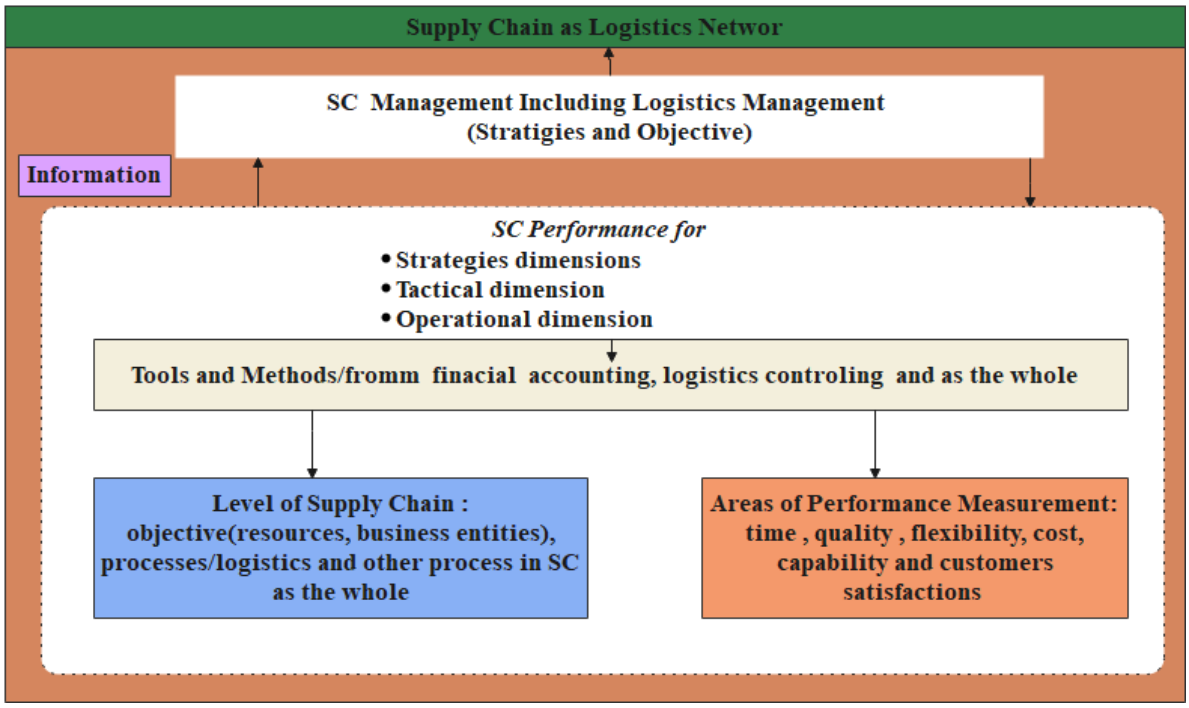

Figure 2:9 Performances management as a part of management in SC (sourced: Dobroszek, 2012)

Performances measurements in the SCM is also defined as the selection and use of quantitative measure capacities, processes, and outcome to delivery information about critical aspects of activities in the SCM, including their effect on the various manufacturing and services delivering processes (W.Han, 2017) . Many experts believe that performance measurement is essential in the processes of SC planning and control in the operational activities of the business enterprises (Forlund, 2010) and (Savelsberg, 2013).

2.3.1. Evolution of Supply Chain Performance Metrics

Performance metrics in the processes of industrial activities, generally, defined as the techniques of quantifying the efficiencies and effectiveness of operations (Neely A, 1995). As it stated earlier, measurement is important as it directly affects the behaviors of SC that can impact overall metrics. For centuries, companies had been used both quantitative & qualitative performance indicators were put forward to track, and measure their performance metrics, firms traditionally relied solely on financial accounting metrics for many of which date back to the 19th century and even earlier (Caplice, 1992). But, at the begging of the 20tyh century, diversification of performance had becoming induced the information of performances metrics,

and Dup Pont Company in 1903 had executed the "rate of return on an investment (ROI) to appraise the performance of different units and developed operational scales of Du Pont system which is widely adopting forwards (Bichou, 2004).

After World War II, the nature of an environment surrounding enterprises had been changing and becoming full of uncertainty and variations which called for the necessity to balance the relationship between marketing, research and development, human resources, and finances (Kazemkhanlou, 2011). Henceforth, many companies have shifted their priorities and started to use financial and none financial indicators of SC performance metrics, (i.e. is the mixed approaches) to the extent of the coverage of the scopes of the former SC performance metrics. With the evolutions and maturity of business enterprises' concepts in the late 1990s, performances measurements systems in industries have changed completely to a balanced integrated approach (Gopal, 2012). It was split into four timelines and depicted in the following Figure 2.10.

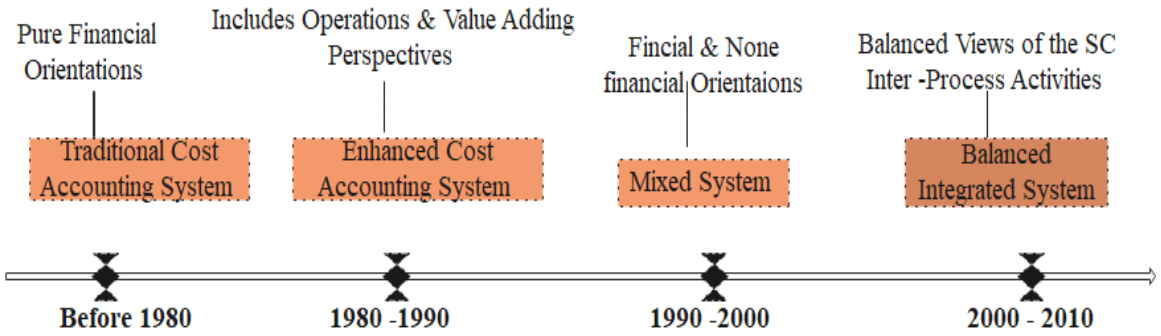

Figure 2:10 SCPMs evolutions time line (adopted from Agami, A., Saleh, M. & Rasmy, M., 2012)

2.3.2 Models of Supply Chain Performances Measurements

According to former scholars proposes in the literature, there are many SC performance measurement models (Macklprang.A,W.,Robinso,J.L.Barnandos ,E.and Webb, 2014). Some of the SCPM analysis models are as below.

2.3.2.1 Activity Based Costing SC Performance Metrics Model

It was developed in 1987 by Kaplan and Bruns (1987) in an attempt at financial measures for operational activities in industrial key operations. This model involves breaking down business cost drivers while conducting estimations of resources such as time and costs, needed for each

one (De Souza, 2011). According to this scholar's investigation, costs are then allocated based on these cost drivers rather than on traditional cost accounting methods such as allocating various costs. However, it still now has its limitation like relying and only focusing on pure financial performance metrics which couldn't be a full guarantee for effective performance evaluation in the business processes (Agami, Nedaa, Mohamed Saleh, and Mohamed Rasmy, 2012). Having this limitation of this model, the current researcher would like to prefer the SCOR model which is relevant by its capability to conduct deepen the analysis of SCPMs in the selected case study.

2.3.2.2 Functional- Based Measurement System (FBMS) Model

It was originally developed in 2005 by Christopher (2005) to cover the detailed SCPM applicable at different linkages of the chain of the organizational activities (R.Homberg, 2000). Even though it was easy to adopt and target can be dedicated to individual departments, it does not provide the top level of SC performance measurements to cover an entire SC activity (Ilrod Cassandra et al, 2013). Due to these limitations, this model was criticized by various formers scholars for viewing the separate SC functions in isolations with the overall strategy and hence results in localized benefits that may harm the whole SC (Bhagwat, Rajat, et al, 2007).

2.3.2.3. Performance Measurement Pyramid Model

It was proposed by Cross and Lynch in 1992. The main purpose of these PMs is to link a firm's strategy with its operations by translating objectives from top-down based on customer requirements and measure from the bottom up (Kariuki, 2012). This model contains four applicable objectives that use to address the organization's external effectiveness (left sides of the pyramid model below) and its internal effectiveness (right sides of the model below).

It starts with defining an overall corporate vision at the initial phase of the model which is then translated into an individual business unit objective. The second level business units are short-term targets of cash flow & profitability and long-term goals of growth through market position analysis (e.g. market status and financial aspect). And the business operating system bridges gaps between top-level and day–to–day operational measurements (i.e. customer satisfaction, flexibility, and productivity). Finally, four key performance measurement characteristics (quality, flexibility, costs, and time to delivery) were used at departments and work at the center of daily basis (Kurien, 2011).

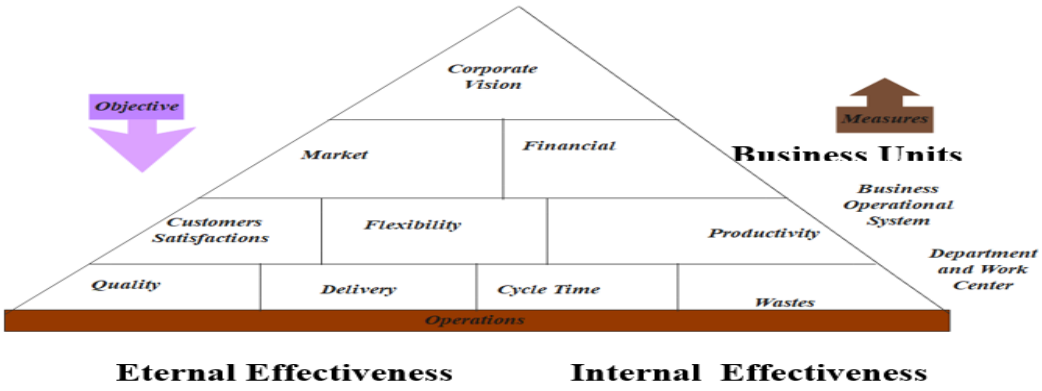

Figure 2:11 SC Performance measurement pyramid model (adopted from Joseph E., J., 2014)

According to (Neely, 2000), the strengths of this performance metrics approach model are identified as it ties together the hierarchical view of business performances measurements with the business process views as it directed from the above Figure2.11: It also used to make an explicit of the differences between measures (external parties-customer satisfactions, quality, delivery time and cycle &waste). However, the limitation of these performance metrics in the efficiencies and effectiveness of the business activities regarding SCIs and its metrics were identified as followings (T., 2004) and (Caniato, 2016):

- it does not provide any key performance indicators (KPI) in the processes of evaluating performance metrics in the business operation
- And also, this performance measurement model does not use explicitly integrated concepts of organizational activities and aspects of continuous improvement.

Having this shortcoming of performance measurement in the processes of analyzing the SC operational system coordination and performance metrics to enhance SC productivity of the case industries, combinations of SCOR model, manager levers achieving coordination (MLAC) and quality management system (QMS) relevant resources utilization tools have been used to address the predefined research question.

2.3.2.4 Balance Score Card (BSC) SC Performance Metrics Model

It is a performance measurement and strategic management system, developed in (1992) by Robber S. Kaplan. The balanced scorecard approach provides a clear prescription as to what companies should measure to 'balance' the financial and non-financial perspectives, internal and external measures; and efficiency and effectiveness measures (Kablan,Robert S.,Norton,DavidP., 1992)and (Ilrod, Cassandra,Susan Murray PE.Bandeep, 2013). An author agrees with these

generic definitions of this approach, but the realization in the literature to evaluate their key performances was not as expected. Having this further investigation and analysis, the current researcher intended to the extension of the concepts to propose the food complex manufacturing processes.

The scorecard can accomplish critical management processes in the manufacturing system such as (Ing-Long Wu, 2012): Clarifying and translating vision and strategy, Communicating and linking strategic objectives and measures, Planning, setting the target, and designing strategic initiatives, and Enhancing strategic feedback and learning.

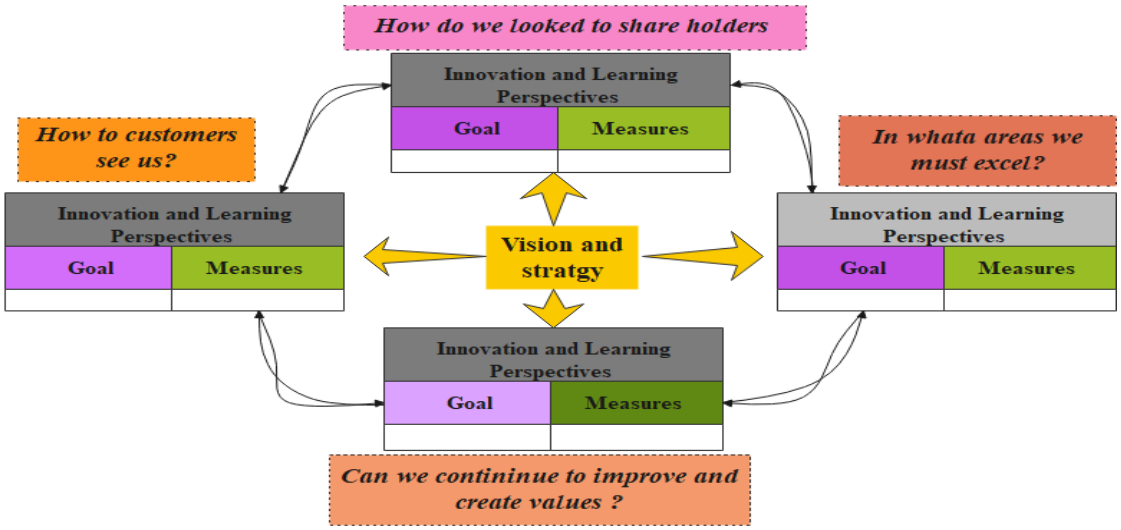

Figure 2:12 Balance score card adopted from Robert S. Kaplan (1992)

This SCPM principle provides excellent guidance to follow when it implements properly in the real case of the manufacturing or services delivering operational activities. This approach would recommend that a small number of balanced SC measures be tracked based on the following perspective as it already mentioned in the above Figure (Kablan,Robert S.,Norton,DavidP., 1992):

- Financial Aspects (e.g., costs of manufacturing and warehousing system)
- Customer perspective (e.g.., on-time delivery and order, fill rated)
- Internal business Perspectives (e.g.., manufacturing adherence and forecast errors)
- Innovative and learning perspective (e.g.., certified employees and product development cycle time)

2.3.2.5 Supply Chain Operation References (SCOR-model):

It was developed by the SC council in 1997 which is defined as the strategic management tool that assists the processes of measure, monitor, and communicate a firm's strategic plan and goals throughout firms in a way that understood everyone (Huan,S.H. Sheoran , S.K and Wang .K, 2004). And also, (W.Han, 2017), defined this performance measurement in the process of the SC as the source of guidance on the types of metrics one might use to get a balanced approach towards measuring the performance of one's overall SC. The SCOR- model approach can advocate a set of SC performances measure comprised of a combination of the following (Pretorius, 2013):

- Cycle time aspects metrics (e.g.., production time cycle and cash-to-cash processes in the industrial and profit-oriented enterprise)
- Cost metrics aspects (e.g., costs per shipment and cost per warehouse pick especially in the processes of raw material intake and distributing the output products)
- Services or quality aspects metrics (e.g.., on-time shipment and defective products monitoring in the processes of the manufacturing system)
- Asset metrics (e.g.., inventory management)

In contrast to the balanced scorecard, which is focused on an executive enterprise or firms –level measurements, while the SCOR model approach directly addresses the needs of SC management with the balanced measurement as depicted in Figure 2:12.

2.4 Different Areas those Addressed by Formers Researchers

2.4.1 SCOR – Model in the Processes of Analyzing SCPMs

Various scholars and researchers have been tried to address the SC and its performance measurements analysis in the processes of industrial activities. (Pretorius, 2013), and (Kocahlu B., Gulsun ,B. and Tanyas ,M., 2014), provided suggestions for the SCOR –model which is used to measure SC performances metrics through looking at perceptions of customer-facing & internal facing. The other researcher tried to assess and analyze customer-facing which is used to measuring the performance attributes of reliability, responsiveness agility to the customers and suppliers (Boefeng, 2011) and (Sillanp, 2015). An author agrees with these activities used to

evaluate SC performances in the manufacturing system. But, still now extensive and further analyses are expected to address this study's research questions.

According to former researchers (Irum,S.,Sabab,A.,Kashiif, M.C, 2013), various models have been analyzed in the processes of SC performances measurements activities. In different research papers, tools of SC performance metrics analysis were applied. This is to evaluate performance on five main elements of the SCOR - model in the SC integrations and its performance metrics like the plan, sources, make, delivery, and return (Series, et al, 2019 and pamala,D. Pietro,D., 2011).

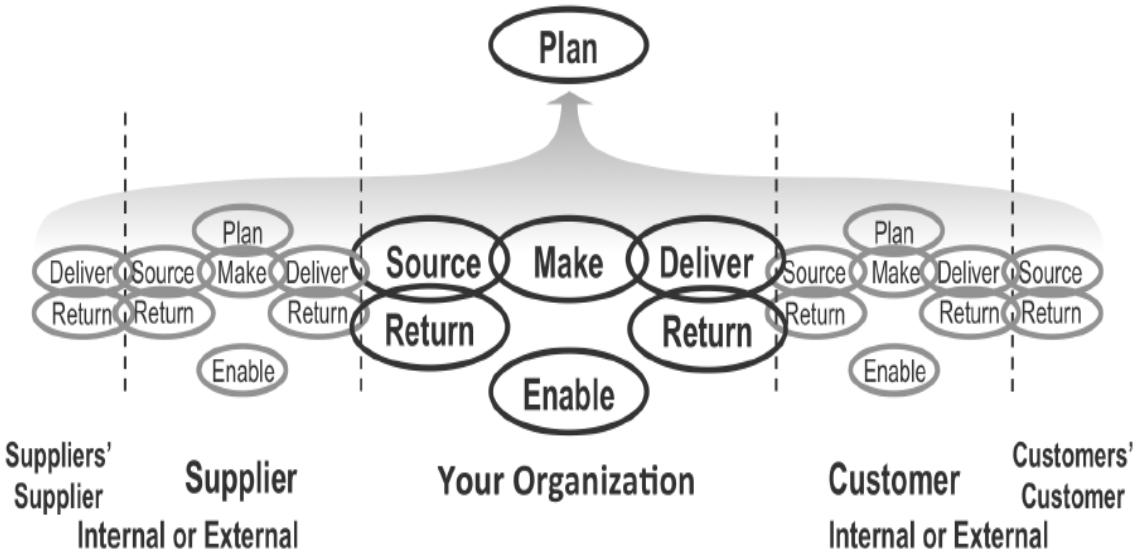

Figure 2:13 an organized major SC and its performance metrics evaluation through various management processes (Adopted from SC council, 2012/ SCC,)

Other researchers also internalized different levels of analyzing SC integrations and its performances metrics through the SCOR model in the processes levels as followings (Ganji et al, 2015):

Level -1 Metrics are diagnostics for the overall health of the SC in the manufacturing and services delivery processes. These metrics are also known as strategic metrics and key performance indicators (KPI) in industrial activities. This level is useful for the processes of the establishment of strategic and realistic targets to support the strategic directions.

Level-2 Metrics: serve as diagnostics for the level -1 metrics in the SC and its performance metrics. The diagnostics relationship assists the owner of the manufacturing and services delivery system to identify the root cause or causes of SC performance gaps for level-1 metrics.

Level-3 Metrics: is serving as a diagnostic for level -2 in the processes of manufacturing

According to (Pretorius, 2013), this model used to analyze SC performance metrics through a systematic approach for identifying, evaluating, and monitoring SC performances.

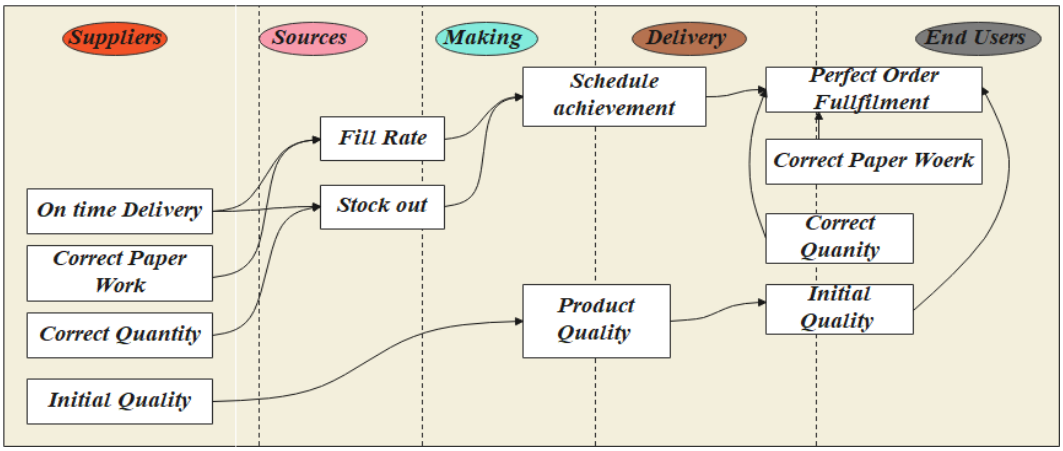

Figure 2:14 Levels and interface of SCOR –model in SC performances

The proposed framework quantitatively analyzed the inter-dependent relationships among a set of Key Performances Indicators (KPI) in the processes of SCI of the case firms. This framework can provide an effective approach to manage SC performance in the dynamic environment (Beheshti, Hooshang M., 2014). This model has benefits and limitations in the processes of performing the tasks of evaluating SCPMs in industrial operations (Lockamy III, 2004).

Potential Advantages of SCOR-***model in PMs Analysis:*** its strength compared to the BSC model in the processes SC performance measurement is that provides the standard format to facilitate communications (Teguh Suprato,A., 2017). And also it is a suitable tool for the upper management of companies to design and reconfigure their SC to achieve the desired performances (Huan,S.H. Sheoran , S.K and Wang .K, 2004). Moreover, the SCOR model is used to enable an enterprise to analyze their SC performances systematically to increase communications among the members exist in the operational framework to design a better SC network (Pamala,D. Pietro,D., 2011)**.**

Limitations of *SCOR-model in PMs Analysis*: according to (Hwang Y., 2008) & (Tatacchi, 2010), the following are some issues those not addressed by the SCOR – model have noted that,

although oriented towards to processes, this model is not oriented to words business strategies. (Georgise, 2014), also identified another limitation of the SCOR –model as it does not offer a systematic method for prioritizing measures and implementing them in developing countries due to variations in environmental factors conditions. The other limitation is lack of clear connections between functional strategy & corporate strategy might expose the firm's wide alignment of resources. An author agreed with the approach and model that has been used in the process of analyzing the SC performances, but, still, now the optimal scenarios of SCI need to be integrated to enhancing productivity through various resource utilization and management approaches.

Agility Measure in performance Metrics Analysis: According to (Ilrod, Cassandra,Susan Murray PE.Bandeep, 2013), this approach was part of the SCOR model that to internalize how well the relationships involved in the processes of enhancing and widely accepted as a winning strategy for growth. The key elements of agile SC include: being information-driven, having market sensitivity (demand-driven approach), an integrated process, and being network-based (Flynn et al, 2010; Savelsberg, 2013).

2.4.2 BSC – Model in the Processes of Analyzing SCI & it SCPM

Various scholars and researchers tried to use this tool of evaluating performance measurements of SC integration and its performance metrics in various literatures. For instance: (Ing-Long Wu, 2012) and (Wei, 2014) were applied this tool to evaluate SCPM through analyzing four main perspectives:

- Financial aspects
- Internal business process aspects
- Customer aspects
- learning and growth aspects

The current author agreed with these key aspects of BSC elements those need to be used in the evaluations of the SCP measurements. But, this paper intended to integrate the tools of optimum scenarios, resource utilization, and another relevant model to address this study's research question. The other researchers (Odontidou, Eleni, 2013) also measured the performance measurements of SC metrics in the processes of industrial operational activities and developed a model for SC performance evaluations in the manufacturing system. (Welay, 2016), also designed ways of analyzing SC metrics in the firms through the methodology that can assist

firms to prioritize and formulate viable measurement analysis strategy was developed. And also, (Macklprang.A,W.,Robinso,J.L.Barnandos ,E.and Webb, 2014) have applied the BSC tool of SC performances and metrics evaluation to evaluate overall SC comprehensively.

(Thakkar, 2007), Proposed an integrated SC performances measurements framework for the case of small and medium scale enterprises (SMEs) in India using a set of qualitative and quantitative insights gained during the research case area. Through the progress of the literature, (Bigliardi, 2010)tried to apply the BSC – model that is designed and delimited for performance measurement systems. Major benefits of this model can be highlighted as the following (Chang et al., 2013):

- this model is characterized by the simplicity to translate factory's strategy into operational terms
- Creation of leadership for change in the strategic management system in the processes of SC of performance measurements evaluation.
- It is easy for the implementation processes for learning & adopting the firm's business strategy

Through these and other potential advantages of this model, former researchers have been used to evaluate the key of the SC performance metrics.

However, some researchers tried to identify the limitations of this model (BSC) compare to the advantages of the SCOR model as the following (Thakkar, 2007):

- It fails to specify a user-centered development process while internalizing the processes of evaluating SC performance metrics
- It does not provide a mechanism for maintaining the relevance of defining measures.

SCOR model adopts building block approach and offers to compute traceability while an analysis conducting the SC performance measurements in industrial activities.

Having these and other considerations, the optimal approaches like the combination of SCOR model, MLAC, and QMS sub-related elements resource utilization approaches have been used in the processes of this investigation. So that, the current researcher, intended to conduct the compressive analysis on the impacts of SCI on SCPM, and then SC system overall productivity to develop optimal scenarios to address the current problems.

2.4. 3 SC Integration Dimensions in Industrial Processes

Due to lack of clarity and misconceptions on the understanding of the SC integrations in industrial operational activities, some researchers examined the SC integrations with a single dimension while others with multiples dimensions (Alfalla-Luque, Rafaela, 2013) and (Zsidin, 2015) . Through analyzing suppliers and customers' relationships, management in SC' industrial activities (Lee), recommend that SC integrations contained about three main dimensions: Information Integration (II), Coordination and resources sharing (CRS), and organizational relationship linkage (ORL) in the SCI, and its activities in a real case (Lee.H.L., 2000)& (Zenebe, 2018)

i. Coordination and Sources Sharing: is a mechanism in which coordinated decisions are made in the process of SCI to enhance overall SCPMs. Coordination in SCI is active cooperation among stakeholders to harmonize different activities to achieve the desired ultimate goal of the SCI in business processes (Phillipset al , 2000 & Zenebe, 2018). An author agreed with the general impacts of coordination SC on the interrelationships of activities in the SC operations, but still, now there is an expectation regarding resources (information, time, faculties, etc.) utilizations.

ii. Organizational Relationships Linkage (ORL): is the process of analyzing an activity like all participants in SC including manufacturers, buyers, suppliers, customers, and other external organizations such as, third party logistics, services providers that are critical to the success of SC (Lee, Chang Wonet al, 2007). An author agrees with these key dimensions of SCI. But, further analysis, through evaluating of its impacts on productivity going to be addressed by this study. And also, this research intended to include performance metrics analysis to evaluate SCI indicators. This achievement can affect SC system productivity enhancement in the business operation entirely.

2.4.4. SC Strategic Analysis in the former Research Papers

Designing and analyzing SC strategy is a very critical activity to penetrate the market domestically and across the globe. According to (Kulp, 2004), the flows of information directly impacts production plans, inventory control, and distribution plans in the processes of SC integrations in manufacturing and services delivery industries. To overcome the adverse effects of various factors in SC operations in industries, firms need to implement an optimal strategy for

the integrations of SC stakeholders (Savelsberg, 2013 & Irum et al, 2013). As this scholar, the strategy on the realignment is critical for the success of the SC and evaluation of its overall efficiencies. The recognition of outsourcing, packaging, customization (standardizations), agreement on delivery frequency, and common uses of logistics equipment have high impacts in terms of costs, quality & speed (Mostert, 2017) and (Khim, 200b). A clear strategic enterprise monitoring in the process of SCI (interflows of key operational activities) need to run business in a competitive scenario and used to improve communication channels, create cross-functional teams along the supply chain in the real case of industrial activities. An author intended to develop a possible and optimal strategy to propose optimal scenarios and resources utilization, inter-linkages of various SCI to increase SCPMs finally profitability of the firm.

2.5 Methodology those haven used in the Various Literature

Various researchers used different methods in different kinds of literature in the processes of analyzing SC and its performance metrics. (Guan, Wei, and Jakob Rehme, 2012), and (Dissanayake C. K., 2018)identified SC challenges, representative demands types of data (primary and secondary) were collected through various methods. The methods of data collection those formers researchers have been used were semi-structured interviews, questionnaires, various research strategies (methods and sources of data collections), and used data collections from different sources of data like relevant books, manuals, available documents, organizational charts, such as (Neely, 2000), (Maloni, 2006), (Hwang Y., 2008), (Pretorius, 2013) and (Welay, 2016).

An author used relevant methods to current research questions, and key inputs to address the final goal of the study through more extensive and use an integrated approach like semi-structured and well-structured questionnaires in contrast to the former articles reviewed. According to (Power D. , 2005), (David, 2014) and (W.Mekuria, 2018), survey research was commonly a method that a large amount of information can be collected & quantitatively manipulated in the processes of finding the way to address the research question. But, the author of this research paper designed to apply quantitative and qualitative approaches to enhance the firms' productivity.

2.6 Challenges Faced Researchers in the Former Research Papers

In some literature, former researchers tried to identify some challenges that have been faced in SC integrations and its performances metrics analysis. According to (S.Hosseini, 2012), (Pamala,D. Pietro,D., 2011)and (S.R., 2015), the main core of challenges were: Challenges towards existing collaborative planning in the SC operational activities of the real case, forecasting and replenishment practices in the SC industrial activities, Transparency in information and knowledge in operational activities & SC behaviors. And also other scholars (Otchere, Alexander Fianko, 2013), (Attia, 2018)tried to identify various challenges such as traditional inter-and inter-organizational boundaries tended to remain intact, inter-organizational complexities in responsibility were usual and promotional activities were frequently not pre-announced. The other SCIs and their SCPM challenges supposed to be negative constraints to analyze and conduct the investigations as the followings (Sweeney, 2011); (Kumar, Vikas, 2018) and (AlSagheer, Abdullah, 2011) (Ing-Long Wu, 2012):

- Trends towards outsourcing, fragmentations of products & delivering services
- Customers order management was a tough challenge because different value chain partners integrated their SC to satisfy the needs and anticipations of customers
- procurement management become a difficulty and integrate two organizations those have different value chain, vision, mission, cultures, leadership & structures
- applications of integration were very difficult because of different enterprise research planning (ERP) system adopted by an organization
- the processes of data & information integrations were complex and complicated
- the forces of globalization and commoditization were not stoppable and they could impact SC integrations decisions

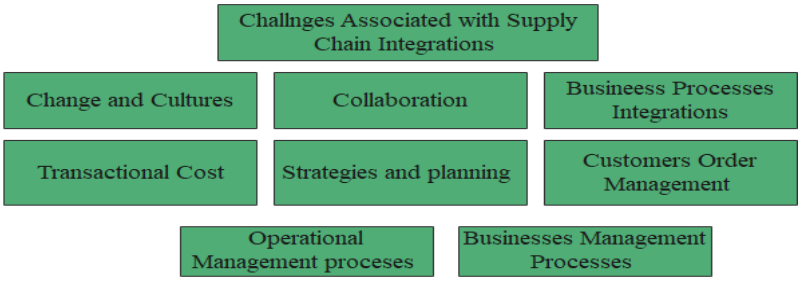

Figure 2:15 Challenges Associated with SCI and its PMs (adopted from Alsagheer et al., 2011)

An author agrees with these, and other expected likelihoods of the challenges in this research process. Having these predictable inconveniences to conduct the study, an author intended to design research methodology (especially how to access the data of the SCI, and its elements of performance metrics from sampled case Industries).

2.7 Analysis and Findings of the Literature on SCI & it's SCPM

Different researchers used different tools of data analysis in the processes of analyzing SC integrations and their performance measurement in manufacturing and service delivery processes.

According to (Power D. , 2005), (Foerstl, Kai, Evi Hartmann, Finn Wynstra, and Roger Moser., 2013) and, (Wei, 2014) various tools and approaches of data analysis in various formers articles, journals, thesis, and literature were used. For instance: (Thakkar, 2007) and (Wei, 2014) have used the SCOR -model tool of SCPM evaluation that focused on the balanced approach and multiple levels in the industrial activities analysis. However, some recent researchers have proposed to combine the method of decision-making tools like Analytical Hierarchy Processing or AHP (Shahroodi, Kambiz, 2012) (W.Han, 2017). Even though (Lima-Junior el at ., 2017) supports the AHP tool, and (Mackweba, 2009), and (Maditati, 2018) argue that this tool was not effective solely.

But, an author intended to apply integrated tools of SCI and its performance metrics in the current study to enhance SC system productivity of the case firms. And also, the other scholars were used key performance indicators (KPI) tools that use to evaluate: perfect order fulfillment, responsiveness that customer-focused attributes which are describing at which tasks are performed, and mostly expressed by cycle time metrics (Irfan et al, 2019). (Guan, Wei, and Jakob Rehme, 2012), and (S.R., 2015) have used the BSC tool to evaluate the SCPM through various internal and external ^{inter}-flows of key elements of the SC activities. Some papers with corresponding tools of data analysis and implications were as the following table.

Table 2:1 Authors with corresponding of their analysis tool in literature (compiled by an author)

Author (s)	Tools of analysis	Overviews of the Approaches
Kaplan,1992 & Bittitici, 2001	Balanced scorecard BSC SC analysis tool	Designed to evaluate corporate performance from four different perspectives like financial, internal business processes, and learning

		enterprise growth.
Huang, 2004 & Li, 2005	AHP (analytical hierarchy processing	-Propose this tool as appropriate to analyze the SC industrial processes to make a decision
Lima –Junior et al., 2017	SCOR –model	-Is used to offer a practical approach to analysis SC performances measurements and proposed key performance metrics in the industrial activities
Golparavar,M.,Seifbarghy, M., 2009	Supply Chain Operational References mode (SCOR-model)	-Is used three supply levels and five processes. -Is used intermediate production activity are coordinate before the scheduling of the operations to be performed in the system. -But, not used multi-criteria decision-making method in SC analysis
Bigliarde and Bottani , 2010	Balance Score Card (BSC) SC analysis tool	Develop BSC –the model for measuring performances in the food industry business processes
Chi-Fen Chou, 2010, Dissanayake ,2018	Supply Chain Operational Reference (SCOR-mode)	-Tried to evaluate the performance of the Grocery retailer - but, the applicability of the SCOR-model's features(make) not fully applicable which is the current study going to fully integrate
Meiraf Waley, 2014	AHP (analytical hierarchy processing)	-Tried to evaluate the decision based on multi-criteria decision processes which were developed by (Saaty, 1998). -It used to evaluate general measurements depending on the judgment of an individual
Shaflee el at, 2018	Balance Scorecard (BSc)	-It is used by external customers to enrich performance measurements. -and also used to show relationships between SC performances & balanced scorecard metrics -But, the strategic analysis and operational analysis not sufficiently included which is going to be incorporated in the current study
W.Han,Y.,Huang & M.,Mackbet, 2017	KPI (key performance indicator)	-Used to define and evaluate various financial and non-financial parameters in the key operational activities of the firms. - But, the impacts of SCI were not sufficiently internalized. This study intended to add this to the investigation to propose a way of enhancement of productivity

The current researcher agrees with the above of different tools on analysis that has been used in the former literature and intended to the extent the approaches to fill the holes of the papers.

2.8 Selected Model for Current Study and its Summary in Literatures

Through the literature, different researchers and scholars, have been used different mechanism to integrate SC integrate and models in performance metrics evaluations of SC in operational activities. As the above section 2.3.2 & Table 2.1 elaborated, an author has tried to mention the models in SCPM. Among of those, an author has selected the SCOR – model to link with the key elements of SCIs. This model is used to segregate key SC processes and match their process element based on the benchmark performance data, used to provide users with a framework for understanding where they need to make improvements in SC processes. This model was widely applicable in the evaluations of SC performances in manufacturing activities (Pamala,D. Pietro,D., 2011) and (Kocahlu B., Gulsun ,B. and Tanyas ,M., 2014). It was used to evaluate the cross-functional SC performance evaluation and multiple levels of the process and contained various operational activities than other models. As different researchers stated the SCOR – model is designed to maintain to support SC at various levels of complexity that extended that across multiple firms (Dissanayake C. K., 2018) .The model mainly focuses on three-level (top-level, configuration level, and processes level) as it has depicted on the above Table 2:13. However, other scholars argued the effectiveness of evaluating the particular industry's overall SC performance and the inter-flows of key information (Bai etal , 2014). But, still, it has its limitations, in the literature of the former in terms of solely used.

Various of the literature have used this model solely in the processes of SCPM evaluation, but an author going to use combinations of SCOR, MLAC, QMS relevant tools, and other resources utilization and cost opportunities monitoring approaches to enhancing productivity in the key operational activities of the identified manufacturing case industries.

2.8 Conclusion and Research Gaps

In this chapter, various materials such as literature, articles, journals & master thesis, have reviewed the "Analyze of SCI Integrations and its Performances Metrics to Enhance Productivity", of Food complex Industries. Generic concepts on SCI and its performance metrics have been discussed through evolutions and formers scholar's scientific investigations. Different areas (research methods, tools of analysis & findings) that have been used by different researchers were reviewed to establish the current study's contributions in the journey of scientific processes.

Going through the former kinds of literature reviewing processes, an author was able to identify research gaps. The major gaps are lack of balanced approach and little focus on customers & competitors, lack of system thinking performance metrics were not well internalized on a concern of evaluations of SC operational activities and assisted by incorporated continuous improvement tools comprehensively. The other gaps were weak focusing on SC resources utilization, lack of integrated tools of analysis, the strategy was not directly connected to the processes of allocations resources, using SCOR –model solely, but, the current researcher designed to merge this model with MLAC & QMS relevant tools which have been used solely without integration of another tool, but SC integrations hadn't account sufficiently. And also, some literature, rarely and less focused on empirical analysis to examine factors influencing success & failures in the implementation of integrating SCI with SCPM, management of key SCI integrations which weren't used in the literature has been used comprehensively.

But, among the above research gaps, the researcher used further extensive analysis on lack of balanced approach and little focus on customers & competitors, using of SCOR –model solely, rarely and less focus on empirical analysis to examine factors influencing success & failures in the implementation of SC performance metrics, implementation guidelines to enhance SC operations' productivity which wasn't used in the literature has been used. This was through the combination of SCOR-mode, QMS, and MLAC relevant tools. Having these research gaps, current research has been Conducted comprehensive analysis on SCI and evaluate its performance metrics, efficiency, and unnecessary SC system expenses to find a possible solution for the pre-defined research questions.

CHAPTER THREE

3. RESEARCH DESIGN AND METHODOLOGY

3.1 Research Design

Different scholars define research design in different ways. (Kothari C. R., 2004), defined that "Research Design" as the arrangements of situations for collections and analyze that data in the pre-defined objective and research questions of the study through clear scientific procedures. And also, (Dawson, 2009) was another former author who stated the concepts, forming a research design is used for an arrangements methodologies (quantitatively and qualitatively) to achieve great understanding and scientifically follow the procedures. The research design is the logical flows of conceptual structures within the investigations and also it is drafting for the collection, measure, and analysis of the data. Some scholars, (Kumar, 2011) also classified research design into two main classes qualitative and quantitative. The current investigation intended to apply mixed approaches (combination of qualitative & quantitative research design).

Having these fundamental of formers scholars' base of knowledge in scientific research, and author of this research designed the flows of the study and conducted every activity like read literature, formulate the problem, set an objective of the study, collected relevant data on SC integrations and its SCPMs of food complex manufacturing process in the case industries those have been specified, conducted data analysis and interpreted the results. And also identify major negative impacts from the analysis and find its possible solution through proposing corrective measurements as mentioned in Table 5:5, developed implementation of SC operations improvement guidelines model as it depicted in Figure 5:2, and deferent possible scenarios to enhance case firms' overall SC system productivity.

3.2 Logical flows of current Research Framework

After various formers literature, articles, journals, and research thesis have been reviewed, an author was able to build the body of the existing knowledge towards SCI and its performance metrics. Based on these concrete concepts through the emphasis on the study's research questions, an author could design logical flows of activities in the different phases of the study to address the aim of the investigation.

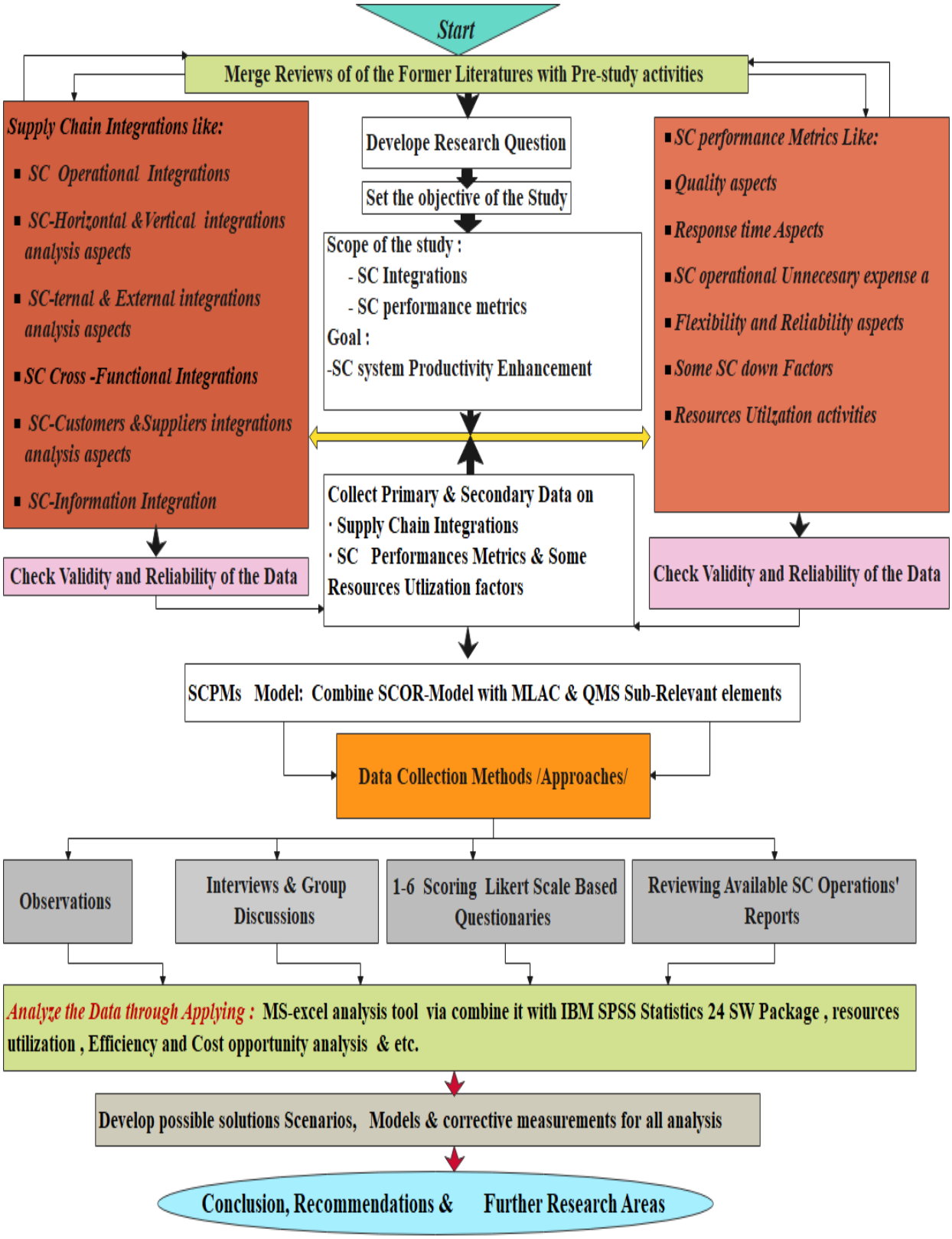

Figure 3:1 Conceptual framework of the research

3.3. Data Collection

In this thesis, different methods of data collection have been used to collect relevant data on the SC integrations (integrations of the internal system, integrations of an external system, supplier's integrations system, and customer's integrations system) of the specified case food complex manufacturing process industries. And also, it collected the SC performance metrics (SCPMs) like time aspects, costs aspects, quality aspects, and reliability and flexibility aspects in the case industries to analyze through the predefined objective of proposing possible scenarios for the enhancement of productivity of the manufacturing system. Typically, it was classified into two main categories as primary and secondary data.

3.3.1 Primary Data Collections

These types of data on the pre-defined research questions have been collected from the case industries (five food complex industries around Addis Ababa), through various mechanisms. That was through structured and semi-structured interviews, 1-6 based Likert scale questionnaires, informal communications with managers, shop floor workers, and suppliers, stakeholders of the case companies, retailers, and end-users.

Interviews: is used to collect the necessary inputs or data on SCI & its performances matrices (SCPMs) through conducting relevant discussions with companies' responsible bodies (i.e. general manager, production, marketing, quality managers, supervisors, etc.) and from stakeholders, sister companies, retailers and end-users (G.Mc., 1990). The researcher used formal & informal - interviews to seeking out further data on the current research question.

Questionnaires: an author used quantitative Likert scale questionnaires ranging from 1-6 and distributed to about six food complex industries (Kebron food complex industry, Booez Food Complex industry, and Wakene Food Complex Industry, Yamrot Food Complex Industry, K.O.J.J Food Complex Industry Asko, and Burayu branches) around Addis Ababa. And also, mixed of open-ended & closed-ended structured questionnaires were used to get complete & relevant data about SC integrations (i.e. SC internal integration aspects, SC external integration aspects, SC customers integrations aspects, SC suppliers customer integrations aspects, etc.), and SC performance metrics (SCPMs) like SCPMs regarding costs in the SC activities, supply chain performance measurements regarding response time and time delivery in the SC activities, SC performance measurements regarding production flexibility and reliability in the

SC system and quality aspects data. The questions prepared in English in a simple and easily understandable manner on the areas elaborated earlier (IIQ, L1), before it distributed to respondents, should be evaluated carefully the consistency and its validity as a pre-defined research question. The questions were distributed to various hierarchy (managers, sale and procurement departments, key customers, key suppliers, quality departments and SC supervisors, and some workers) levels of the case study's companies.

Relevant Documents, reports, and literature: these sources and methods of collecting the key research data are used for two purposes (i.e. 1 to validate the other questionnaires, interviews, and observations, and 2. used to support and facilitate the analysis phase of investigation) in the research processes (Mitcham, 1982) . Having these fundamental bases of research processes, an author used to use this method to collect necessary and relevant data on the SCI, performance metrics, and other relevant productivity enhancements such as cost opportunities, resources utilization, and capacity utilization parameters.

3.3.2 Secondary Data

This type of data is those which have already been collected by someone else from book, articles, published document and which have already been passed through the statistical process (Kothari C. R., 2004).The researcher used to collect various data related to SCI and its performance metrics of the identified case food complex manufacturing industrial processes. These can be documents related to order taking and order responses, quality of raw materials and products in the manufacturing system, unnecessarily incurred costs in SCIs that cause SCPMs of the case firms, resources utilization operations in the production system data on operational costs, marketing, services, and sales, etc.

The questionnaires and some surveys enhance the processes of assessing the current performance status of the case industries in terms of SC integrations and performance metrics and relating these to various business management approaches. Case companies' previous records or documents those supposed to be used in the processes of an assessment of the performances measurements/evaluation/ have been collected based on availability.

3.4 Right Samplings

The right sample needs to be taken to certify the reliability of the findings of the research and moderate the risks of threatening the whole effort of the research (Kumar, 2011) . This research gave significant consideration to ensure the sample represents the population to come up with possible conclusions from the sample outcome. Since this investigation intended to analyse SCI and their performance metrics to enhance productivity, five food complex industries around Addis Ababa such as Booez Food Complex Industry plc. Kebron Food Complex Industry plc. Wakene Food Complex Industry plc. Yamrot Food Complex Industry plc. K.O.J.J Food Complex Industry plc. The non-probability sampling method which is called the purposive sampling technique has been taken into apply. These case firms have been identified due to location and potential initiative real case such as GTP –II anticipated Agro-Industrial SC process to involving the global market and support the GDP of the country from creating the cooperative and optimal inter-flows of the business entities (WBAR, 2017) around this area. And also, in this area, various business activities like SC key operations such as inbound logistics, outbound logistics, manufacturing process, inter-flows of information, and other exporting and importing corridors' activities have been running. The other reasons that, these companies have purposively have been taken for the SCI analysis and its performance metrics in this study, is due to the involvement of the various stakeholders or key elements of cooperation of SC such as Ethiopia's AirPort, Industrial zones, high density of the consumers and demands, the study was able to be conducted extensive analysis to evaluate the customer satisfaction into the delivery mode, companies' domestic and global market competitions and efficiency and effectiveness of resources utilization on aspects of SCI. Around Addis Ababa, about 40 % of manufacturing industries found from this, about 31% categorized under food processing and beverage industries (EIC, 2018).And also, the accessibility of the inputs of the intended SCI & its performance metrics analysis (data affordability) enabled the author to intentionally select these food processing industries found around Addis Ababa.

The sample units for the research were chosen based on the non-probability sampling method or judgemental sampling. The reason why the researcher intended to use this approach was aiming to collect comprehensive and reliable information from the sources having the relevant knowledge and direct related operational experiences directly linked to the subject of the study.

According to Carvalho (1984), the researcher determined sample size preferred on the situations purposely (Naresh, 2007)

Table 3:1 Non-probability sampling adopted from Malhorta Naresh, K. (2007)

Population	Sample Size		
	Low	Medium	High
91-150	8	20	32
151-280	13	20	32
281-500	20	50	80
501-1200	32	80	125
1201-3200	50	125	200
3201-10000	80	200	315

Through this scientific approach, an author selected general managers, production managers, technical and operational manager's quality departments heads, procurement departments, sales & market departments, supervisors, warehouses or store managers, key customers, and suppliers as correspondents. About 80 - 125 questioners were distributed through an intentional selection of the respondents to get relevant information on SCI and their performance measurements in the operational system of the firms. Observations, interviews with the selected body (Appendix- II), and other documents were used as the sources of the data for this study. Based on these methods, the researcher designed to use none-probability sampling techniques and analysed SCI & their performance metrics to propose a possible solution pre-dominantly, in the current case firms.

3.5 Data Collection Procedures

An author used various approaches of data collection procedures after the designing of consistency and relevance of the questioners' contents was reviewed. Then it delivered to the staff of the above case industries' selected respondents using physical contacts & electronic devices. In addition to the distributed structured and open-ended questioners to the selected samples respondents, an author used structured and semi-structured interviews with various respondents (sample taken from the case study) in the firm to conduct data collection regarding the SCI system and firm's SC system performances measurements to address the pre-defined aim of the study. The interviews have been conducted briefly and straight forwarded through avoiding wasting the respondent's time.

3.6 Methods of Data Analysis

Data analysis is depending on both the objective of the study and the nature of the variables in the data collected (Neely A, 1995; Kothari C. R., 2004). Having this scholarly accredited scientific procedure, an author has been conducted various tasks.

The collected data on this research problem has been analyzed using various tools of relevant data analysis such as MS- Excel solver tools, IBM 24 SPSS software package, and other resources utilization computation to evaluate the various operations of SC integrations and their performance metrics in the manufacturing system of the case study firms. These tools used in the analysis of SC integrations (i.e. internal, external, customers, suppliers & operational SCI) and key performances indicators (lead time or delivery time, costs of production system, quality of products, flexibility) to evaluate their impacts on the overall productivities specified case profit-oriented industries. The other approach was to merge the SCOR model with MLAC (Managerial Levers Achievement Coordination) and QMS (Quality Management System) sub-related tools or elements to which essential to minimizing wastes and poor management operations and enhancing productivity. Combine SCOR –model & Manager Levers Achievement Cooperation (MLAC) which is used to evaluate SCPM to demarcate the current study from the former studies. Regarding gaps and short-coming of former research papers, SCOR-model used wed to evaluate SC performance and analyzing the status of the firm's SC system productivity. This study incorporated MLAC and QMS related tools into the scenarios to the extension of the analysis of SC operation using the SCOR model and proposing a possible solution.

The other analysis approaches that the current researcher used analysis of the unnecessary costs (CoQ), resources utilization in terms of capacity utilization, and Efficiency in the SC operational system using relevant resources utilization's management approach as it depicted in Figure 5:20. These aspects also were not comprehensively incorporated in the previous study through considering resource utilization, cost opportunities, and multi-dimensional management approaches. So, the researcher extended these to address the aim of the study. Additionally, since the aim is to enhance the SC system's overall productivity through analyzing SCIs and their performance indicators, various management scenarios and productivity analysis tools have been used to address the predefined research question.

3.7 Ethical Considerations

Ethical rules and the processes of obeying major guidelines of research & scientific code of conducts were the vital parameters that have been highly considered in this study (U.Sekaran, 2006). The researcher received a letter of information form from the Addis Ababa University Institute of Technology (AAiT). Before proceeding to ask for the required data, participants of the study have been informed of the objective of the investigations and its major benefits on long-run organization's competitiveness through emphasizing the required data was only for academic purposes. The value of the study subject has been carefully paid attention to respecting rights, needs, and confidentialities of the data acknowledging sources of information. These ethics ensured that the participants have remained anonymous throughout the study. Avoiding the distortions (miss - presentation) of collected data from respondents was another critical ethics that was taken into high consideration in this investigation.

All the above ethical considerations as well as other key issues that concerned are related to conducting scientific research and investigations were strictly uphold.

3.8 Testing Reliability & Validity of the Data

3.8.1 Validity Test

Before proceeding to conduct to analysis to address the pre-defined research problem, assure the validity of the data is essential activity (W.Trochim, 2000) .And also. Validity was an extension of an empirical measuring or evaluation adequately reflects the real intended areas of predefined research objective to address scientifically without any diversion or missing the directions (Flick, 2015). Based on this scientific approach, an author determined the validity of the data collection instruments (design of questioners, open & closed-ended type of questions) through discussing with research experts, supervisor& academicians. The scientific and professional-based supportive comments forwarded to were used as critical parameters of the validation processes. Again also, an author makes discussions with some responsible bodies, collect accessible numerical data from the company's documents, operational reports, ways of operations of SC management -system and commitments of actors of SC operational system.

3.8.2 Reliability Test

Is the degree to which analysis tools /approach /generate suitable & consistent results and is an accurate representation of targeted case population under case in the scientific investigation (Dawson, 2009) and (Shanti Bhushani Mishra , Ashasi Alock, 2011).The most well-known used in the literature to assess the scale of reliability (internal consistence's of the data) is using Chronbac Alpha statistics analysis. It should be greater than 0.70 to produce reliable scales and if it was less than 0.70, it should be eliminated. Researcher tests the reliability of the response of the distributed questionnaires using MS-excel & IBM 24 SPSS analysis tool. These were tools used for their suitability and more relevance to the feature of the data. Having this, an author tested the reliability of the collected data by calculating the Chronbach's Alpha value for all variables of the SCI and its performance metrics evaluation as mentioned in Table 3:2 below.

Table 3:2 Internal consistency analysis of the data for all items

S. No	SCI & SCPMs related Descriptions	Chronbach's Alpha value	No of items
1	Company integrations with suppliers	0.7644	10
2	Company integrations with customers	0.7423	15
3	Cross-functional departments integrations	0.8092	11
4	Internal SC-system operational integrations within the firm	0.733	15
5	SC information integrations	0.719	10
6	Suppliers and customers integrations	0.8113	10
7	SC system performance metrics regarding response time	0.7632	15
8	SC system performance measurements regarding quality	0.7414	9
9	SC system performance measurements regarding costs /unnecessary expenses/	0.7450	11
10	SC system performance measurements regarding production flexibility	0.70541	10

Source: Own questioners and survey analysis on SCI & SCPMs attributes (2021)

The comprehensive summary of the reliability test on the evaluations of the internal consistence's & validity of the of correspondent's responses on all items those designed based on the ways of addressing the pre-defined research problems.

CHAPTER FOUR

OVERVIEWS OF FOOD COMPLEX SECTOR

4.1 Global & African Context of SCI & SCMPs in Food complex Industries

Food processing industries fundamentally have been flourished after the whole – wheat (WW) flour meal through the single-pass system like Stone hammer or disc milling system to a rollers milling (Miller Perry R., 2015). Wheat is the primary inputs of the food processing industries which is grown in most parts of the world from Near-Arctic to Near-Equatorial Latitude (Tijaja, 2016). In the global context, the major types of wheat (Input of Food Processing Industries) were hard, soft, red & white, and seasonal based wheat. According to research reviews (Silva, Carlos Arthur B., 2007) , the productions of this raw material have been increasing largely due to research institutions and production technologies since 1960 in food complex industries' SC operations.

The European countries achieved the highest yield while Asian and African countries tend to below average. As long as the demand-driven from population density, and daily conceptions and predominance of the agro-industrial activities across the world, the followings have emerged and (Galli, Francesca, 2015) and (UNID, 2009).

- Globalization and information, resources, and capital inter-flows.
- Urbanization processes and Agro-Industrialization activities

These are the influential factors of the creations of industry chain networks in the processes of the SC integrations operational activities. Food processing industries & agro-business SC network rapidly moving towards globally inter-connected via various complexities (UNDIO, 2017/18). These and other relevant scenarios push forward the current real case of the developments of the agro-industrial processes and food complex industries across the world through

- SC integrations (vertical, horizontal, internal & external)
- SC network and inter-flows of the capital, information, and resources

4.1.1 Whole –Wheat (WW) Raw Material Exporters & Exporters

Increase raw material (WW) global conceptions have been led to the incensement of trade and SC-Network complexities. Wheat trade (chain) projected an increase to134 million tons by 2018

as FAO –OECD agricultural outlooks of 2009-2019 through various considerations. Developing countries such as those in South & East Asia as well as countries in Africa such as Egypt and Nigeria projected as global wheat demand to feed fast grown local consumptions like population and expansions of Agro-industrial activities (Reidy, 2018/2019). As this operational report of International Grain Council, WW Flour Meal Trade has accounted for 6-8% of total WWT and has experienced significant change.

4.2 Ethiopian Context of SCI & SCMPs in Food complex Industries

Food complex industries in Ethiopia were the types of plants those predominantly initiated by the potential local accessibility of the raw materials (wheat) and the demand is high ((EMA), 2016/17). Wheat is mostly grown in the high land areas of the country. Among the 9 regions, Oromia, Amhara, and SNNPR produce 59%, 27%, and 9% of the country's wheat respectively. Nearly about 98% of the cereal crops are produced by smallholders and while 2% was produced by commercial farmers which focused on seed multiplication purposes (Agency, 2016/17)

Ethiopian Millers' Association Reports: through the creation of value chain and SCI in with potential sources of wheat production actors, the following were reported: There are about 210 flour meals in EMA in Ethiopia with a total plant capacity of 3.2 million of flour per year.

- Current flour milling capacity is 10,858tons/day and 2,996,808ton/year

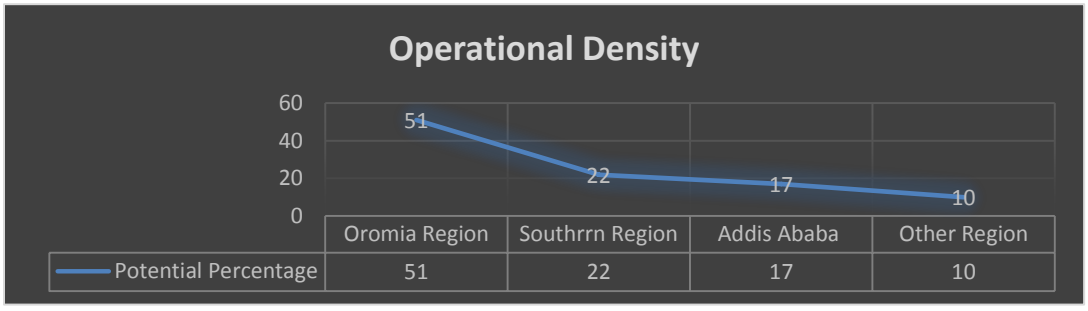

Figure 4:1 Source EMA flour milling, pasta & macaroni (EMA, 2015)

Import and Self-Sufficient in Ethiopia: there are two major types of sources of food processing industries in Ethiopia such as locally supplied (65-75%) and imported (25-35%). Ethiopia imported about 850MTof Durum wheat and total milling factories estimated about 3.7million tons (ERCA, 2018)and ((AACCSA), 2017).

4.2.1 Major Stakeholders in Wheat Value Chain

SC integration in wheat production context was the full involvements of key actors like NGO, private enterprises to transact wheat renders various services such as input suppliers (seed, fertilizers, pesticides, herbicides, tractors & combines), training, market information (buyers, suppliers price), financial services (Credits and Saving) in the WVC (Mekebeb G. kalkul M., 2015). But the consistency of the services is not addressed optimally for all stakeholders to improve the SC performances of the operations.

Wheat Producers: they sell the wheat (primary inputs of food complex processes industries) to downstream stakeholders such as wheat processes industries, wholes sellers, and end consumers. About 80% of the wheat surplus is sold to whole sellers at farm gat, warehouse, and spot markets ((AACCSA), 2017) and

Wheat Processing Industries in Ethiopia: The wheat processing industries (food complex industries) pass through the SCI like suppliers to companies, companies to whole sellers through significant value-adding operations before it reaches consumers (Mekebeb G. kalkul M., 2015). They sell value-added to whole sellers and retailers at market prices and distributed later on to bakeries at suicides fixed prices.

4.3 Case Companies' Context of SCI & SCMPs

The current case food complex industries identified for the investigation entitled ***"****analyze supply chain integrations and its performance metrics to enhance system productivity****"*** are the privately-owned companies. The companies are following various new technologies based on providing a variety of products like quality wheat flour, pasta, and macaroni products and services (customer order managing, additional customer value provisions). These take place via various information, resources, and managerial coordination of the stakeholders of the case firms.

Table 4:1 Case companies' general information

Name	Duration of Operating time	Location	Production Capacity	Product Variety	Sources of Raw materials
K.O.J.J Food Complex industry	Started from 2002 G.C	Asko, Burayu	140 ton per day	Wheat Flour Macaroni Pasta & other by products	Bale Arsi Gojam and other areas

Kebrone Food complex Industry	Since 1997 G.C	Burayu	134 ton per day	Wheat Flour Macaroni Pasta & other by-products	Bale &Arsi Gojam Other potential
Booez Food Complex Industry	Since 2009 G.C	Burayu	112.8 tons per day	Wheat Flour Macaroni Pasta & other by-products	Bale Arsi Gojam and other areas
Wakene Food Complex Industry	Since 2012 G.C	Burayu Tataki industrial area	134 tons per day Plus some by-products	Wheat Flour Macaroni Pasta & other by-products	Bale Arsi Gojam Other areas
Yamirot Food complex industry	2010 G.C/ greater than 10 years	Burayu Tataki industrial area	104 tons per day plus by-products	Wheat Flour Macaroni Pasta & other by-products	Bale and Arsi Gojam and other Regions

Mission: as the interviews that were conducted implied, more or less same target at the mission level because of the market opportunities and real cases of the consumer's behaviors' value chain.

- ☛ Create long-term interaction and coordination with their domestic, and international customers through delivering qualified and standardized products.

Vision: the above case food complex industries demonstrated their vision on the food complex industry's SC integrations, cooperation, coordination, and customers requirements' fundamental business scenarios. This was articulated as the following key sentence:

- ☛ Become the leading Food processing companies in the Ethiopian context

Competitors: Competition is the fact that involved in the business processes which required the new strategy that expected to be generated through managerial responsibility. The following were some companies compete with the current case firms in the food processes industries.

Table 4:2 Competitors of the case companies

Name of the company	Production capacity /year	Location
Kaliti Food Complex Share Company	3,886 tons	A.A Kalit
Afia Food Complex Company	25, 000 tons	Burayu
Fafa Food Complex Industry	14,134 tons	A.A Saris
Dirre Dawa Food Complex Industry	241,351 tons	Dire Dawa
Nasa Food Factory	20, 000 tons	Laga Tefo

4.3.1 Raw Material Selection and Production Flows Chart

Flour mill preparation for other phases: productions and raw material selection is the essential phase of the SC operational activities in the case firms (See appendix -II) researcher's interviews. The flow of the material materials passes through suppliers to production processes by obeying quality-assuring operations as the following figure depicted.

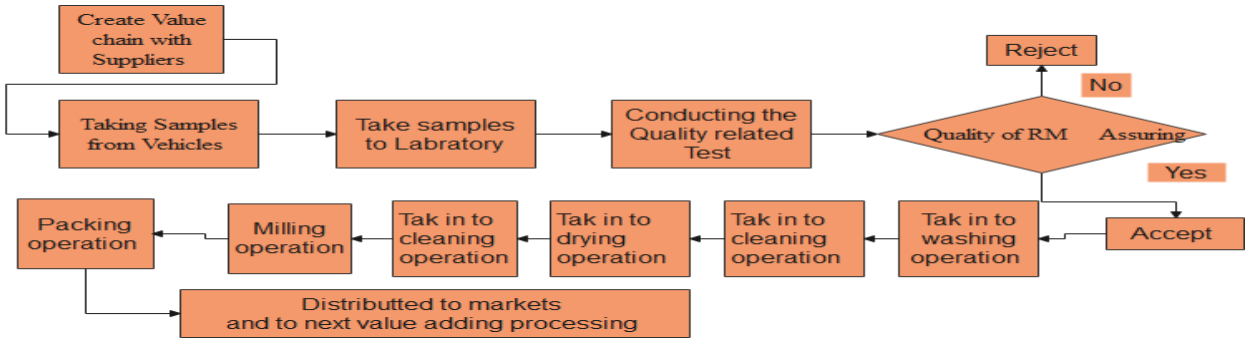

Figure 4:2 Material selections and production - flows processes of wheat flour meal

Pasta and Macaroni Production Flow Chart: these types of products were the major outputs of the food complex processes industries next to flour meal. Based on the demand, and consumers' behaviors, the case firms, producing it through the following flow charts.

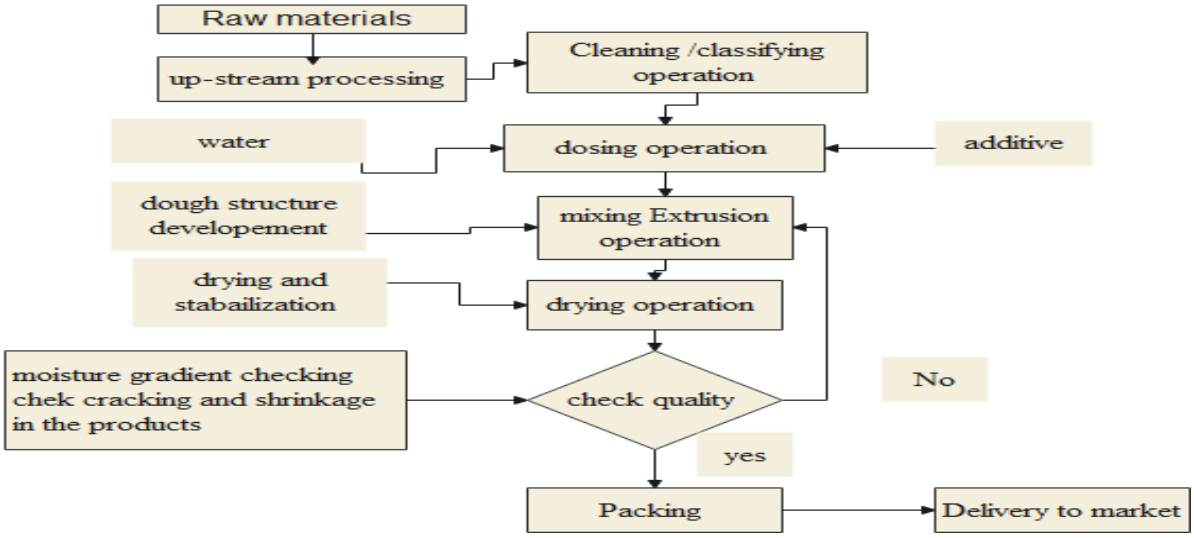

Figure 4:3 Pasta and macaroni production processes

4.3.2 Supply Chain Network of the Case Firms

In supply chain network were the critical elements in this case firms which are chained from farmers to end-consumers of the products as the following figure depicted. The sources of this SCN, was correspondents' interviews responses.

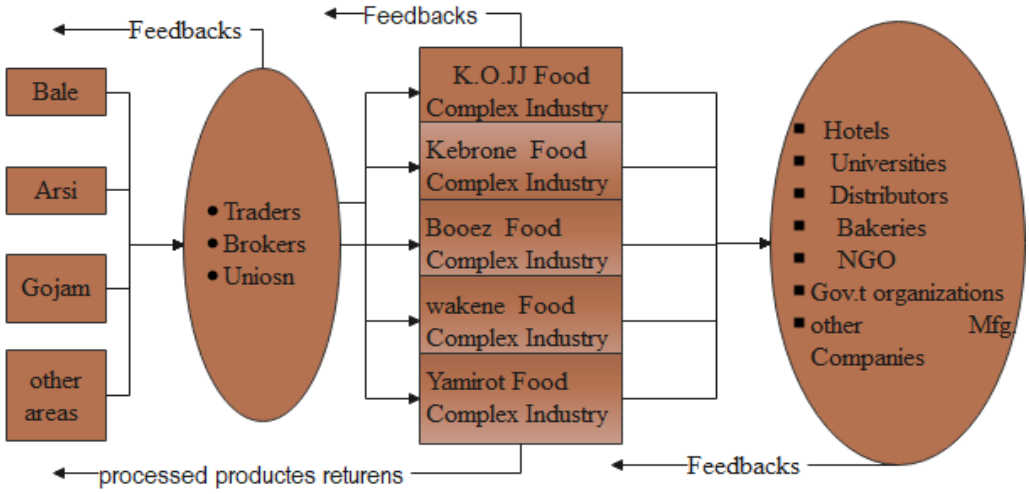

Figure 4:4 SC network in case companies

CHAPTER FIVE

DATA PRESENTATION, ANALYSIS, DISCUSSIONS & PROPOSE POSSIBLE SOLUTION

5.1. Introduction

In this chapter, the analysis, interpretations, discussions, and possible solutions through various optimal scenarios were conducted based on the data via data collection approach those elaborated of the methodology of the above. Having this, and non-probability sampling technique of the study, the researcher purposely selected respondents from the identified case firms' supply chain system as general & middle managers, production managers, sales and finance department, quality department, procurement department, technical &operational managers, key customers, and suppliers shop floor operators and warehouse inventory mangers' SC system. These respondents were purposely selected due to their daily operational activities (responsibilities) were highly linked with supply chain integrations' operations in the firm and required parameters or data on the predefined research questions for the current investigations. Through these bases of intentional respondents' selection scientific approach and scholarly support as depicted in Table 3:1, about 85 questioner papers were distributed.

From the total 80 questioners, about 71 were returned which is contained about 83.53 % response rate. This is definitely beyond Fowler's (2002)'s approach that "if the respondent rate is above 75%, descriptive data analysis can proceed sufficiently which implied that solid evidence for the current response rate was more effective for analysis. In addition to these questioners, the quantitative data on SC system costs of quality (unnecessary expenses), response time, resources utilization, and production system were collected from accessible supply chain operational areas. Data analysis, discussions, interpretations of the results, and proposed solutions through possible scenarios were presented in the following subheadings.

5.2 Analyzing of Data those Come from Questioner and Quantitative Sources

As mentioned and designed in the research methodology of this investigation, quantitative and qualitative data analysis approaches are required to be involved based on the various data collected on supply chain integrations and SCPMs analysis of the case companies. Through likers' scales of six points (significantly low, low, medium, high, significantly high, and not

applicable, (See Appendix-I) an author used to quantify qualitative data in quantitative data to analyze addresses the various research problems that have been defined. The other part of the investigation was quantitative data (See Appendix -III) analysis to assist the descriptive analysis. These and other subheadings were internalized in the following.

5.2.1 Analyze Response Rate of the Respondents

5.2.1.1 Respondents' Gender, Level of Educations & Work Experiences

Having the sampling technique mentioned in the paper's methodology, various respondents were taken to be direct participants from the targeted and identified five case companies. These respondents were top and middle managers, production managers, quality departments, sales and market departments, procurement departments, technical and operational managers, supervisors, key customers & suppliers (Broker, Traders & Unions) since the aim of the study was enhancing the SC system productivity, operators, included to sources of the data. The reason why the researcher purposely took these respondents was the relevance of their positions & responsibilities in the firm's SC operational activities and current required parameters on SCI (internal, external, operational, customers, information and suppliers integrations) and SCPMs (quality, costs, and timely delivery and flexibility aspects) as depicted on study's framework in Figure 3:1

The aim of assessing and presenting the respondents' demographic profiles was to determine whether the study consisted of heterogeneity sample units, experiences, educational levels. These and other parameters were analyzed & summarized in the following table.

Table 5:1Respondents' general profile analysis

Gender of the Participants Of The Study					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	60	84.5	84.5	84.5
	Female	11	15.5	15.5	100.0
	Total (N=71)	71	100.0	100.0	
Educational Levels of the Respondents					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	M.SC/MA &above	17	23.9	23.9	23.9
	B.SC/BA	46	64.8	64.8	88.7
	Level	3	4.2	4.2	93
	Diploma	5	7	7	100
	Total (N=71)	71	100	100	

Work Experiences of the Respondents in the Case Firms					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-3Years	2	2.8	2.8	2.8
	2-3Years	5	7.0	7.0	9.9
	3-5Years	27	38.0	38.0	47.9
	5-7Years	20	28.2	28.2	76.1
	8-10Years	12	16.9	16.9	93.0
	Above 10 years	5	7.0	7.0	100.0
	Total (N=71)	71	100.0	100.0	

Source: Researcher's questionnaires & demographic analysis (2021)

The above Table 5.1 depicted the frequency distributions of respondents' work experiences that counted between 5-7 years on the SC system operational areas 28.2 % (20) & between 3-5 years was 38.0% (27). Similarly, 23.9% (17) of the respondents were above 8 years of work experienced while below 3 years 9.80% (7). This is implied that more than 23.9% of the respondents have more than 7 years of work experienced and above 3years was 90.2% within the case firm's targeted operational areas which were sufficient to give relevant data on the raised issues. This means, when the participants of this investigation were more experienced in an organization and professionally high, their reflections and responses become reliable and good sorts of analysis.

Having these scenarios and others, the analysis consisted of the professional level heterogeneity of the respondents. Table 5.1 indicated second degree, first degree, level, and Diploma holders in multi-disciplinary 23.9% (17), 64.8% (46), 4.2% (3), 7% (5) respectively. This implies that above 65% of the respondents were first degree and second degree which was essential for reflecting their professional responses on the distributed questionnaires through internalizing causes of SCI and its parameters of performance measurements.

5.2.1.2 Respondents' Positions & Educational Backgrounds in the Firm

As the researcher designed purposive sampling, questionnaires were distributed to various positions like general managers, HR, production managers, suppliers, and customers as depicted in the figure below. The fundamental reason was, these sampled respondents take part in the SCI and performance measurement-related activities (order processing, receiving, and delivering) their daily operations. As the hand right figure depicted, the participants of this investigation were from various positions in the firms. This was the critical mechanism that is used to make

data inclusive and sourced from multi-functional departments to address the pre-defined research questions.

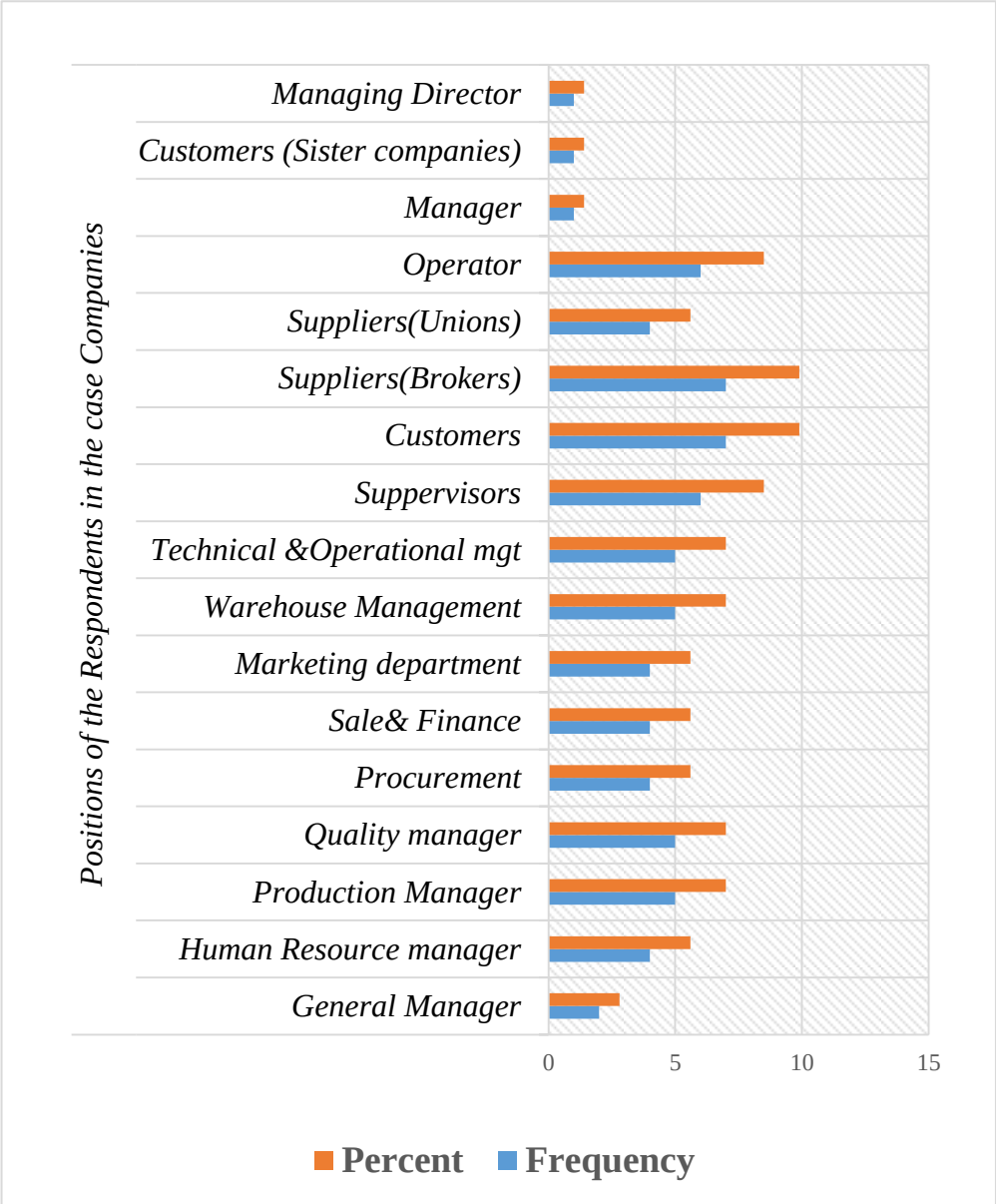

Figure 5:1 Correspondents' demographic analysis

And also respondents' Professional backgrounds were from multi-disciplines as mentioned in Figure 5.2 of the below which is enhancing the processes of getting reliable and comprehensive sources of data on SCI & its performance measurements key parameters. It was portrayed as the following.

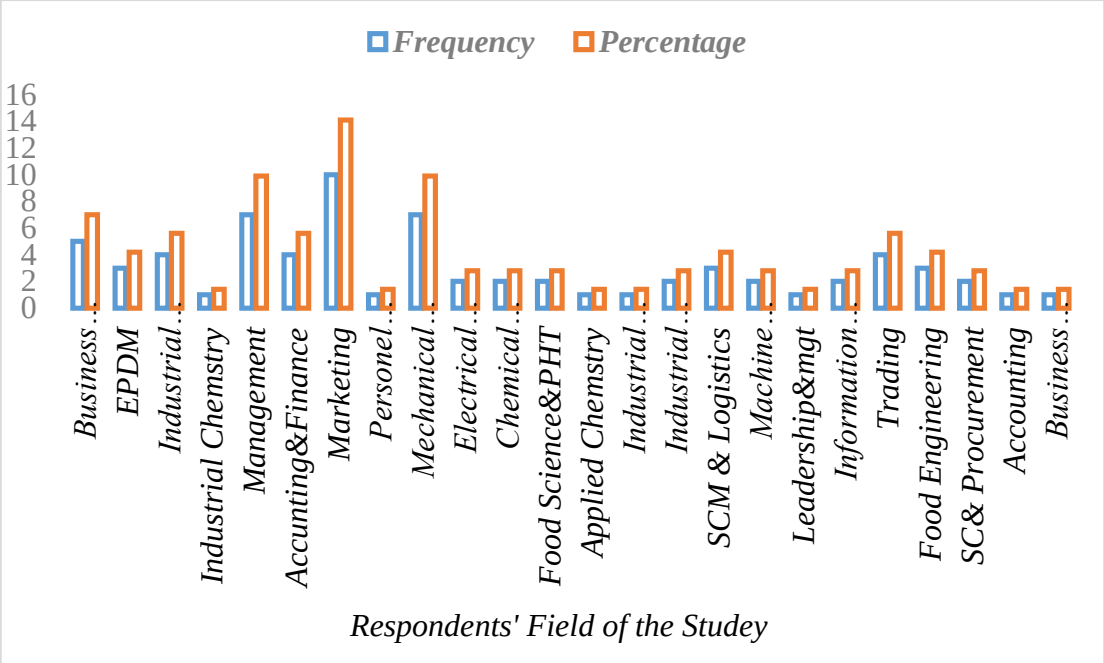

Figure 5:2 Respondents' field of studies

These and other comprehensive involvements and interactions of multi-professional disciplines on the data collections have been taken to as essential elements to solidify the process of this investigation.

5.2.2 Statistical Analysis on SC Integrations & its Performance Measurements' Various Operations in the Case Firms

Having the study framework elaborated in the methodology of the study that was depicted in Figure3:1, there were about ten key variables on SCI and its performance measurements. This descriptive statistical analysis used to evaluate the frequency, mean, standard deviation, and percent (%) of the respondents or participants' responses on the raised SCI (internal, external, custom, suppliers, operational and information) & SCPMs (response time, unnecessary costs, quality, and product flexibility) operational issues in the identified case companies in terms of various descriptive statistics outs. The researcher used a Likert scale of 1-6 points to collect and quantifying the approach to address the aim of the study. The above-enumerated variables were the most critical parts as mentioned on the conceptual framework of the research and to meet the pre-defined research objective. Results of this analysis were the

indicators for developing the possible solutions through optimal scenarios and enhance the productivities of the SC system and the overall competitiveness of the case firms.

5.2.2.1 Company's Integrations with Suppliers Analysis

In an Industrial process, SCI is the critical element that is primarily required to co-ordinate & manages various inter-functional departments. Having this comprehensive concept, data was collected on suppliers' integrations with the company focused on the processes of the collaborative relationship and inter-flows of different entities using a 1-6 Likert scale scoring system. The researcher analyzed the reliability of the collected data in data analysis tools and gets a 0.794 (79.4%) value Cronbach's Alpha which is greater than 0.70 that implied the reliability and consistency for analysis. As the researcher internalized the questionnaires and interviews those reverted from the correspondents (See Appendix-IV), there were various operational activities: sourcing suppliers strategically, an assessment of the collaboration and coordination of firm's performances, quick order fulfillment, and inter-flows of information and resources.

Sourcing Suppliers strategically: Are the processes of wise commitments of the management system that finding reliable sources of key suppliers to make the production system conveniences. The raw material of the food complex industries sourced from various geographical locations and requires strategic cooperation of suppliers with the company. The current study has investigated this parameter of SCM activity as 11.27%, 61.97%, 23.94% low, medium, and high (Qn4) respective analysis tool (MS-excel & 24 IBM SPSS software package). As the researcher conducted interviews and discussions with relevant correspondents, various factors like quality, interferences of brokers, costs and market fluctuations, the poor commitment of the management system, and others were explored.

Assessment of Collaboration & Coordination: refers to company integrations with suppliers through continuous evaluations of the status of inter-relationships between firm and supplier. An author was able to compute this issue's aspect in the case company as 7.04%, 57.75%, and 30.90% low, medium, and high (Qn5, Appendix –IV, 1) respectively. This is implied that medium performance was not far away from 50% which needs further improvement on the channels of cooperation and co-operative between suppliers and Food Complex industries

those taken to be investigated is needed. As the researcher investigated key respondents during the data collection period, SC system inconveniences were elaborated.

Order Processing, Inter-Flows of Information and Resources Monitoring: going through the phase of the data collection period, these were taken to be the essential elements of supply chain operational activities. The current case Industries (Five Companies around Addis Ababa) receiving raw material mostly from Brokers and Traders. These types of suppliers were sensitive to certain fluctuations and not reliable for the production system. They are not trusted in quantity and quality.

Consisting of the above and the other relevant parameters included in the questionnaires survey (See Appendix-I) and analyzed, the average of the companies' integrations with suppliers was depicted on the following Figure 5:3.

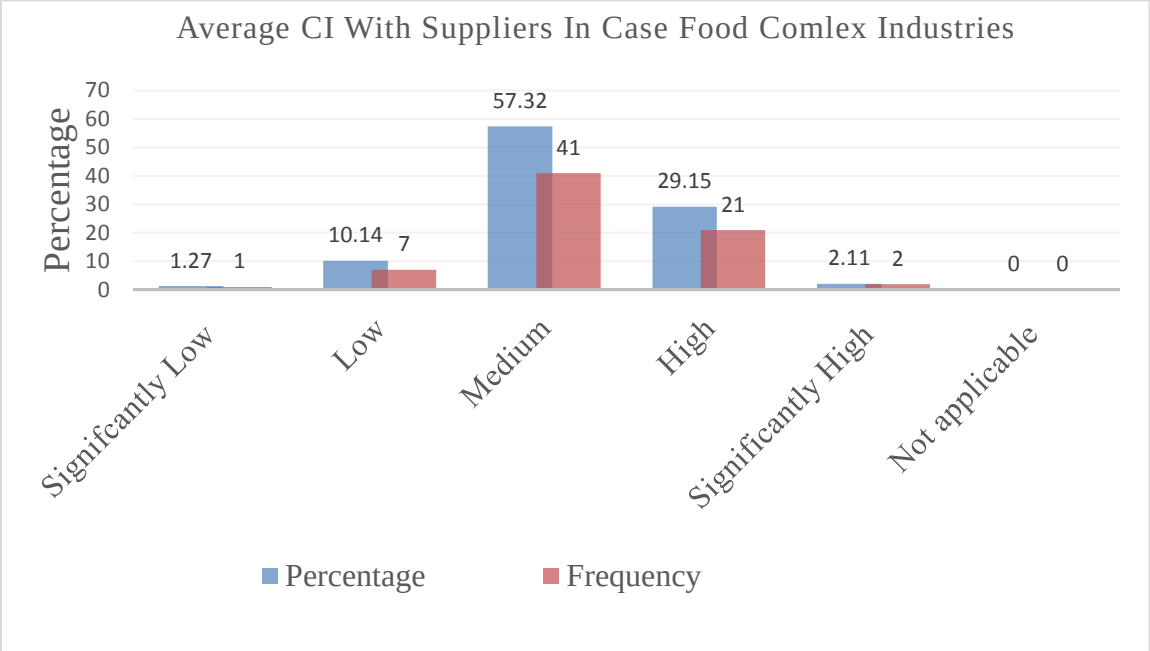

Figure 5:3 Respondents' responses on company's integrations with suppliers (source: Research Data, 2021)

Correspondents have been responded to their responses on the integration of companies with suppliers in SC operational activities in their company through 1-6 Likerts scoring scales data collection instruments (Appendix –IV). Most of the respondents responded the statements specify the activities on the company integration with suppliers which is 10.1%, 57.8%, 30.8% low, medium and high respectively. Additionally, structured and semi-structured interviews with

selected respondents were conducted to investigate extra factors of poor achievements of cooperative & smooth communications between suppliers and company.

5.2.2.2 Company's Integrations with Customers Analysis

In business processes and SC operational systems, there are two categories of customers: internal customers and external customers. In the context of the current case companies, internal customers are inter-functional dependents like Procurements & purchasing with quality de.t Warehouse and production dep.t, and also production dep.t and sales and marketing &, etc. External integrations: is focused on the cooperation and collaboration of the current case companies with their customers, sister companies, stakeholders and retailors.

An author distributed questionnaires to purposively selected respondents from the five Food Complex Industries located around Addis Ababa and collected. Since data collection instruments pass through evaluations of different respondents, it is necessary to analyze the reliability of the data. Based on these scenarios, the researcher conducted a reliability test through an analysis tool (MS-excel, and validated with other software like IBM 24 SPSS Software Package) and obtained Cronbach's Alpha 0.703 which is greater than 0.70 as elaborated in Table 3.2.

Regarding customer cooperation and collaboration with the company in the context of current case industries, the researcher was provided sufficient descriptions in which the respondents can evaluate the current operational system towards customers' requirements and internalized as summarized in Appendix-IV part 2. For instance, Create smooth communications with key customers were 23.9% (17, 56.3%, and 16.9% as low, medium, and high respectively(Qn12)while understanding customer requirements and do on it to enhance the inter-relationships and trust were resulted as 19.7%, 47.9% and 28.2% were low, medium and high respectively (Qn13). The following figure below indicated the average of the correspondents' responses on company integrations with customers (CIC).

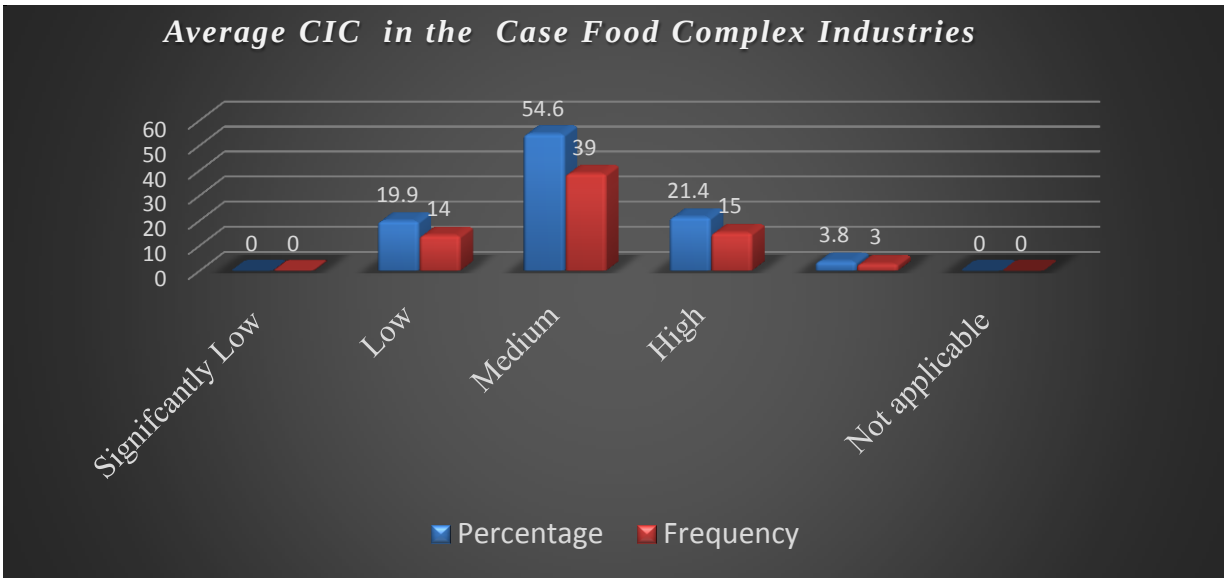

Figure 5:4 Respondents' responses on company's integrations with Customers (source: Research Data, 2021)

Correspondents have been responded to their responses on the integration of companies with customers in SC operational activities in their firm through 1-6 scoring Likert scales data collection instruments (Appendix –IV). Most of the respondents responded the statements specify the activities firm on the company integration with suppliers which is 19.9%, 54.6%, 21.4% low, medium, and high respectively. Additionally, structured and semi-structured interviews with selected respondents were conducted to investigate various possible factors on cooperative & smooth communications between customers and companies in the case firms.

5.2.2.3 Analysis Cross-Functional Integrations (CFI) within a Company

The researcher analyzed the reliability and validity of the collected data in data analysis tools and gets a 0.771 value Cronbach's Alpha which is greater than 0.70 that implied the reliable and internal consistency of the data was recommended as the true representative of the raised issues to be investigated. Questionnaires, group discussions, and interviews reverted from the correspondents (Appendix-IV) which are included various items. For instance: different functional departments in the identified food complex industries correspondents scoring their leveling answer on commitments on coordinate various operational activities as 8.5%, 56.3%, and 26.8% were low, medium, and high respectively (Qn11, Appendix-IV). And also to make the study make comprehensive, respondents answer the item CFI "inter-flows of SC-activities and co-relation on managing operations of the warehouse, suppliers, customers and resources"

22.5%, 56.3%, and 15.5% as low, medium, and high respectively (Qn8, Appendix-IV) in the case firm industrial processes.

This is implied that proper commitments of the internal company's key stakeholders are a critical tool to improve the current situations. Under these various issues, those primarily linked with this CFI in the case firm were discussed. These are:

- Cross-Functional Collaboration
- Cross-Functional Coordination
- Cross-Functional Communication

The combinations of these and other relevant elements in the taken to be analyzed case firms highly essential for the overall SC system productivity of these industries. Since about ten items entail CFI in the case firms, the following figure depicts a summary of the average of all raised items in a single table (See Appendix IV).

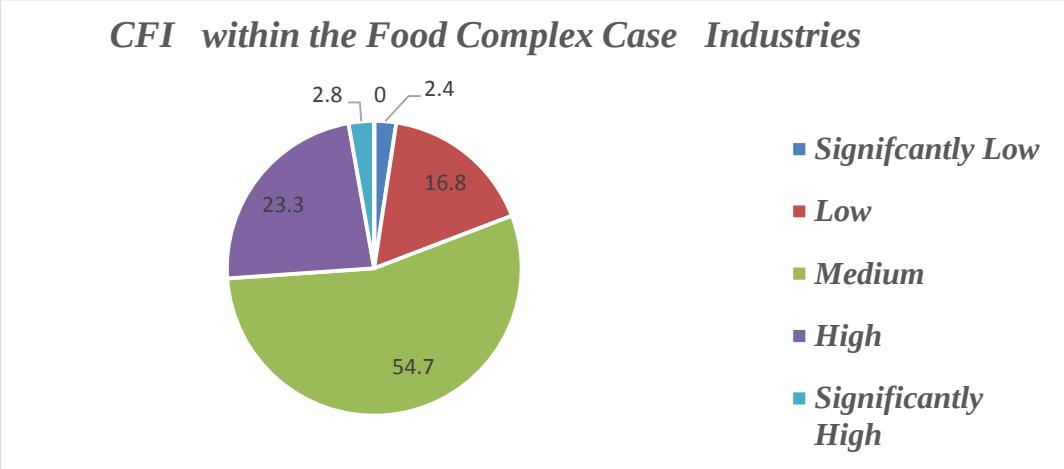

Figure 5:5 Respondents' responses on cross-functional integrations (source: Researcher's Data, 2021)

Respondents have been responded their responses on cross-functional integrations within SC operational activities in their food complex industry through 1-6 scoring Likert scales data collection instruments (Appendix –IV) and in Figure 5:5 Most of the respondents responded the statements specify the activities firm cross-functional integration within the firm which is 16.8%, 54.7%, 23.3% low, medium, and high respectively. Additionally, structured and semi-structured interviews with selected respondents were conducted to investigate various possible factors on cooperative & smooth communications between customers and companies in the case firms. The detail expressed in proposes possible solution part of this paper.

5.2.2.4 SC Internal Operations Integrations Analysis

Since the reliability (internal consistencies) and validity of the collected data is significant to address the predefined research aim, an author analyzed it using MS-excel and another supportive software package (IBM 24 SPSS software package) to validate the analysis or testing phase. Through this, 0.733 value Cronbach's alpha obtained which is greater than 0.70 that implied the reliable and internal consistency of the data was recommended as the true representative of the raised issues to be investigated. Going through the phase of the data collection phase of the research, and the author was able to understand as internal SCI is used to break down functional barriers and enhancing the cooperation and coordinated inter-flows of key elements in the current case industries. Resources utilization is very significant for the competitiveness of the firm which was included in the item of internal SCI and responded as 33.7%, 49.7 % and 11.3% were low, medium, and high respectively (Qn9) while operations of coordinating planning across the firms were 22.5%, 57.7% and 18.3 as low, medium and high respectively. Additionally, an author conducted different data collection processes such as structured, semi-structured interviews and discussions regarding internal SC operational integration with purposively selected key correspondents from case firms.

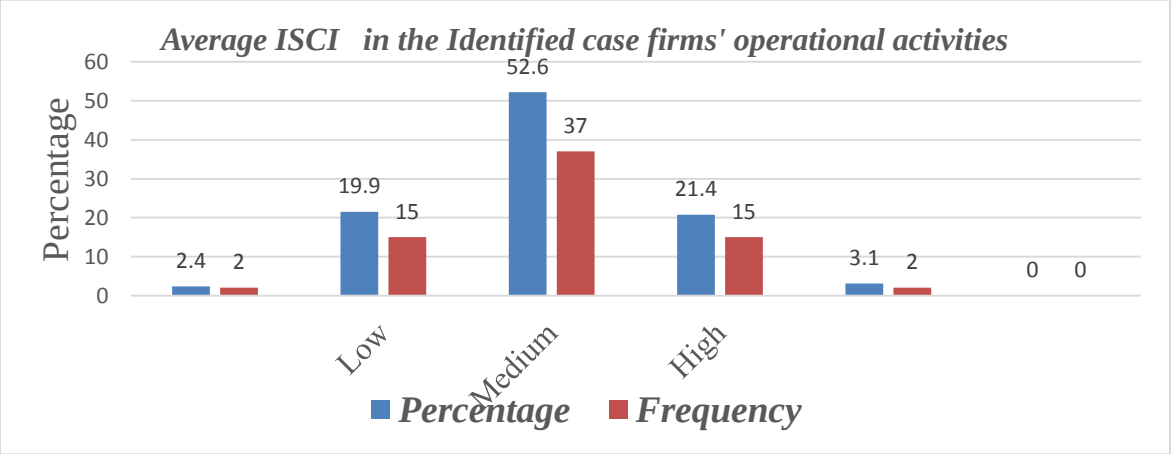

Figure 5:6 Respondents' responses on SC internal operational integrations (source: Research Data, 2021)

Correspondents have been reverted their responses on SC internal operational integration of their organization through 1-6 scoring Likert scales data collection instruments (Appendix –IV) & in Figure5:6. Most of the respondents responded the statements specify the activities firm on internal SC operational integration with suppliers which is 19.9%, 52.6%2, 21.4% low, medium,

and high respectively. Additionally, structured and semi-structured interviews with selected respondents were conducted to investigate various possible factors on cooperative & smooth communications between customers and companies in the case firms.

5.2.2.5 SC Information Integrations (SCII) Analysis

To run the manufacturing and SC operational activities, optimal inter-flows and integration of the key information is an essential SC element in the food complex industries. As far as the firm designing the optimal channels of integration and use them as the primary inputs of tactical decisions, the SC system can be coordinated and every stakeholder cooperatively conducts their daily operational activities. Through these SCII, the case firms can manage various functional departments like sale and finance, procurement, production and quality, warehouse to be competitive in the market.

The researcher collected data on the SCII in the reality of the case companies. Then analyzed reliability and validity of the collection through data either truly represents the issue taken to be analyzed and addressed predefined research question of this paper. As it mentioned in the above Table3.2, the criteria of the internal consistency (reliability) of the data obtained as 0.719 which is beyond 0.70 and enable analyst confidently proceed to the main analysis.

Through internalized questionnaires, group discussion, and interviews those reverted from the correspondents (Appendix-IV), there were various items included in the part of this. For instance: correspondents scoring their leveling answer on demand, order issues, and production processes coordination in the case firms' SC system operational activities as 22.5%, 62.1%, and 14.2% were low medium, and high respectively (Qn10, Appendix-IV). This is implied that the 22.5% reflect that the necessity of the operational management of SC system interference to minimize various negative factors in Ethiopian food complex industries (primarily in the current case firms).

The following figure below indicated the average of the correspondents' responses on SC information integration in the five food processing industries.

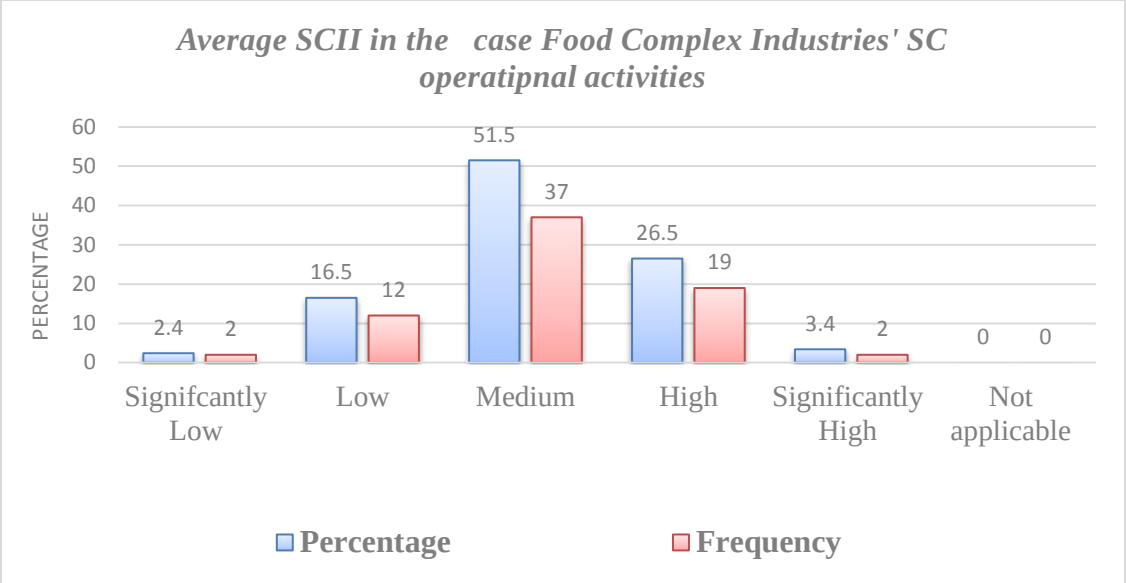

Figure 5:7 Respondents' responses on SC information integrations (Researcher's Data, 2021)

Correspondents have been reverted their responses on the SC information integration in their organization through 1-6 scoring Likert scales data collection instruments (Appendix –IV) & in Figure 5:7. Most of the respondents responded to the statements specify the activities of the firm on SC information integration which were 16.5%, 51.5%, 26.5% low, medium, and high respectively. Additionally, structured and semi-structured interviews with selected respondents were conducted to investigate various possible factors on cooperative & smooth communications between various functional departments of the case firms. Based on these, the researcher tried to propose possible in which case firms culturing the followings:

- Manage the interflows of information to assist the SC system and production process
- Integrate various operational activities through easily accessible inter-flows of key data
- Use relevant information technologies, and how every daily operational activity evaluated and resource utilization can be optimum?

5.2.2.6 Suppliers and Customers Integrations Analysis

The optimal integration of customers and suppliers in the SC operational activities in the case of current case industries was explored as a critical task for overall profitability. The researcher collected data on the suppliers and customers integrations the on the processes of coordination,

interrelationships, and communication of real of the case companies through conceptualizing the below demand –suppliers interflows.

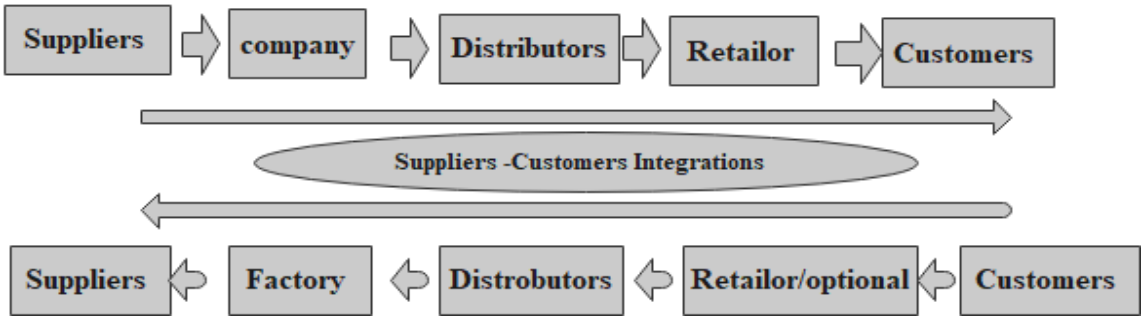

Figure 5:8 Suppliers & customers integrations (Researcher's analysis, 2021)

The responses diverted from the correspondents analyzed to evaluate the reliability and validity of the data as it truly represents the issue taken to be analyzed and addressed predefined research question of this paper. As it mentioned in the above Table3.1, the criteria of the internal consistency (reliability) of the data obtained as 0.811 which is beyond 0.70 and enable analyst confidently proceed to the main analysis.

There were various items included in the part of this. For instance: different functional departments in the identified food complex industries correspondents scoring their leveling answer on interactions on order receiving and supplying various operational activities as 15.49%, 57.75%, and 19.72% were low medium, and high respectively (Qn9, Appendix-IV table6). This is implied that the 15.49%, .5% reflect that the requirements of the operational management of SC system interference to minimize various negative factors in Ethiopian food complex industries (primarily, in the current case firms). The following figure below indicated the average of the correspondents' responses on Suppliers integration with customers in the case firms.

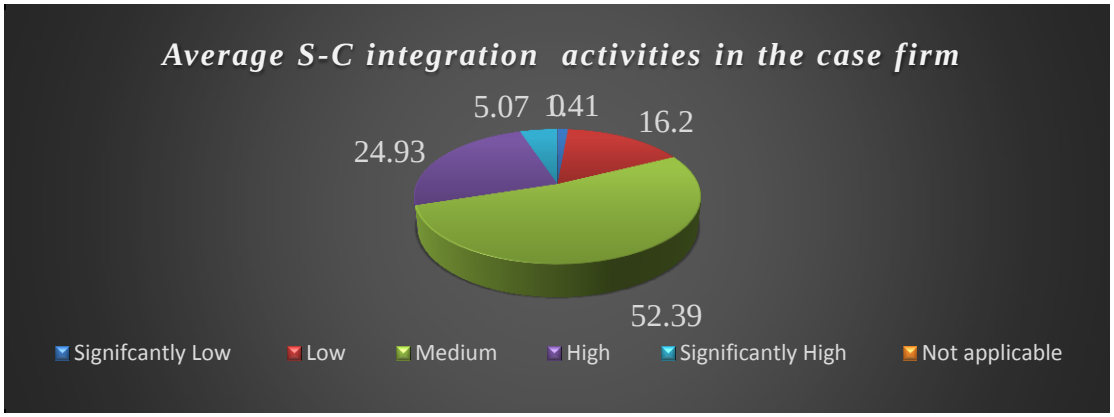

Figure 5:9 Respondents' responses on customers –suppliers' integrations (Source: Research Data, 2021)

Correspondents have been reverted their responses on Supplier integration with customers in the organization through 1-6 scoring Likert scales data collection instruments (Appendix –IV) & in Figure5:9. Most of the respondents responded the statements specify the activities of the firm on suppliers' integration with suppliers which is 16.2%, 52.39%, 24.93% low, medium, and high respectively. Additionally, structured and semi-structured interviews with selected respondents were conducted to investigate various possible factors on collaborations, cooperative & smooth communications between customers and suppliers in the case firms.

5.2.2.7 SC Performance Metrics Analysis Regarding Response Time

The researcher explored that as the SC operational activities in Ethiopia's food complex industry (pre-dominantly the current five case industries) know their SC performance metrics. Based on the methodology as it mentioned in Figure 3.1, the SCOR-model was used to evaluate the SC performance of the case firms. Response time is the term that includes various key elements those an author validated their relevance with current case firms' operational activities and depicted in the following Figure 5:10

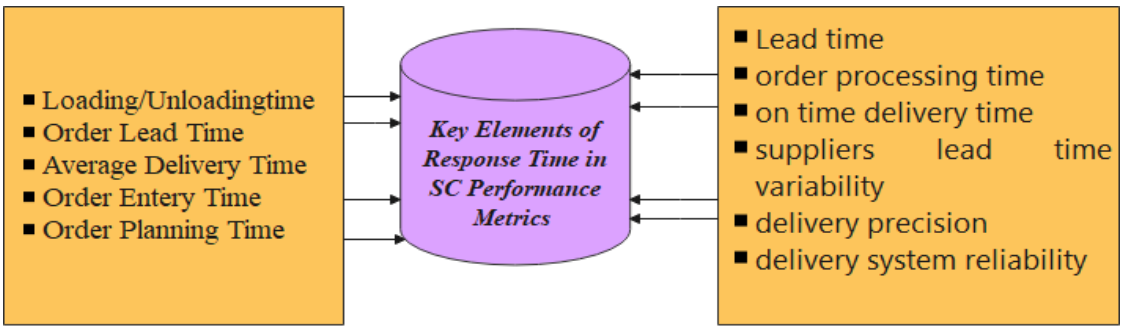

Figure 5:10 Key elements of response time in SCPMs (Researcher's conceptualized, 2021)

Through considering the above key elements of Response Time in SCPMs of the case firms, the responses diverted from the correspondents and reliability and validity of the collected data were analyzed. This is the way of truly represent the issue taken to be analyzed and addressed predefined research question of this paper. As it mentioned in the above Table3.2, the criteria of the internal consistency (reliability) of the data obtained as 0.763 which is beyond 0.70 and enable analyst confidently proceed to the main analysis.

There were various items included in the part of this. For instance: different functional departments in the identified food complex industries correspondents scoring their answer on monitor variability in delivery time processes in supplying various operational activities of the case companies as 15.49%, 57.75%, and 19.72% were low medium, and high respectively (Qn7, Appendix-IV). This is implied that the 15.49% .5% reflects that the requirements of the operational management of SC system interference to minimize various negative factors in Ethiopian food complex industries (primarily in the current case firms). The following figure below indicated the average of the correspondents' responses on SC performance metrics that cause due to weak SCI regarding the response time in the case processes industries.

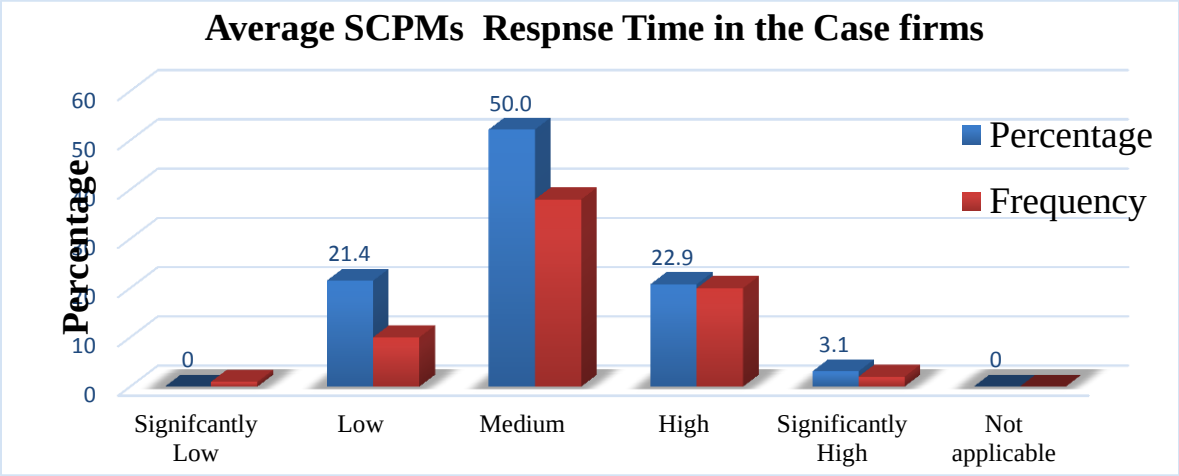

Figure 5:11 Respondents' responses on SCPMs on response time aspects (Source: Research Data, 2021)

Correspondents have been responded to their responses on SCPM on the operational activities key elements of response time that depicted in Figure5:11 in the case companies through 1-6 scoring Likert scales data collection instruments (Appendix –IV). Most of the respondents responded that the statements specify the activities of the firm on SCPM of a response time aspect in the case firms 21.5%, 52.2%, and 20.8% as low, medium, and high respectively. Additionally, structured and semi-structured interviews with selected respondents were conducted to investigate various possible factors on cooperative & smooth communications between customers and suppliers that cause low response time in the case firms.

5.2.2.8 SC Performance Measurements Analysis Regarding Quality

As the researcher proposed to use SCOR-Model with other SC-related management tools, Quality was another critical element in the processes of measuring the SCPMs in the current case industries. Under this, the following areas have been taken into consideration during data collection processes: warehouse /store monitoring/, quality of information inter-flows, quality of operational management in the SC activities phase by phase, raw material purchasing and preparation processes, production processes in the case Companies.

Storage /warehouse/ monitoring: Store management and resource utilization are the important parameters or elements of SCPMs indicators. In Appendix –I), an author tried to collect various SCPMs indicators in the real case of the firm's SC system operational activities. As correspondents reverted their answers on Qn6 which is stated as monitoring warehouse accidents and order fill rate processes through active market-based data accounted 14.1%, 70.4% & 12.4%, and Qn8 which is stated as an assessment of various operational quality management 28.2%, 50.7, and 19.7% as low, medium, high respectively (See Appendix-IV, Table8). In addition to the above, the researcher collected data through literature, interviews, and discussion with key correspondents on quality aspect operational areas in the case Industries. The following factors have been considered as the major parameters that can directly affect the performances of warehouse /inventory/ management.

- Resource utilization & storage space utilization
- Inventory accuracy
- Inventory accidents rate
- damage and unusable stocks
- Poor stock card management, etc.

Managing these key elements of warehouse and inventory management in the processes of Ethiopia's Food Complex industries (primarily, current case Companies) through various management tools those relevant tools like QMS. The aim is to enhance overall productivity and enable the firms profitable.

Quality of Information Inter-Flows: An author explored that as the inter-flows of the key resources and information in the operational activities of the case firms SC system is the critical element for improving SCPMs. As correspondents reverted their answers Qn5 which is stated as

monitoring order entry and invoice accuracy accounted for 19.7%, 36.6% & 38.1% as low, medium, high respectively (See Appendix-IV, Table8). This is implied that the intervention of operational management is required to coordinate and collaborate with multi-functional staff like purchasing department to suppliers, production dep.t to sales & marketing dep.t, etc.

Operational Management Activities Regarding Quality in SCPMs

Fundamentally, enhancing the SCPMs in the processes of industrial activities result from various phase-by-phase, SC-related operational management. It includes raw material purchasing and preparation processes and production processes monitoring system. As correspondents reverted their answers (Qn9, appendix I) which is stated as proper assuring of the SC operations from raw materials sourcing to product commencement activities accounted for 2.8%, 70.4% & 25.4% as low, medium, high respectively (See Appendix-IV, Table8). This is implied that, the intervention of operational management required to coordinate and collaborate the multi-functional staff like purchasing dep.t to suppliers, suppliers to customers, production department to sales, and marketing dep.t to enhance the current 70.4% on the item (Qn9, Appendix-IV).

Through considering the above major elements of quality aspects in SCPMs of the case firms, respondents answered the questionnaires. Then researcher tested the reliability and validity of the collected data. This is to ensure that the statements (Appendix –I, Table 7B) truly represent raised issues taken to be analyzed and addressed predefined research question of this paper. As it mentioned in the above Table3.2, the criteria of the internal consistency of the data obtained as 0.741 which is beyond 0.70 and enable analyst confidently proceed to the main analysis. The following Figure 5:12 below indicated the average of the correspondents' responses on SCPMs regarding the quality in the current case industries.

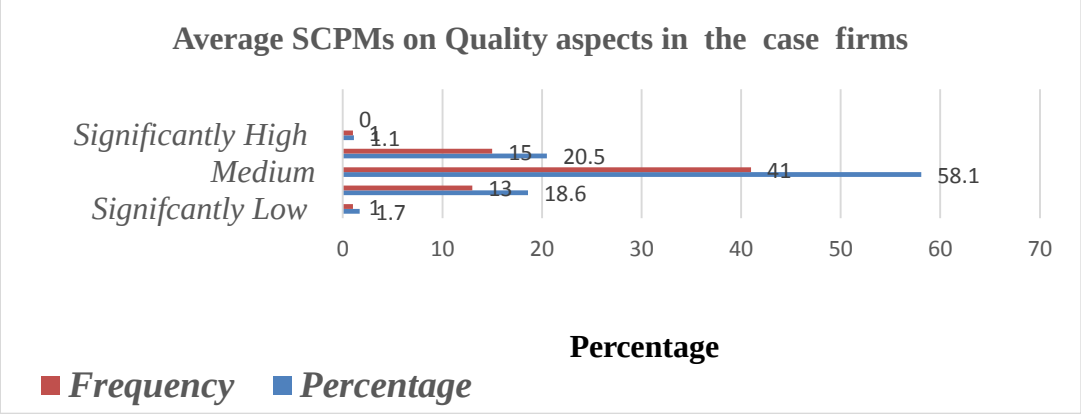

Figure 5:12 Respondents' responses on SCPMs regarding quality (Source: Researcher's Data, 2021)

Correspondents have been responded to their responses on SC performance metrics on the operational activities key elements of quality aspects as depicted in Figure5:12 in the case Companies through 1-6 scoring Likert scales data collection instruments (See Appendix –I, Table7B). Most of the respondents responded the statements specify the activities firm on SC performance metrics in the case firms evaluated as 18.6%, 58.1%, and 20.5% as low, medium, and high respectively that was due to poor SCI operational management process. Additionally, structured and semi-structured interviews with selected respondents were conducted to investigate various possible factors on cooperative & smooth communications between customers and suppliers, operational management systems in the case firms. To improve these indicators, all SC activities in Ethiopia's food complex industries (primarily, the current case industries) required to culturing the following management tools:

- Empower all stakeholders in the various SC system operational phases
- case firms' functional departments commit their daily activities actively and optimally
- Teamwork, coordination, smooth communications, and follow-up of every activity are very critical to improve the SCPMs, etc.

5.2.2.9 SCPMs Analysis Unnecessary Costs Aspects

The impacts of unnecessary expenses (Costs of Quality) in the case of food complex industries' SC system have its impacts on the SC performance analysis. Management system towards monitoring unwanted costs optimally was still below expectations. Having this Researcher collected data and analyzed the reliability and validity of the collected data in data analysis tools and get 0.745 value Cronbach's Alpha which is greater than 0.70 which is reliable. This is the true representative of the raised issues to be investigated.

Questionnaires, group discussions, and interviews reverted from the correspondents (Appendix-IV, Table9) which were included about 11 items. For instance: different functional departments in the identified food complex industries correspondents scoring their leveling answer on costs incurred due to management probable at various phase of SC system operational activities as 21.3%, 53.5%, and 29.6% were low, medium, and high respectively (Qn8, Appendix-IV). This

implied that in the SC operation improvements are required to optimize resource utilization and managing inter-flows of resources. The researcher explored various factors of CoQ (costs of quality) during the data collections like literature, structured & semi-structured interviews, discussions with managers and key correspondents on the raised issues in the identified case industries. The main categories of the costs considered under this were the following:

- Preventive costs related to SC system activities
- Appraisal costs related to SC system activities
- Internal failure costs related to SC system activities
- External failure cost-related SC system activities

The fundamental benefits of monitoring and optimally controlling these basic expenses in the SC system of the Ethiopian food complex industries (primarily current case industries) is an initial assessment and hard evidence for strategic decision and improvement. And also it is the most significant tool for devising SC operational activities' performances and managing the effectiveness of quality improvement initiatives. Having the above key elements of expenses those an author incorporated in the item of questionnaires (See Appendix-IV), and respondents reverted their responses. The below figure indicated the average of the correspondents' responses on SCPM regarding poor cost incurring (CoQ) in the five food processing industries.

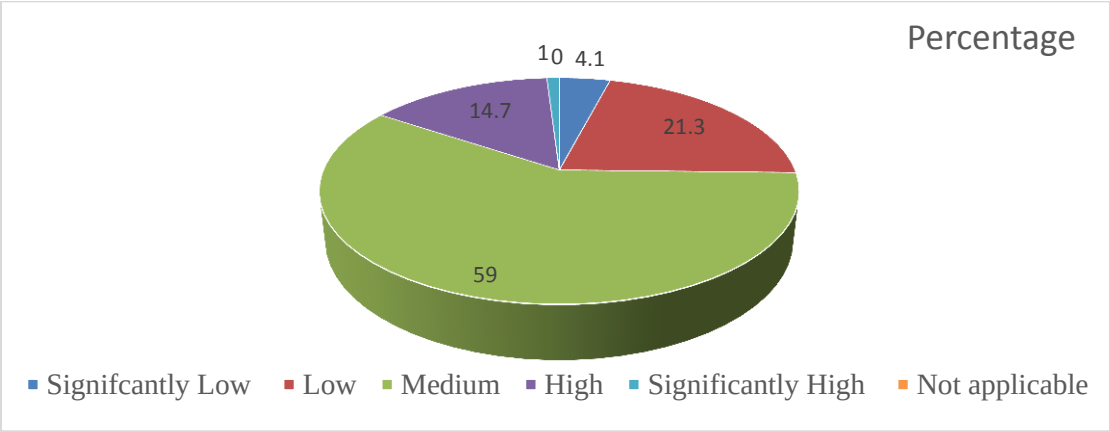

Figure 5:13 Respondents' responses on SCPMs regarding unnecessary expenses (Source: Research Data, 2021)

Correspondents have been responded the provided questions on SC performance metrics on the operational activities key elements of cost aspects in the case companies through 1-6 Likert scoring scales data collection instruments (See Appendix –IV) & as depicted in Figure 5:13. Most of the respondents responded the statements specify the activities firm on SCPM in the

case firms 21.3%, 59.0%, and 14.7% as low, medium, and high respectively. This is implied that 59.0% indicate that the current system was below expected resource utilization and incorporation of poor monitoring system in SC operational management.

5.2.2.10 Reliability &Flexibility Aspects on SCPM Analysis

In addition to the above-analyzed elements of SCPMs, flexibility and reliability are also, indicators of SC performance metrics evaluation the case Industries that caused from the weak SC integrations. Since validity and internal consistency, the data is pre-condition for the true representative of the raised items (Appendix -I, Table 7D), it was analyzed as the above Table 3:2 depicted.

Flexibility: is the process in which the company culturing the tactical strategy toward fluctuation of extraordinary demands requisite. As the qualitative data through structured, semi-structured interviews and discussions with correspondents were indicated, the demand for the products was based on conceptions of the consumers. But, the problems were order patterns and were random. The other problem was raw material is available in a certain season. As questionnaires survey correspondents have reverted their answers Qn4 (Appendix-IV, Table10) which is stated as analyze plan versus actual in production system & take corrective measurements on risk factors accounted 8.5%, 43.4% & 43.1% as low, medium, high respectively. To penetrate the market and improve sale opportunity, it is an essential market requirement-based production system. This is required wise implementations of trade-off raw material scarcity and inventory management to overcome inconvenience.

Reliability: is used to eliminate the inconveniences and make product delivering operational activities smooth and continual. Qn5 (Appendix-IV, Table 10) from the questionnaires and survey response on monitoring variability in production system account as 32.4%, 50.7%,14.1% as low, medium, and high respectively. This is implied that, interventions of management tools such as:

- Coordinate companies with customers and raw material suppliers strategically to make delivery system and production accessibility conferences
- Assess SCPMs operations phase by phase & take corrective measurements

Through the above indicators, and author compiled about 10 items of questionnaires' (See Appendix-I Table7D) and respondents reverted their responses. The below figure indicated the

average summary of the correspondents' responses on SCPMs regarding flexibility and reliability that resulted due to poor SCI operations in the current case industries.

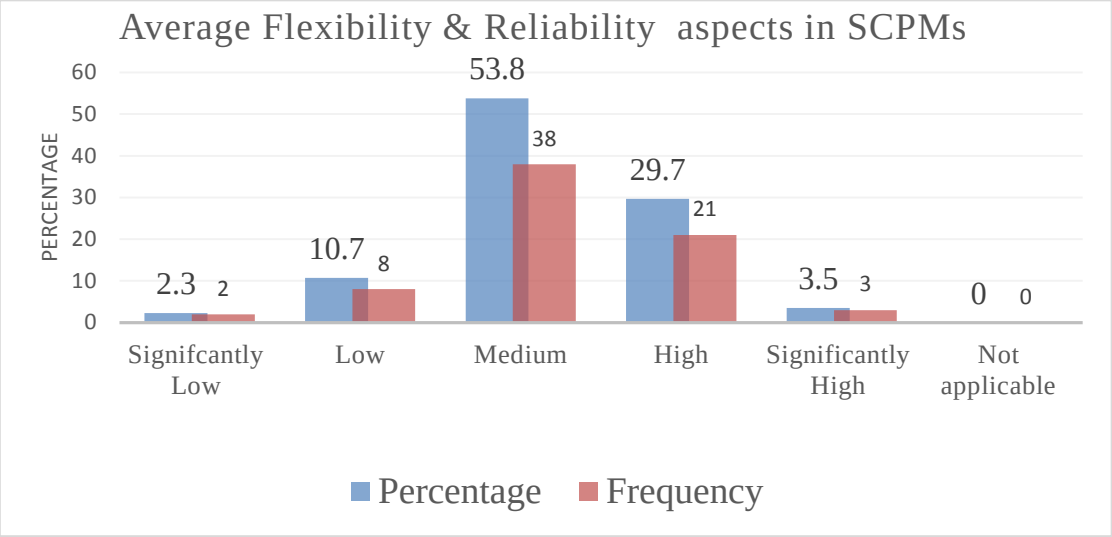

Figure 5:14 Respondents' responses on SCPMs regarding reliability and flexibility (Source: Researcher's Data, 2021)

Correspondents have been responded to their responses on SCPM on the operational activities key elements of flexibility and reliability aspects as depicted in Figure5:14 in the case Companies through 1-6 Likert scoring scales data collection instruments (Appendix –IV & Table 7D). Most of the respondents responded to the statements that specified the activities of the firm on SCPM in the case firms 10.7%, 53.8%, and 29.7% as low, medium, and high respectively. This is implied that the indicators indicate that the current system requires the proper management intervention was below expected resources utilization and incorporation of poor monitoring system in SC operational management. The detailed solutions are available in the following section of this study to addresses the pre-defined research problem and objective.

5.3 Analyzing Relationship between SCI and its performance Measurements

5.3.1 Correlation Analysis

Having the study framework depicted in Figure 3.1, there are various key elements of SC integrations (independent variables), and supply chai performance aspects (dependent variables). An author used scientific and statistical analysis tools such as correlation analysis, regression analysis, and methods to evaluate the relationship between different two variables. The current

study used correlation analysis to define the relationship between SC integrations and SC performance metrics using the above types of questionnaire (data that comes from the Likert scale questioner). Correlation analysis is the process that enables the researcher to define the relationship between two variables and facilitate the processes of predictions on one behavior from another (Behrens, 1990). Pearson's product-moment correlation was frequently used in literature its correlation matrix indicates the direction, strength, and significance of the bivariate relationship between all variables (Gogtay, Nithya J., and Urmila M. Thatte, 2017). The coefficient of correlation (r) was very useful to summarize the relationship between two variables with the single number that fails from -1 to + 1 based on the degree of correlation. The analysis used a 2-tailed test statistical significance at the level of 95% significance and the p value was < 0.05. Size of coefficient of correlation (r) and benchmark of interpretations (MacEachron,1982; Cohen et al, 2002):

- when 'r' was lie between 0.1 to 0.20, it is a slight relationship
- when it falls between 0.20 to 0.40, it is considered as a weak relationship
- when it falls between 0.40 to 0.60, it is a moderate relationship
- When it falls between, 0.60 to 0.80 is high and between, 0.80 to 1 is a very high relationship indication.

Having these scenarios and interpretation approaches, an author analyzed the data of SC integrations and SC performance metrics aspects (obtained from questioner) that already analyzed in the part of the above. The intention of this analysis is to evaluate the inter-relationship between these key elements of SCI (suppliers and customers integrations with company, SC cross-functional, SC internal operational, SC information, and customer's integration with suppliers) and SCPM (response time, quality, cost, reliability, and flexibility aspects) and facilitated the proposing possible solution to address the pre-defined research aim.

Table 5:2 Analysis of Correlation Matrix between SCI & SCPM variables

Correlations Matrix Analysis Output

		Suppliers Integrations with Company	Customers Integrations with Company	SC Internal Operational Integrations	SC Cross-Functional Integrations	SC Information Integrations	Customers Integrations with Suppliers	SCPM response time aspects	SCPM quality aspects	SCPM cost aspects	SCPM reliability and flexibility aspects
Suppliers Integrations with Company	Pearson Correlation	1									
	Sig. (2-tailed)										
	N	71									
Customers Integrations with Company	Pearson Correlation	.753**	1								
	Sig. (2-tailed)	0.000									
	N	71	71								
SCInternal Operational Integrations	Pearson Correlation	.726**	.756**	1							
	Sig. (2-tailed)	0.000	0.000								
	N	71	71	71							
SC Cross-Functional Integrations	Pearson Correlation	.635**	.615**	.721**	1						
	Sig. (2-tailed)	0.000	0.000	0.000							
	N	71	71	71	71						
SC Information Integrations	Pearson Correlation	.727**	.721**	.752**	.734**	1					
	Sig. (2-tailed)	0.000	0.000	0.000	0.000						
	N	71	71	71	71	71					
Customers Integrations with Suppliers	Pearson Correlation	.732**	.702**	.623**	.588**	.728**	1				
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000					
	N	71	71	71	71	71	71				
SCPM response time aspects	Pearson Correlation	.679**	.698**	.612**	.519**	.731**	.837**	1			
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000				
	N	71	71	71	71	71	71	71			
SCPM quality aspects	Pearson Correlation	.612**	.563**	.545**	.479**	.672**	.691**	.621**	1		
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
	N	71	71	71	71	71	71	71	71		
SCPM cost aspects	Pearson Correlation	-0.007	-0.014	-0.054	0.080	0.015	0.072	0.034	0.118	1	
	Sig. (2-tailed)	0.955	0.906	0.653	0.505	0.904	0.552	0.780	0.325		
	N	71	71	71	71	71	71	71	71	71	
SCPM reliability and flexibility aspects	Pearson Correlation	0.220	.240*	.235*	0.106	0.178	0.080	0.172	.239*	0.089	1
	Sig. (2-tailed)	0.065	0.044	0.048	0.378	0.138	0.507	0.152	0.045	0.463	
	N	71	71	71	71	71	71	71	71	71	71

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The above-summarized correlation matrix depicts the Pearson's correlation test conducted for SC internal operational integrations with SCPM (response time aspect) indicated as positive and

small correlation by a coefficient (r = 0.612, N =71) and significance at 0.01 and SC information integration correlation coefficient with SC operational response time (r = 0.752, N =71) with the significance of 0.01. This is the inter-relation of the SC activities as the moderate and strong correlation of SC internal operation integrations with SCPM (response time aspects) through near to 0.01 significance value respectively. And also, from the correlation analysis between the dimensions of SC integrations and SC performances metrics aspects, suppliers integrations with the company were found to be moderately correlated with SCPM (response time aspect) with the coefficient (r = 0.612, N =71), (sig < 0.01). Strength and statistically significant positive correlation founded between SC information integration and SC internal operational integration with (r = 0.752, N= 71), at a correlation significance level of 0.01 (2-tailed) as it generated by IBM 24 SPSS software package supported with MS- excel tool pack. Through this statistically supported correlation analysis, the output confirmed that slightly correlation was observed between SC cross-functional integrations with SC performance metrics (cost monitoring aspect) with statistically significant output (r =0.08, N =71), correlation significance 0.505 (2-tailed) which is the weak significance with cost aspects in the SC operational activities (Table 5.2).

To sum up, the analysis of the correlation between Key SCI (independent variables) and SCPM Dependent variables using the above-elaborated analysis tools, the following relationships have been founded based on Spearman Correlation analysis:

- ☞ SCI key elements (supplier's integrations with the company, information integrations) have been founded having positive strong co-relationship with SCPM (response time, quality aspect) while customer's integration with suppliers strongly correlated with SCPM response time aspects.
- ☞ SCI elements (cross-functional integration, information integrations, customers integrations with company) have been founded as moderately correlated with
- ☞ SCI elements (cross-functional integration, information integration, supplier's integration with company) have been founded as slightly weak co-relationship with SCPM (unnecessary expenses or cost, reliability, and flexibility aspects).

Having these summaries of correlations analysis, between variables, the proposing possible solution, and implementation scenarios can be emphasized pre-dominantly to address the pre-defined research questions in the current case food complex industries.

5.3.2 Regression Analysis

Under this, some assumptions have been developed based on the formers study framework SCI elements and the SC performance measurement aspects.

Multi-collinearity Assumption: according to this assumption, independent variables are not related to each other in the identified SC operational activities. To evaluate this assumption, the analysis has been conducted using IBM 24 SPSS software and founded tolerance 0.1 (10%) and variance of inflation factor less than 10 in the relationship of SC integrations (Appendix – V). This is an indication of the existence of multi-collinearity. Since, it confirmed the scholarly accepted scenarios such as variance inflection factors must be between 1 and 10 to indicate the relationship of variables in statistical analysis (Hair J.F. et al, 1994; S.Ge, 2013).

Linearity Assumption: this assumption deal with the linearity relationship between independent variables (current SC integrations element) and dependent variables (SC performance aspects). An author tried to examine this assumption by analyzing normality tests and scatterplots to examine the relationship between independent and dependent variables. For instance: for the impacts of SCI on SCPM (response time aspect) regression analysis, B value (intercepts) or the slope of the model was positive with significance ($P<0.05$) and the sum of square ($R2 = 3.71$) which implied that the dependent variables caused or factored by 37.1% in the system. Normality assumption also can use the impacts and how one variable determines the other through looking at the distributions of data as the specific dependent and independent variables depicted in the following Figure 5: 15.

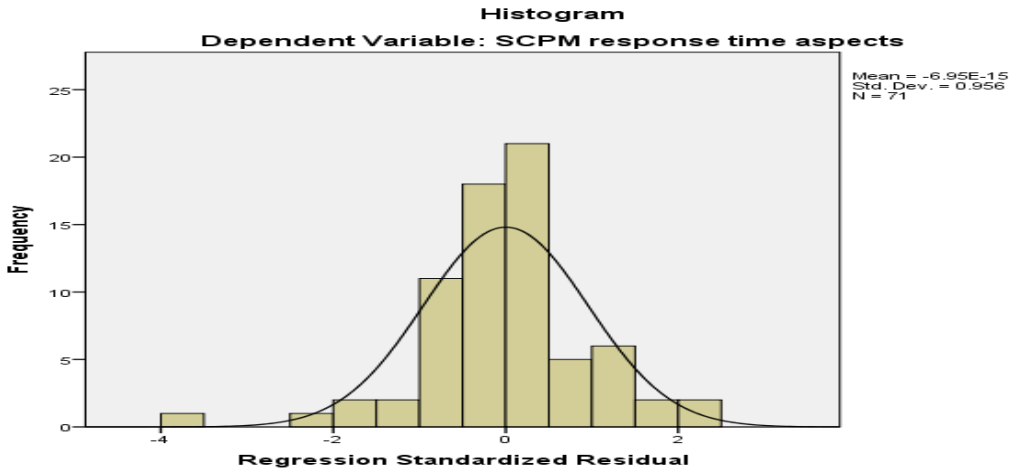

Figure 5:15 Analysis of Normality and Histogram for Regression Assumptions

Summary of the findings on the analysis of the relationship scenarios of SCI and SCPM in the future operational implication, pre –dominantly in the current case firms SC activities. From this, SCI (independent variables) such as SIwC (suppliers integrations with the company) those with significant value (P<0.05,β = 0.374 and t=1.47) have greater impacts on SC performance metrics (quality aspects). SCII (supply chain information integration) on response time (SCPM) through +ve slope, significance (P<0.05,) and the sum of square (R^2 = 0.299) implied that the independent variables impact the dependent variables (SCPM) by 29.9% in the cause firms SC operational activities (See Appendix V). While those have significance value P> 0.05, still now, $\beta = positive$) and sum of square (R^2 = 0.002, i.e. 0.2% impact) such as CIwC (customer's integration with company) have low impacts on SC performance metrics (quality aspect) as it revealed from regression analysis (Appendix V).

These all are some analysis (from questioner and survey collected data type) intended to examine the relationship between key elements of SC integration (independent variables) with SC performance metrics (dependent variables) through correlation analysis as it depicted in Table 5.2, impacts of one variables on other using regression analysis (Appendix V). Having these, an author proceeding to quantitative data (5.4 Section) and merge it with the above internalized cooperatively achieve the pre-defined aim of the research.

5.4 Cost Opportunity, Resources Utilization & Efficiency Analysis

5.4.1 Unnecessary Expenses Analysis in Current Case Firms SC system

Going through various business scenarios and approaches, the researcher collected quantitative data on costs and unnecessary expenses that have been evidenced by their adverse effects on overall SC system operational performances. As this study's objective, as long as cost opportunities or effective resource utilization in the SC activities is monitored efficiently, the productivity of the firm can be enhanced. To address this pre-defined research aim, an author has been tried to collect unnecessary SC operational activities relevant data from the case companies (See Appendix -VII). The following Table 5.3 depicted the analyzed findings on costs analysis in the case firms with available data. The challenge that an author has been faced was companies' commitment to providing required data. Through these and another bottleneck, the researcher systematically itemizing the data that related to SC activities in the case firms.

Table 5:3 Summaries of unnecessary expenses in SC operation (Researcher's Data, 2021)

	Time span of SC operational activities of Case Company with available data										Time span of SC operational activities of Case Company with avialable data									
Unnecessary Expenses in Supply Chain System	2018/2019					2019/2020					2018/2019					2019/2020				
	1-6 month	%	6th -12th month	%	Av%	1-6 month	%	6th-12th month	%	Av%	1-6 month	%	6th -12h month	%	Av%	1-6 month	%	6th -12th month	%	Av%
SC operational system Preventive Expenses	106447.6	43%	16683.25	3%	23%	67033.9	11%	79410.54	32%	21%	35344.85	22%	60267.85	30%	26%	94668.57	27%	69931.05	30%	29%
SC operational system Appriasal Expenses	21460.25	9%	55426	11%	10%	37227.95	6%	55817	23%	14%	41118	25%	32959	16%	21%	61512	18%	40889.05	18%	18%
SC operational system Internal Failure Expenses	101459.7	41%	385348.5	79%	60%	490762.7	78%	87162.35	35%	57%	62020	38%	83149.25	41%	40%	177478	51%	80910.85	35%	43%
SC operational system External Failure expenses	20218.78	8%	33314.19	7%	7%	31323.78	5%	24991	10%	8%	23796.65	15%	24669.65	12%	13%	16471.5	5%	39208	17%	11%
Total	249586.3		490771.9			626348.3		247380.9			162279.5		201045.8			350130.1		230939		

From this analysis, 29%, 18%, 43%, and 11% SC operational activities preventive expenses (SCoPE), SC operational activities appraisal expenses (SCoAE), SC operational activities internal failure expenses (SCoIFE), SC operational activities external failure (SCoEF) expenses respectively in the average of 2019/2020 case firms. For the further trend analysis of expenses mentioned in the above Table5.2, the SC performance metrics of the case firm can be affected due to poor SCI, and the productivity of the firms can be impacted. As findings and analysis, SC operational activities of preventive and internal failure expenses have resulted in 26% and 43% respectively. Based on the data collection phase (See Appendix - III) of this investigation on SCI and its performance metrics, an author explored various types of parameters. Since, this study focused to analyze, SCI which was the causes of low SCPMs that lead firm' SC productivity and profitability. The following Figure 5.16 was summarized all types of SC operational activities expenses for all operational time.

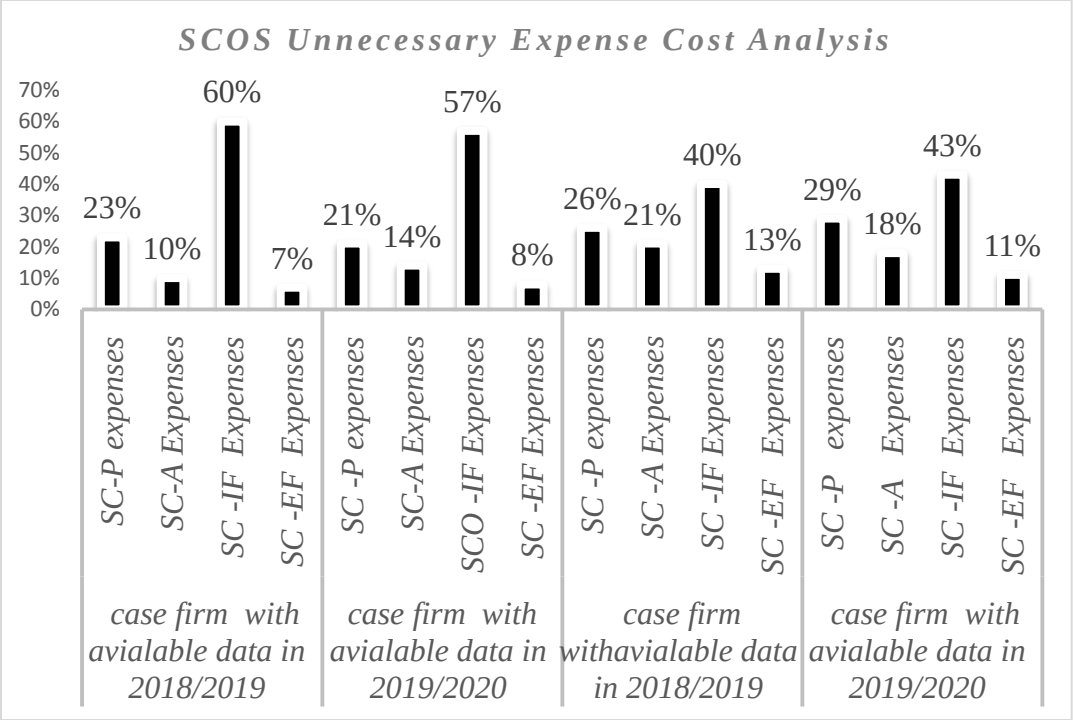

Figure 5:16 SC activities' unnecessary expenses analysis (Researcher's findings, 2021)

Potential causes of the above expenses: going through the survey, an author identified the major cause of these expenses in the case of firms SC operational system as below.

- Operational management like follow-up every SC activities problems
- Poor resource utilization and low committeemen on monitoring expenses

Raw Material Impurities Cost Analysis in SC system: going through the data collection tools, an author was able to identify quality problems of raw material impurities which were 2-3%/kg that affect the SCPMs and overall profit of the case firms. The following table is mentioned with about six SC supplied raw materials of the case companies and followed by its analysis.

Table 5:4 Supplied raw materials in 1-6th month SC operational value chain (2021)

Supply Raw Material or Wheat tons/month for 6 months							
Name of the Firms	September	October	November	December	January	February	Total
K.O.J.J Food Complex company	2341	2115	2997	3120	3591	3345	17509
Kebrone Food Complex Company	2912	2910	2714	2210	3120	3251	17117

Booez Food Complex Company	2129	2210	3121	3119	2617	3101	16297
Yamrot Food Complex Company	2102	3101	2521	1781	3129	2623	15257
Wakene Food Complex Company	1985	2314	3145	2816	3101	3251	16612

Analysis: 1quintal = 100kg

= 1 ton = 10 quintals which implied that = 1000kg

= 0.5% of 100kg = 0.5kg

= 0.5*10 = 5kg /ton that the company received 5kg /ton impurities.

Since the average raw material (quintal of wheat) supplied through value chains of the K.O.J.J was 17509tons/6monts with 2000birr/quintal. According to the above computing:

= ton = 5kg

= 17509tons =x, x= $\frac{17509tons * 5kg}{1ton}$ = 87545kg

That means, 1ookg = 2000birr

87545kg = x, x = 2918166.7birr/month

Having the above procedure, the total cost of the case company's loss due to the raw material quality problems was depicted by the following figure:

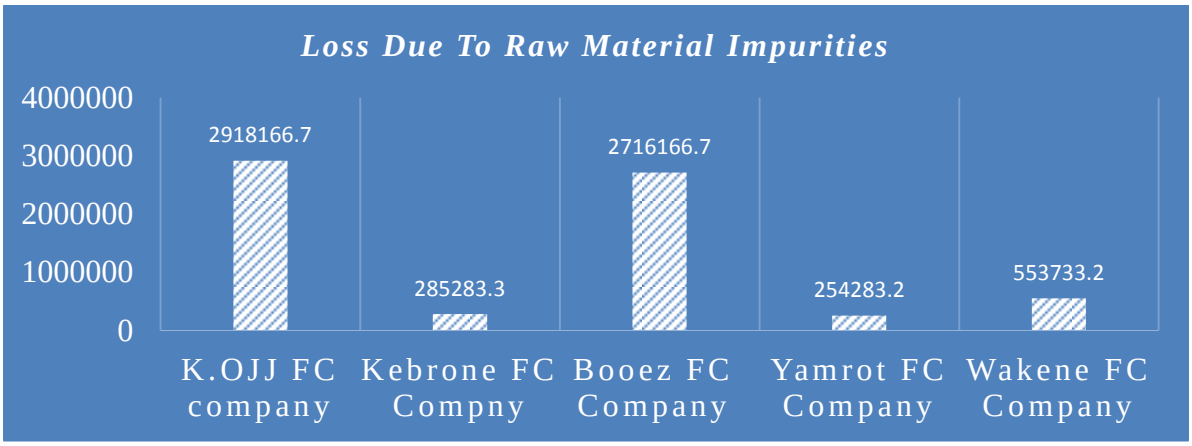

Figure 5:17 Losses due to raw material impurities

As the study survey indicated, the potential causes of the above losses were:

- ***Level of Coordination & Relationship with Suppliers****:* the main reason for creating good integration with potential suppliers is to make supplied materials as per company needs. But, as actors of the SC operational value chain of the case companies mentioned, the brokers or suppliers add impurities to it.

- ***Storage and Inventory Problems:*** *as survey investigation of the current study is indicated, these impurity and risk factor of loss amount of the above resources.*
- ***Suppliers' Suppliers poor SC value chain operational activities***
- ***SC Network Problems:*** This is very critical for SC system operational activities and VC of wheat (primary raw material of food complex industry) of the case firms.

An author proposed scenarios and a management approach in which these factors can be eliminated

5.4.2 Resources Utilization, Efficiency & Effectiveness Analysis in SC system

According to this study, an author directed that the productivity of the case processes industries can be measured by magnitudes of achievement of SCI that causes low indicators of SCPMs those summarized through the survey. An author concluded that improvements of these directly impact the overall productivities of case processes industries. In addition to these, resource utilization, incurring unnecessary expenses as depicted in Figure 5.16 of the SC operational – system that has adverse effects on the productivity of the firms. The other typical critical devising approach measuring the productivity of the case companies that have been taken were efficiency & effectiveness, downtime (hr) analysis.

Table 5:5 Production capacity VS actual SC operational activities (Researcher's Data, 2021)

Production Capacity VS Actual for 1-6 SC operational System						
Name of the Firms	September	October	November	December	January	February
K.O.J.J Food complex company						
Production Capacity	***Tons/month***					
Wheat Flour	*3640*	*3640*	*3640*	*3640*	*3640*	*3640*
Pasta	*1204.3*	*1204.3*	*1204.3*	*1204.3*	*1204.3*	*1204.3*
Macaroni	*1753.4*	*1753.4*	*1753.4*	*1753.4*	*1753.4*	*1753.4*
Actual						
Wheat Flour	*2446.1*	*2570.91*	*2302.24*	*2487.43*	*2398.07*	*2561.23*
Pasta	*861.12*	*817.44*	*892.32*	*821.61*	*798.41*	*812.57*
Macaroni	*1122.9*	*1260.32*	*1141.44*	*1372.53*	*1190.19*	*1202.81*
By Products						
Frushca	*55.54*	*49.07*	*51.73*	*43.82*	*59.01*	*48.04*
Fermancho	*93.6*	*84.23*	*92.28*	*81.39*	*84.03*	*78.05*
Kebrone FC Company	***Tons /month***					
Production						

Capacity						
Wheat Flour	*3484*	*3484*	*3484*	*3484*	*3484*	*3484*
Actual						
Wheat Flour	*2511.08*	*2441.92*	*2319.2*	*2366.26*	*2267.98*	*2522.52*
By Products						
Frushca	*3.45*	*4.79*	*4.18*	*3.97*	*2.96*	*3.81*
Frushclo	*7.92*	*7.37*	*7.73*	*7.12*	*7.82*	*6.34*
Booez FC Company	*tons/month*					
Production Capacity						
Pasta	*1747.2*	*1747.2*	*1747.2*	*1747.2*	*1747.2*	*1747.2*
Macaroni	*1123.34*	*1123.34*	*1123.34*	*1123.34*	*1123.34*	*1123.34*
Actual						
pasta	*1310.4*	*1291.81*	*1309.11*	*1311.18*	*1356.2*	*1243.8*
Macaroni	*936*	*932.17*	*929.29*	*895.45*	*872.1*	*928.5*
By Products						
Sweeping Pasta	*1.95*	*2.17*	*3.91*	*9.08*	*1.09*	*7.87*
Sweeping Flour Qt.	*3.9*	*2.39*	*7.61*	*10.34*	*2.89*	*8.27*
Yamrot FC Company	*tons/month*					
Production Capacity						
Wheat Flour	*2995.2*	*2995.2*	*2995.2*	*2995.2*	*2995.2*	*2995.2*
Pasta	*998.4*	*998.4*	*998.4*	*998.4*	*998.4*	*998.4*
Macaroni	*1747.4*	*1747.4*	*1747.4*	*1747.4*	*1747.4*	*1747.4*
Actual						
Wheat Flour	2127.84	*2104.86*	*2067.89*	*1987.27*	*2129.21*	*2128.19*
Pasta	686.41	*673.82*	*679.24*	*617.53*	*679.02*	*670.34*
Macaroni	1204.32	*1201.56*	*1162.81*	*1209.16*	*1201.14*	*1207.84*
By Products						
Frushca	*42.14*	*35.98*	*32.83*	*39.78*	*29.92*	*34.78*
Fermancho	*64.01*	*71.91*	*61.34*	*54.82*	*49.91*	*51.11*
Sweeping Pasta	*21.32*	*21.35*	*13.34*	*11.16*	*14.89*	*25.35*
Wakene FC Company						
Production Capacity	*tons/month*					
Wheat Flour	*3484*	*3484*	*3484*	*3484*	*3484*	*3484*
Actual						
Wheat Flour	2437.24	2415.92	2439.32	2474.42	2495.22	2446.6
By Products						
Frushca	11.99	19.29	12.39	20.16	10.11	9.14

Fermancho	15.72	21.18	10.47	18.19	12.13	7.29

Efficiency & Effectiveness: is the ratio of an actual output to effective capacity in the production system. This measurement is used to analyzing resources utilization performances using data from the above Table 5.4 which deal with an actual and effective capacity of the case companies. For instance: the following was one of case firm (K.O.J.J Company's average of utilization) or efficiency.

$$\text{Efficiency } (\eta) = \frac{Actual\ Output}{Effective\ Capacity} * 100$$

$$= \frac{7912.817\ tons\ \ 6\ \ months}{11482\ tons\ per\ \ 6\ months} * 100 \quad = 68.92\%$$

Having the above approach, an author computed for the rest case firms as ff. Figure 5.16.

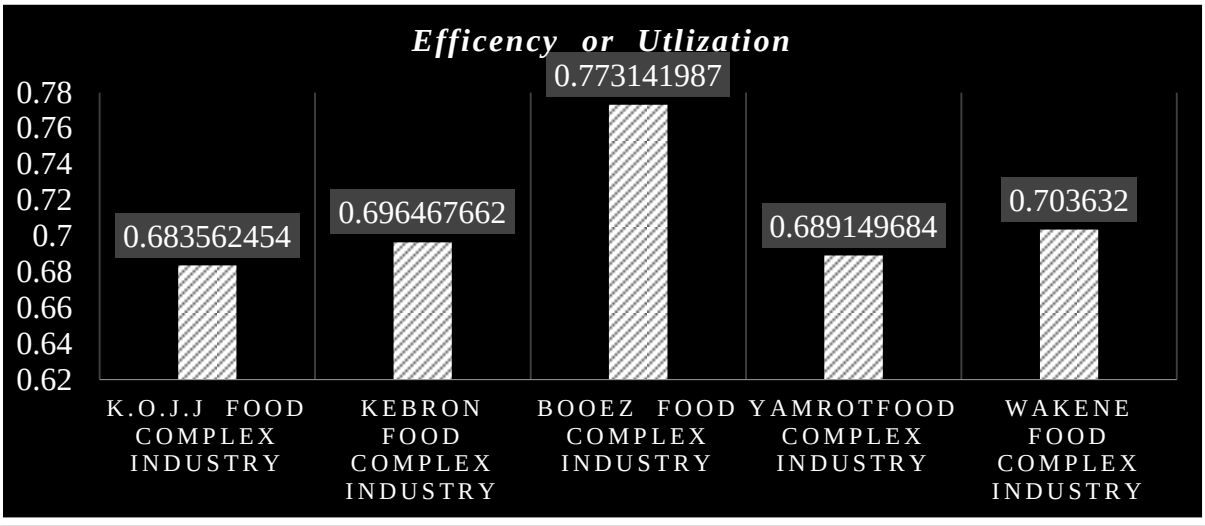

Figure 5:18 Efficiency or utilization in the case firms (Researcher's analysis, 2021)

Down Time Analysis: in addition to the above resources utilization and cost analysis, this downtime analysis also has its impacts on the SCPMs of the case firms which is an indication of overall productivity. Based on firms with available data for this analysis, it discussed as following:

Case Company A, Yamrot Food Complex Industry: was one of the case companies that have taken as case industry for this study.

Metrics: operational time = 8hr with 3 shifts which is 24 hours per day and 26 days per month (Table 5.4) for detail base of this analysis.

$$\begin{cases} Wheat\ Flou = 2995.2\ \frac{\text{tons}}{\text{month}} = 115.2\frac{\text{tons}}{\text{day}} = 4.80\frac{\text{tons}}{\text{hour}} = 48\frac{\text{kuntal}}{\text{hour}} \ldots \text{production capacity} \\ Pasta = 998.4\ \frac{\text{tons}}{\text{month}} = 38.4\ \frac{\text{tons}}{\text{day}} = 1.6\frac{\text{tons}}{\text{hour}} = 16\frac{\text{kuntal}}{\text{hour}} \quad \ldots \text{production capacity} \\ Macaroni = 1747.4\frac{\text{tons}}{\text{month}} = 67.21\frac{\text{tons}}{\text{day}} = 2.80\frac{\text{tons}}{\text{hour}} = \frac{28\ \text{kuntal}}{\text{hour}} \ldots \text{production capacity} \end{cases}$$

Total of productivities over 6 operational time production capacity = 39586.2 tons /6 months,

This means $\begin{pmatrix} 1day = & 24hours \\ 6months\ (26\ days * 6) & x \end{pmatrix}$, x = (26 days*24hours*6)/1day

= **3744hours /6months**

= Down Time (Hr) = 1032.76 hours /6 operational time

The operational activity of the above case firm loss 1032.76/3744 operational time = 27.64% which means 9501.4-ton loss per 6 SC operational system and production. By taking into account the above procedure, the rest were calculated and depicted as below figure.

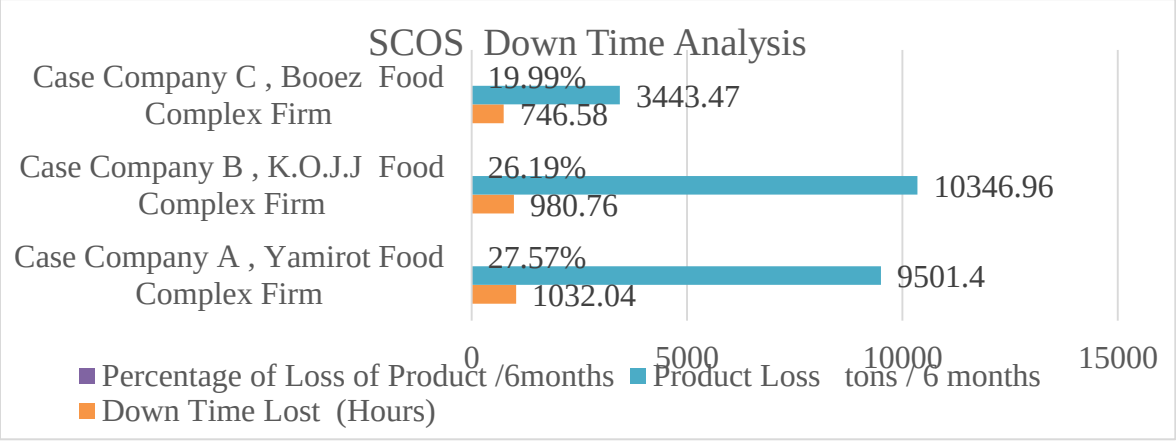

Figure 5:19 Downtime analysis in SC system (Source: Researcher's data, 2021)

These indicators are directly impacting the SC performances that are caused by poor SCI, and affect the overall SC system productivity & profitability of the current case industries. The researcher investigated the following causes during data collection from various SC operational actors or stakeholders (See Appendix I & II) as follows.

- Interruptions of supplying forces of the raw material suppliers
- Electric power and price fluctuations, manpower skills, and foreign currency problems neighborhood
- Coordination SC operation strategically and managing every operation scientifically such as management decisions based on analyzed facts

These and other relevant factors were responsible for the above downtime and adverse effects of the production capacity of the SC operational system of the identified case companies. The proposed scenarios to minimize the above key causes were discussed in Table 5.5 of the following.

5.5 Summary of Findings

5.5.1 Findings from Analysis of Different SC Operations' Data

In this study, SC integrations were taken into account as the factors of SC performance metrics, Cost utilization, resources utilization, and other factors of poor SC operational productivity.

Supplier Integration with Company: under this, sourcing suppliers strategically in the operational activities of the case firms' was analyzed 11.3%, 61.9%, 20.9% low, medium, and high respectively. And also, the assessment of collaboration and coordination of suppliers to the company's SC operational activities to run the SC system was evaluated as 7%, 57.8%, and 30.9% as low, medium, and high respectively. This was averagely below 65% which needs management intervention to be achieved its SC system resource utilization.

Customers Integration with Company: from collecting data through the designed study's methodology, various measuring statements have been used. For instance: the creation of smooth communication with key customers evaluated as 17%, 56.3%, 16.9% low, medium, and high respectively while understanding customer requirements and do on it to enhance the inter-relationship and trusted as 19.7%, 47.9%, 28.2% as low, medium and high respectively.

Cross-Functional Integration (CFI): the other findings of this study were an achievement of CFI through considering collaboration, coordination, and smooth communication as 16.8%, 54.7%, 23.3% as low, medium, and high respectively from the data analysis tools. This an indication of SCI within various SC–functional departments such as quality, purchasing &procurement, production, marketing and financing, warehouse departments in the SC system that averagely evaluated as 21.5%, 52.2%, 20.8% as low, medium, and high respectively.

Supply Chain Performance Metrics: this is quantifying the SCI operational activities in the SC system. Weak SCI affects the performance level of the SC operations. Having these scenarios, this study investigated statements such as monitoring variability in delivery time operation in the SC system of the case firm as 15.5%, 57.7%, and 19.6% low, medium, and high respectively. and also, from data analysis, the quality aspect of SCPM that evaluated as 18.6%, 58.1%, and

20.5% as low, medium, and high respectively that was due to poor SCI operational management process.

Reliability Aspect: is SCPM evaluation dimension that resulted from poor SCI which is the process of evaluating inconveniences in SC operational activities that investigated in this study as 10.7%, 53.8% & 29.7% low, medium, and high respectively.

Cost Opportunity is the scenario and SC operational parameter that essential for the profitability and overall SC system productivity of the case firm. In addition to data come from the questioner, this study, included available SC operational documents and analyzed them (Appendix–V). For instance: SC operation's related preventive expense 29%, appraisal expenses (18%), internal failure expenses (43%), and external failure expenses (11%) as depicted in Figure5:15. This is the indication of weak SCI in the SC operational activity & management activities in the case firms. And also, losses due to raw material impurities have been analyzed as depicted in Figure 5:16.

Efficiency Effectiveness down Time Analysis: due to poor SCIs, this achievement has been investigated for all case firms such as 68.4%, 69.6%, 77.3%, 68.9%, and 70.4% for case firm 1, 2, 3, 4, and 5 as it mentioned in Figure 5:17. To enhance this, the researcher proposed possible scenarios to meet the aim of the study.

SC Operations *Downtime Analysis*: in this study, these aspects were analyzed as 19.9%, 26.2%, and 27.6% from available data. This is the indication of barriers in SC activities and resource utilization of the case firms. The causes have been elaborated in the below summary of explored causes.

5.5.2 Potential Causes on SCI, SCPMs & Productivity

SCI is the cause of poor or low achievement of SCPMs in the current case industries required the active and optimal interactions of various stakeholders such as suppliers, customers, operators, and managers at different positions. The effective and efficient coordination and integrations of these key actors were measured by the level of SC performance metrics. The factors investigated through data collection processes (Appendix II & III) have sub-headed as the below.

1. Suppliers' integrations with Company: Suppliers or sources of raw material in these food processes industries were essential for making the SC system functional. But, the researcher was able to investigate various causes in the period of data collections regarding the following.

- Costs and price, foreign currency fluctuations, Lead time, item price, and delivery time
- Interferences of middleman or Brokers in the market
- Unreliability, variability, and capacity of the suppliers of the raw materials
- Poor information inter-flows between key actors in the suppliers-customers chain
- Quality of the raw material and Insufficient strategies on sourcing potential suppliers
- Level of coordination and cooperativeness of the company with key suppliers
- Poor commitments on coordination and inter-linking orders & purchasing processes

These and other indicators were the major indicators of the company SC operational activities not meet the expected interflows of resources such as time, products and raw material, facilities, budgets, and information between customers and current case industries.

2. Company's Integration with Customers: Regarding customer cooperation and collaboration with the company in the context of current case industries, the researcher explored the following negative factors of customers-Company integrations in the SC system as follows:

- Delivering power, order processing, quality, and lead time
- Operational activities regarding customers –company coordination processes
- SC system on Poor commitments of managers, key actors primarily at strategic phase
- Insufficient market information inter-flows & optimal assessment of order fulfillments
- Insufficient creation of additional values to customers
- SC network design problems

An author explored these and other relevant factors in the identified case Organization.

3. Major Causes of Cross-Functional SC integrations within the Firm: researcher explored the critical and major negative factors of cross-functional integration in various SC related operational activities as below:

- Low level of team sprits of workers or actors in the SC system
- Poor inter-relationships between different functional departments in the case firms
- Poor empowering stakeholders and follow-up in the SC operations

- Poor building strategic partnerships trust on the commitments of their responsibilities
- Poor Optimal operational monitoring, revert feedbacks and take interventions early

These and others have been explored by the author as the critical risk factors to optimally coordinate and integrate the cross-functional departments in the SC system of the case firms.

4. Causes of Internal SC Operational Coordination: current researcher internalized the significance and impacts of multi-dimensional risk factors in the processes of enhancing case companies' overall SC operational productivities. The followings are the summaries of the causes of ISC operational coordination:

- Unskilled manpower and lack of good team sprits in the SC operational activities
- Power instability, poor alignment of operational activities to firm's objective
- Order processing, resources, and information sharing variability in the case firms
- Poor operational design of the good platform to empower functional –departments
- Operational obstacles and facility layout problems in the SC system of the case firms
- Poor commitments of various SC operational stages' participants

These and other relevant causes of the internal SC operational coordination have been explored through different data collection such as purposively selected interviews and open-ended questionnaires (Appendix I &II). The researcher proposed the possible scenarios to minimize these major causes of blow expected internal SC operational coordination and cooperation which result in maximum productivity and cost sufficient processes.

5. SC Information Integrations (SCII): an author explored SCII coordination & cooperation as the measuring device to enhance entire current case firms' operations to achieve the pre-defined organizational goal. Going through collection data, the following major causes of optimal SC information integration have been explored.

- Information distortion and bullwhip effects in the current case company's real case
- Weak inter-flows of various decisions and operational data
- SC related information processing obstacles especially due to poor commitments
- Level of trust between suppliers and industry and optimal flows market data
- Unavailability of active information and demand & supply status
- Miss-alignment of forecasting and planning analysis

- ☛ Level of digitalizing SC activities in the case firms which is still now at an early stage

These and other SCII related coordination factors are primarily responsible for the effectiveness and efficiency of resources and information coordination in the SC operational activities in the current case companies.

6. Customers and Suppliers Coordination: Researcher investigated different suppliers and customers related SC system cause regarding integrations, coordination, interrelationships and communication of real case in the case companies such as:

- ➢ Poor willingness to share risks
- ➢ Supplying forces uncertainties
- ➢ Distortion of demand & supply information within the SC system
- ➢ Poor coordination and cooperativeness customers with suppliers
- ➢ Insufficient achievements on delivery adherence
- ➢ Inconsistency of supplying & delivering SC operational activities
- ➢ Insufficient customers' value-adding and attractions

These and other relevant customer-suppliers coordination and integrations in the current case companies' SC system operational activities have been explored during data collection for the sake of addressing the research question.

7. Factors of Efficiency & Effectiveness of SC operational system: efficiency is low operational costs and targeted internal (high functional yield, production lead time and coordination) and external (delivery precision, lead time and customer satisfaction) organizational overall performances (Christopher, 1998). And also the current researcher defined effectiveness in the real case of current companies' SC system scenarios, production processes, environments, and management operations on the extent to which goals are achieved. The followings are a summary of causes of efficiency and effectiveness that have been explored during current data collection:

- ➢ Poor consistency on the raw materials
- ➢ Variations of costs such as foreign currency and price fluctuations in the SC system
- ➢ Impurities and levels of raw material contents of the raw material
- ➢ Commitments of concerned stakeholders in the case SC operational system
- ➢ Communication channels between different functional departments

- Miss-alignment of phase by phase operations with strategy and follow-up activities
- Planning problems, miss-match demand with supply in the production system

The researcher was able to summarize these and other relevant causes are the critical adverse effects on Efficiency & Effectiveness of the case industries.

8. Causes SCPMs in the Current Case Organizations: An author experienced various causes influencing the SCPM in the daily SC operational activities of the current firms' real case as depicted on Figure 5:19 below. Researcher used cause and effect diagram to explore causes concerning an entire SCPM through classifying into four major performance metrics objective (response, quality, costs, flexibility and reliability aspects) based on the pre-conceptualized research framework as Figure 3:1 of the above.

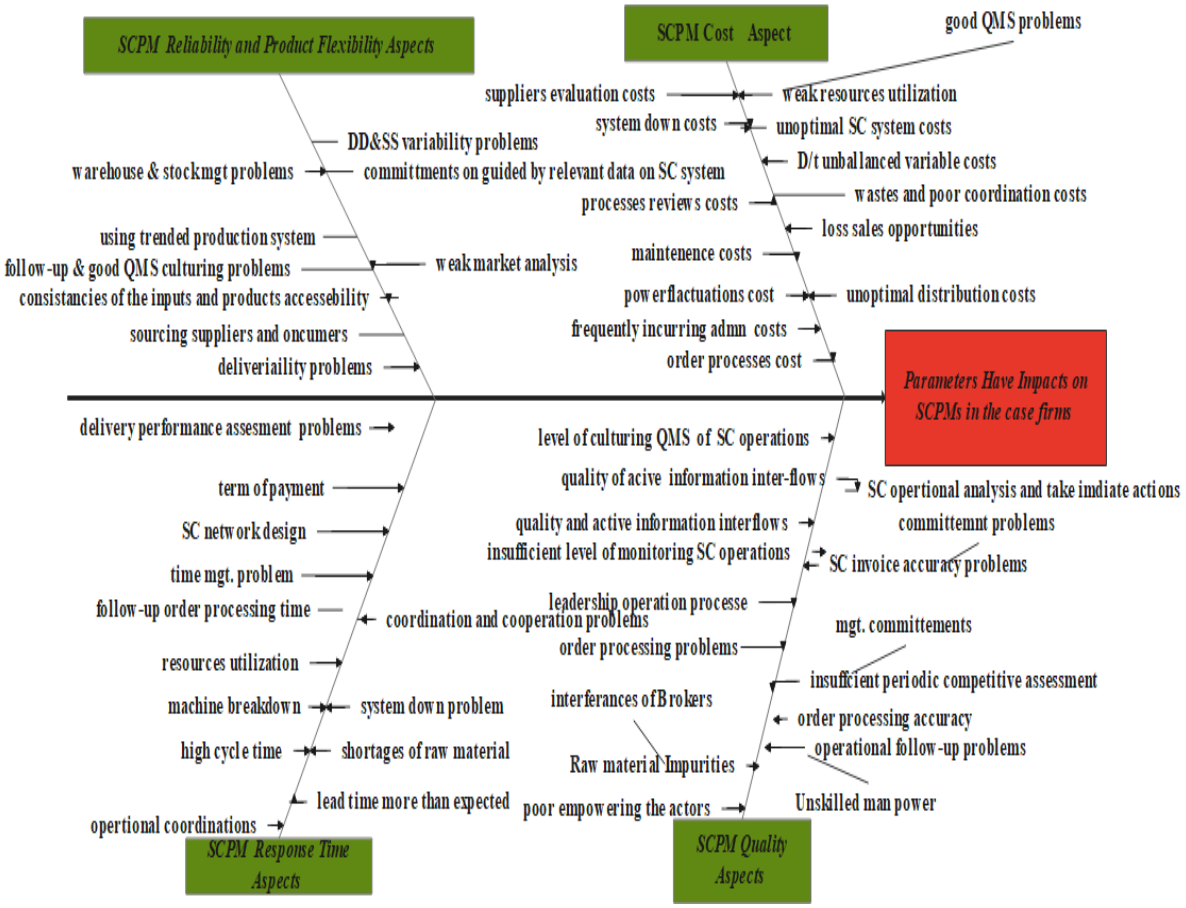

Figure 5:20 Summary of findings the relevant causes that have impacts on the SCPMs (current study's data collection, 2021)

5. 6 Proposed Solution

Since the primary aim of this research is analyzing SCI which is the cause of low-performance metrics that impact overall SC system productivity of the case firms, possible scenarios to address the operational, managerial, system, and causes of SC system of the above were explored. Through this potential summary of factors in SC operational activities in referencing case processes industries, the researcher tried to merge SCOR –model with the relevant management approaches and tools such as

- ☞ Managerial Levers to Achieve Coordination (MLAC) tools as mentioned in Figure 5:20 below
- ☞ Quality Management System Sub-Related Elements (QMS) tools

The primary aim was to address the pre-defined research question of this study and the conceptual framework suggested in Figure 3.1 corresponding to formers' research gaps.

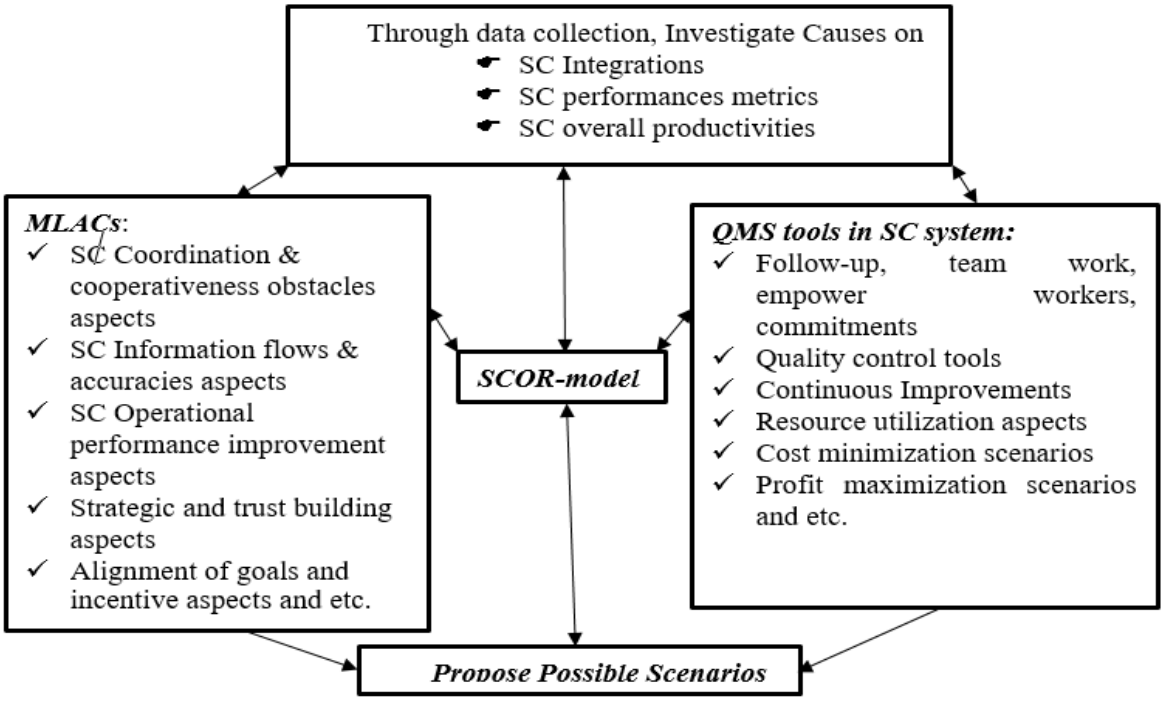

Figure 5:21 Procedural steps exploring SC operations' potential causes and proposed in case firms (Researcher's work, 2021)

5.6.1 Corrective Measurements /Intervention/

This part is focusing on the comprehensive SC activities & scenarios of management in the case firms to eliminate the above-explored causes and achieve the pre-defined research objective. The

following Table 5:6 consisted of the proposed intervention scenarios through merging SCOR-model, MLAC, and QMS relevant tools to collaborate and coordinate all SC tasks and responsible actors. The aim was to eliminate the barriers of the SCI in the current case firms to enhance overall SC system productivity.

Supply Chain Integration: as mentioned in the analysis and findings in the business scenarios and SC activities, lack of collaboration, coordination, and monitoring the SC functional departments in the case firms can affect the SC productivity. The following Table 5:5 depicted the proposed intervention/corrective measurements/ to enhance SC integrations and meet the objective of the study.

Table 5:6 Corrective measurements on SCI of current case industries (Researcher's work, 2021)

S/N	*Causes of SCI in case firms SCO activities those investigated by the researcher*	**Interventions / Corrective Measurements/**	**Responsible Bodies**
1	***Causes of Suppliers integrations with Company***		
	1.1 Interferences of brokers	✓ Create smooth relationship between this middleman ✓ Design value chain and SCN to minimize negative factors of inputs	☞ Mangers and market departments ☞ Strategists and plan developers
	1.2 Unreliability of supplying forces problems	✓ sourcing suppliers strategically ✓ create consistency coordination with sources of SC operational inputs	☞ Market and procurement departments
	1.3 Information inter-flows problems	✓ Plan and follow up resources and information integration in the SC operational activities	☞ Stage by stage SCOs mangers ☞ SCO supervisors
	1.4 Coordination & spirit of cooperativeness problems	✓ Integrate SC operations optimally by enabling all stakeholders ✓ Analyzing factors of SC operations and take interventions continuously	☞ Firms' top, middle and operational managers
	1.5 weakness of Sourcing potential suppliers	✓ Develop optimal scenarios to create a link with potential raw material suppliers	☞ Market and procurement departments
2	***Causes of Customer***		

	integration with Company		
2	2.1 Lead time more than expected	✓ Commit to deliver timely, focus on customer specification ✓ Analyze performances and do on its weakness side, manage time	☞ Operational & production managers ☞ Sales and market departments
	2.2 Coordination and flow of resources	✓ Create an optimal platform to functionalizing different SC operations ✓ Follow–up inter-flows actively	☞ Phase by phase SC operations' managers ☞ Supervisors
	2.3 Commitments of SCO actors	✓ Create smooth communications with key customers ✓ Monitor various phases of SCO	☞ System designers and SC operational managers
	2.4 SCN design problems	✓ Analyze various network and take amendments on value chain networks	☞ Managers ☞ System controllers
	2.5 Information inter-flows on the various operation (market, price, and other parameters)	✓ Manage the inter-flows of active various related SCO information ✓ Analyze market and SCPMs	☞ Operational managers ☞ Market & sales departments
3	***Causes of Cross-Functional SCI in the firm's SCO***		
	3.1Level of Team spirit at operation	✓ Coordinate various functional dep.t via good organizational team sprit ✓ Initiate SC operators to create coordination	☞ SCO phase by phase operational managers ☞ HR and GM
	3.2 Different functional dep.t coordination problems	✓ Create collaborative across all SCO stages ✓ Follow –up all operation actively	☞ All SCOs functional dep.t ☞ SC operation supervisors
	3.3Information inter-flows	✓ Create smooth information inter-flows	☞ SCO system supervisors
	3.4Monitoring SCO activities problems	✓ Follow-up and manage different SC value chain through waste-free operations	☞ All SCO stages managers ☞ Supervisors
	3.5Commitment of SCO	✓ Empowering all assigned responsible workers to meet an aim	☞ Plan developers, operational

	actors	of the firm	managers
4	***Causes of SC internal Operational Coordination***		
	4.1 Unskilled manpower	✓ Update employees through various operations	☞ Mangers and plan developers
	4.2 Coordination problems	✓ Follow –up all SC internal operations	☞ Operational and various SCOs activities managers
	4.3 Information sharing constraints	✓ Enabling SCO actors and create resources and information inter-flows	☞ All SC system functional departments
	4.4 Facility layout problems for different SCO activities	✓ Design processes and create a platform in which necessary SCO inputs can be inter-flows	☞ Processes and functional system designers
	4.5 Commitments of SCO actors	✓ All SCO internal operations should be integrated and cooperated smoothly	☞ All SCO functional departments
5	**Causes of SC information integrations**		
	5.1 Demand &Supply information distortions	✓ Managing all demand & supply operations ✓ Analyzing market and value chain activities in a profitable manner ✓ Use market analysis and conduct production processes planning	☞ Market, sales, and operational managers ☞ Marketing & managers ☞ SC operation's planners and operational managers
	5.2Level of trust b/n inter-dependent or stakeholders	✓ Create easily applicable SC operational related scenarios for information inter-flows ✓ Develop a reliable and optimal strategy to coordinate key SC activities' actors	☞ SC operation system designers and managers in the firms ☞ Strategists and managers in the firms
	5.3Facility layout factors	✓ Eliminate factors that negatively affect smooth resources & information inter-flows ✓ Follow up the process and identify	☞ Process and facilities layout designers ☞ Quality

		system bottleneck and take actions	controllers and SCOs Supervisors
	5.4 Level of digitalizing SCO related problems	✓ Monitoring all information and resources integration using digital activities ✓ Use phase by phase analysis to conduct various SC operational decision	☞ Managers and phase by phase SCOs actors ☞ All functional dep.t
6	***Causes of Customer & Supplier integrations***		
	6.1Supplying forces uncertainty of Suppliers	✓ Strategically sourcing raw material suppliers ✓ Analyze relevant factors and Create a reliable link between SCOs actors	☞ Purchasing and marketing dep.t ☞ Operational managers & plan developers
	6.2 Management of coordination & cooperativeness problems	✓ Follow up all resources and key information integration in the SC operations ✓ Analyze phase by phase SCO in this key link of SC actors ✓ Create co-buyers &co-suppliers relationship	☞ Managers& supervisors ☞ Quality dep.t ☞ The operation, market ☞ Market and supervisors
	6.3 information inter-flows factors	✓ Eliminate barriers of flows of key resources & information ✓ Create optimal SCOs related scenarios to collaborate different inter-functional key data inter-flows	☞ All SCOs actors ☞ Plan developers and operational managers
	6.4 Inconsistency of supply & delivery process problems	✓ Monitoring factors of lead time and delay in the case firms' SC operation activities ✓ Make delivering process optimal	☞ Every actor of SCO of different phases ☞ Market sales dep.t
	6.5 Commitment on SCO smooth communication between Customers Suppliers	✓ Empowering all responsible SCOs actors to enhance the productivity of the case firms ✓ Design optimal scenarios to create a collaborative relationship	☞ Managers at various SCO stages ☞ Plan and strategy developers ☞ Process designers and operational

			managers

Corrective Measurement on SCPM and other Parameters: performance measurement in the SC activities was the process of quantifying an achievement of SC coordination, and integrations. In this study, an author developed possible and relevant scenarios to enhance SC performance metrics which can be affected due to poor SCI (internal and external, operational and cross-functional, operational and information integrations) can be enhanced and various resource utilization activities can be managed. The following Table 5.6 detailed the relevant SC operational activities and terminologies of business scenarios.

Table 5:7 Corrective measurements on SCPMs for current case companies (Researcher's work, 2021)

S/N	***Causes of SCPMs in case firms SCO activities those investigated by the researcher***	***Interventions/Corrective Measurement/***	***Responsible Bodies***
1	***SCO activities Related to Response Time***		
	1.1SC operational system downtime	✓ Follow up different inconveniences in SC factors ✓ Develop management strategies to tackling SC system down ✓ Analyze execution and take actions	☞ Operational managers and all actors ☞ Plan developers and firms strategists
	1.2 Lead time and cycle time	✓ Follow up all order process properly ✓ Manage time, resources, and order processing activities wisely	☞ Sales, market, and operational managers ☞ All SC operational stages and phases
	1.3 Coordinating SC operations problems	✓ Collaborate different SC system order processing activities ✓ Create team sprits and integrate SCO activities to minimize lead time	☞ managers and market dep.t ☞ HR, operational managers ☞ SC operational stages' actors
	1.4 SC network design problems	✓ Develop waste-free SC network for all functional SC operations	☞ SC operations process designers

		✓ Analyze SC external & internal factors	☞ SCO & plan develop parts
	1.5 Order processing time problems	✓ Develop an applicable strategy to minimize cycle & lead time	☞ Market and sale departments
2	***Causes SCO activities Related to Quality***		
2	2.1 Unskilled manpower problems	✓ Recruit qualified employees and give continuous train ✓ Supervising SC operations	☞ HR and managers ☞ SCO supervisors and managers
	2.2 Raw material problems	✓ Apply quality control wisely ✓ Create reliable VC with sources of suppliers	☞ Quality dep.t and supervisors ☞ Market, procurement dep.t
	2.3 Commitments of SCO actors	✓ Empower all employees at SCO stages	☞ All SCOs stages' managers
	2.4 Interferences of brokers	✓ Manage suppliers systematically	☞ Marketing dep.t
	2.5 Quality of Information inter-flows	✓ Allow the flows of key SCO properly ✓ Create an optimal SC operations' flows modality	☞ All SCO functional departments ☞ Plan developers managers
	2.6 Poor empowering employees	✓ Apply different QMS relevant tools	☞ All SCO stages managers
3	***SCO activities Related to Costs***		
	3.1 Weak resources utilization	✓ Manage resources and minimize wastes in SC operations	☞ Phase by phase SC operations' actors
	3.2Wastes and poor coordination problems	✓ Apply MLAC to minimize wastes ✓ Use QMS relevant tools to minimize Unnecessary expenses	☞ Operation production mangers ☞ All SCO actors
	3.3Loss sales Opportunities expenses in SCO activities problems	✓ Analyze factors of losing potential customers and opportunities	☞ Market and sales dep.t ☞ Market & all stages mangers
	3.4 weak monitoring SCO activities	✓ Use SCOR model + QMS relevant tools to monitor SC operation wisely ✓ Follow up SCOs and take actions	☞ Operational managers, all SCO actors ☞ GM, O/managers, and supervisors
	3.5Maintenance costs	✓ Eliminate factors of failures	☞ Operational

		✓ Train assigned operators	managers ☞ All concerned actors
4	***SCO activities Related to Reliability & Flexibility***		
	4.1 Demand & supply variability	✓ Analyze factors of demand& supply and take management action ✓ Sourcing suppliers strategically	☞ Market and sale Managers ☞ Operational managers
	4.2Coordination problems	✓ Use SCOR model + MLAC tool to enhance SCO productivities ✓ Apply QMS relevant tools to manage all SC operational activities	☞ SC operational managers ☞ All SCO managers ☞ All SC operations actors
	4.3Information sharing constraints	✓ Eliminate factors of resources and SC operations ✓ Create an application platform for SCII in these case firms	☞ All SCO actors ☞ At all SCO managers
	4.4Weak market analysis	✓ Conduct market analysis and link it with SC operations plans ✓ Collaborate and link active data to SCO decisions	☞ Market and RD ☞ All SC operations managers
	4.5 SCO Follow-up problems	✓ Monitor all SCO stages and use QMS related tools + MLAC tool to make firms profitable ✓ Use demand & supply forces as core data	☞ All managers at SC operational stages ☞ Supervisors
5	***SCO activities Related to Effective & Efficiency***		
	5.1 Poor monitoring SC operational activities	✓ Use resource wisely and manage optimally ✓ Follow–up SC operations ✓ Create collaboration and coordination in SC tasks ✓ Create team spirit in SC activities	☞ Managers and all actors ☞ Supervisors ☞ Supplying and delivering managers ☞ All SC system operators
	5.2 SC operational concerned Commitment problems	✓ Analyze time management & take interventions ✓ Review plan and follow up operation ✓ Follow-up various SC operations	☞ Operational managers ☞ Firms strategist and plan developers ☞ SC operational

		✓ Empower the employers and create smooth power-sharing	reviewers ☞ Human resource, SC operational managers
	5.3 Resources utilization problems	✓ Make decision-based on facts ✓ Eliminate factors of SC operational system down ✓ Analyze all wastes and design applicable scenarios in which they can be tackled	☞ SC operational Plans developers & managers ☞ Operational managers
	5.4 Level of digitalizing SCO problems	✓ Digitalizing all SC activities ✓ Analyze all SC activities as per operational plan ✓ Use data optimally and relevantly in SC operational management ✓ Managing SC activities based on organized relevant data	☞ All SC activities phase by phase ☞ SC operations planners & strategy developers ☞ SC operational managers

5.6.2 Development of Implementation Scenarios /Guideline/ Model

Having the correlations analysis and above-developed interventions and roles of corresponded management activities on case firms' SC operational system challenges, the researcher developed the model that intended to be used to enhance collaboration and SC operational coordination as depicted in Figure 5: 21. This model or possible and optimal scenarios through which the implementation guideline can be realized using managing various SC operations phase by phase. The recommended procedural activity can detect the problem, collect relevant data on areas of the problem, analyze the collected data using the combination of SCOR –model, managerial levers achievement coordination (MLAC) & quality management system (QMS) relevant tools as mentioned in the above of Figure 5: 20, interpreted the result in a language of business and SC operational productivity and developed interventions scenarios to achieve the pre-defined organizational goal. The following model represented in Figure 5:21 is used to achieve high SC integrations that are intended to enhancing performance measurements and as whole overall productivity.

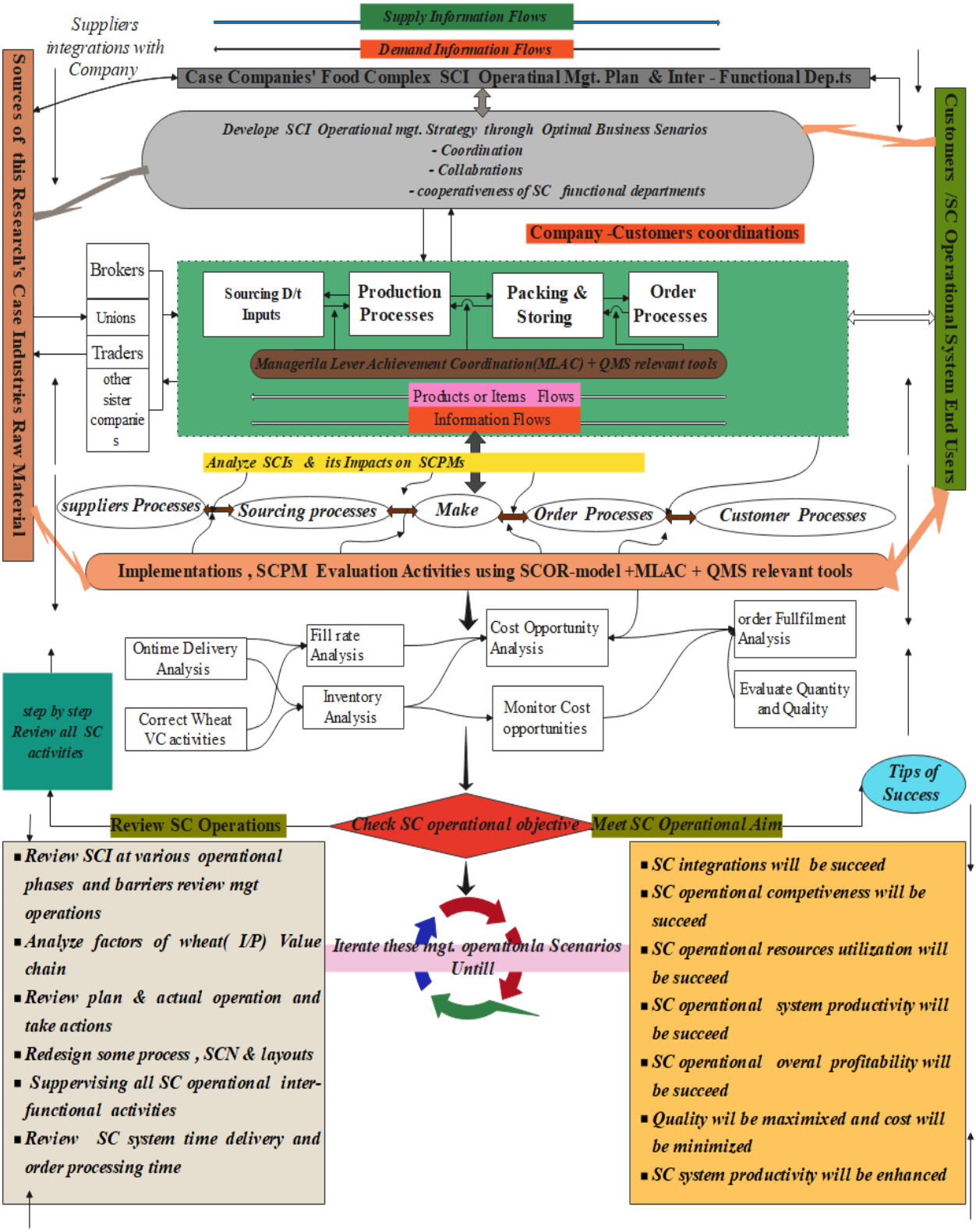

Figure 5:22 Proposed integrated model for enhancing case firms' SC operations' overall productivity (Author's Work, 2021)

In the above implementation guideline model various business management scenarios such as the scope of SC integrations, SCOR- model, and MLAC and QMS relevant tools to SC operational activities have been incorporated. As this proposed model's final aim, the following dimensions have been used as the means of device and bridging to achieve the enhancement of overall SC productivity of the case firms.

- Collaboration, coordination, cooperation of the SC activities of internal, external, operational, information, suppliers, and customer's integrations.

The achievement of these scopes of SCIs has been taken into consideration in the improvement of SC performance metrics. The above-integrated model can be realized through internalizing activities phase by phase (**phase** = SC operational activities indicted between Arrows as depicted on the above arrow on Figure 5: 23).

Phase I: all SC integrations strategy and planning phase those include various operations.

- Internal integration: avail all activities through analyzing all parameters and entrants of SC operations using approaches of managerial levers achieving coordination (MLAC), and QMS relevant tool to meet the high performance
- External integration: is an activity used to design optimal cooperation and link with key SC system activities starting at strategies and plan development.
- Operational and information integrations: these are through considering all factors such as cost opportunities, resources utilization, competitors, and SC network. Good and optimal management approaches (wise usage of MLAC and tools of QMS in SC activities on these elements) are the key issue to improve the flow of activities
- Customers and Suppliers integrations with company: is need fact and feasible platform and network at the planning and strategy to create conveniences inter-flows of resources, materials and products to run optimally the SC operations

Managerial Levers Achievement Coordination (MLAC) is the tool of managing the coordination of various SC operational activities pre-dominantly in the case firms. The aim of this management tool was:

- Aligning the goal and incentive of the SC operational activities
- Improving information accuracy and inter-flows of resources in SC activities
- Improving SC system operational performance
- Enhancing the building strategic partnership and trust in the SC system stakeholders

As scholars summarizing its significance in business scenarios, the following are potential advantages of the real applications of managerial levers achievement coordination (MLAC).

- ☞ Minimizing the cost of the manufacturing system
- ☞ Minimizing inventory cost in SC system's operations
- ☞ Minimizing lead time and improve delivery activities in the SC operational activities
- ☞ Improving the relationship between various SC system functional departments

These and other importance of this tool was proposed to have resulted from the proposed model and processes of validating the integration of the above implementation guideline model.

Phase II: this is a phase of evaluating the SC activities' achievements that can be affected by the level of SCI (Appendix V). Having this aim, an author selected SCOR-model main elements such as plan, source, make, delivery, return and enable in the SC activities of the firms as it earlier selected after compression analysis of Literatures. Relevant management tools are supposed to be used in the processes of implementing this proposed scenario and model at this phase II. So, the MLAC and QMS relevant tools have been incorporated in the process of addressing the problems of the SCI impact the poor SCPM aspects in the case firms and used to solidify the credibility of the proposed implementation guideline to enable real cases to be productive. Under this phase, the following key elements of SCPM (response time, quality, cost, reliability, and flexibility) can be evaluated through integrating all activities of SC integrations. In addition to these, as the analysis, of this study reveal, cost utilization, inbounding logistics, unnecessary expenses of SC activities, SC operation downtime can be evaluated through evidenced scenarios in SC operations in the identified case firm.

Phase III: in this phase, various improvement activities are supposed to be conducted. These can be corrective measurement and interventions, feedback analysis, review the plan, redesign the SC network for those recorded low achievements, train all concerned participants in the system.

As mentioned in the methodology of the study and incorporated in the above-proposed implementation guideline model, relevant quality management system (QMS) tools have been suggested to be used wisely to achieve the aim of this phase of this model. This management approach was incorporated into this proposed model and scenario to address the research questions and aim of the study stated before. Even though quality management system was wide concepts and aspects, the current study suggested consisting of the following aspects under this.

- ☞ SC operations' continuous improvement tools such as Plan, Do, Act& Check (PDAC)

- ☞ Resources utilization approaches in SC operational activities
- ☞ Cost minimization, quality control tools, and teamwork in SC activities
- ☞ Empowering employees in their relevant professional disciplines

These and other relevant tools were proposed to be used to address the aim of this research. Generally, via realizing this proposed solution and phase by phase validation description, the current investigated SC operations problems can be addressed and predominantly, the case firms' SC activities' productivity can be enhanced.

5.7 Summary of the Chapter

In this chapter, various main analyses of this study SCI: supplier's and customer's integrations with the company, SC external and internal integrations, SC information integrations, and customer –supplier's integrations have been analyzed using various data analysis tools. SCPMs (SC operations response time, quality, and unnecessary cost, flexibility, and reliability aspects) those affected by the poor achievement of SCIs in the case of firms' SC system (Appendix V) through correlation and regression analysis and found as the SCI (independent variables) affect the SCPM (dependent variables) and revealed most elements of SCI significantly correlated with SCPM's elements. Not only these but also, resources utilization aspect like SC operational system down analysis and unnecessary cost opportunities analysis has been internalized. Through the entire analysis of this study, an author summarized the summary of the findings on achievements of SCIs in case industries & status of SCPMs have been explored. To address the investigated issues and barriers of SCI, and meet the pre-defined research objective, the researcher proposed possible scenarios via intervention as mentioned in Table 5:6 & 5:7 using a combination of SCOR-model, MLAC & QMS relevant tools. This merging aimed to address the articulated formers' research gaps. The roles of all responsible bodies of SC actors in the current food complex industries were the critical requirement to achieve the target of SC integrations' operational activities and enhancement of overall companies' productivity. Development of implementation guidelines also has been proposed (modeled) to enhance the current case industries' SC operational system's productivity and waste-free that it has been depicted in Figure 5:23.

CHAPTER SIX

CONCLUSION, RECOMMENDATIONS & FUTURE RESEARCH AREAS

6.1 Conclusion

In this [research], the case food complex industries' "Analysis of Supply Chain integrations and its Performances Metrics to Enhance Productivity" have been analyzed using various relevant analysis tools as per- defined in Figure 3.1 of the study's conceptual framework. SCIs analysis has been started SC operational activities of collecting available data. Data analysis tools (combination of MS-excel solver tool with IBM 24 SPSS software package) reliability and validity of the collected data have been analyzed to draw a scientific solution that was used to meet the objective of the study. To identify the level of the current case industries SCI and its impacts on overall firms' SC system productivity, an author computed an average of percentages of SCI such as coordination, collaboration, and cooperativeness activities as below:

1. Potential Suppliers' integrations with company averagely 10.1%, 57.8%, 30.9% low, medium and high respectively
2. Potential Customers' integrations with company averagely 19.9%, 54.6%, 21.4% low, medium and high respectively
3. SC cross-functional integrations within a company averagely 16.8%, 54.7%, 23.3% low, medium and high respectively
4. Internal SC operational integrations / coordination/ activities averagely 33.7%, 49.7% 11.3% low, medium and high respectively
5. SCII averagely 16.5%, 51.47%, 26.5% low, medium and high respectively
6. Customers & suppliers cooperativeness averagely 16.2%, 52.4%, 24.9% low, medium and high respectively and multi-dimensional scenarios' focused interpretations.

Through correlation and regression analysis, the impacts and relationship between these independent variables (SCI) and dependent variables (SCPM elements) have been defined using statistical parameters. Even though performance is the widest concept that covers overall economic & operational, and the dimension of organizational perspectives, this study accepts it as a "progressive achievement of tangible, specific, measurable and SCO meaningful goal". The aim was to quantify resource utilization, profitability, market competitiveness, and other

measurable indicators. Having these business scenarios, the researcher analyzed SCMs relevant aspects as below:

1. SCOs performance regarding response time averagely 21.5%, 52.1%, 20.9% low, medium and high respectively
2. SCOs activities regarding quality aspects averagely 18.6%, 58.1%, 20.5% low, medium and high respectively
3. SCO activities regarding costs / expenses/ averagely 21.3%, 59.0%, 14.7% low, medium and high respectively
4. SCO activities regarding flexibility & reliability aspects averagely 10.7%, 53.8%, 29.7% low, medium, and high respectively

Possible scenarios have been discussed to enhance these case firms' SC performance metrics' indicators that resulted from weak SCI via merging SCOR- model, MLAC, and QMS relevant tools.

To solidify the above questionaries' through Likert scale data collection and analysis, firms' SCO reports have been analyzed to make a comprehensive analysis & proposed possible solutions and model such as unnecessary expenses and resource utilization aspects. From these points of view, it computed as SCO system preventive expenses, appraisal expenses, internal failure expense, external failure expenses 29%, 18%, 43%, 11% respectively, and interpretation through management approaches have been addressed. The other of this study was productivity or efficiency, and resources utilization analysis such as 68.4%, 69.6%, 77.3%, 68.9%, and 70.4% respectively corresponded to current case industries. These were the critical indicators to the achievement of optimal resource utilization and productivity.

Having the concepts of merging SCOR-model, MLAC, & QMs relevant tools to fill the identified research gap those identified before, various causes of SC activities have been explored.

Possible solutions have been developed using the above synchronization of the above approaches and management tools and intervention, and implementation guidelines models as depicted in Figure 5:20. SC operational productivity enhancement scenarios have been wisely synchronized in this proposed solution.

6.2 Recommendations

Having the SCI analysis, and its performance metrics evaluation been concluded, the following lists of recommendations forwarded to enable pre-dominantly the current case companies competitive and profitable and generically for all similar industries.

- ☞ All SC operational activities such as upstream and downstream flows of resources and information, purchasing, preparing for processes, producing storing, and delivery to market base on demand should be supervised and analyzed continuously to eliminate wastes of resources and monitory all operations systematically
- ☞ SCI activities need to have customers & material conceptions based on database interface to synchronize accuracy and uniform data, resources, and information interflows and easily accessible through well-organized SCO activities documentation.
- ☞ Causes of SCO system down factors should be monitored via developing different optimal strategic and mgt. approaches that improve resources utilization and overall productivity
- ☞ These SCIs & SCPMs improvement methods and scenarios are recommended not only to the current case companies but also to all food complex industries in Ethiopia. The proposed possible solution using various multi-disciplinary such as QMS, MLAC, and level of SCOR-model relevant tools to enhance overall SC system productivity of the companies
- ☞ The case firms SC system actors should focus on rectifying the potential causes those result in the interruptions of various SC activities. As per data obtained from the case firms during data collection, monitoring the collaboration, coordination, and inter-flows of resources and information need high management commitments which indicated in the above-developed implementation guidelines model to tackle these challenges
- ☞ All SCIs and SCPMs aspect activities should be digitalized and monitored through design d/t SC activities such as SCN, SC distribution network, company' coordination with key customers, suppliers, and all stakeholders

These and other possible scenarios have been suggested in this study to meet the pre-defined objective and also generically enable other similar industries.

6.3 Incitement of Further Research Areas

In this research, more emphasis has been given to the analysis of SCIs and SCPMs caused due to poor SCI to enhance the identified case firms' overall SC system productivity. It was through given attention more to coordination, collaboration, resources, and information integrations. And also, SCPM's key and relevant aspects such as response time, cost, quality, and reliability & SC operational system's flexibility those resulted due to poor SCI have been concentrated with different management scenarios to meet the aim of the study.

SCORE-mode, MLAC & QMS relevant tools have been synchronized in this study using MS-excel solver tool and IBM 24 SPSS Software Package based on the relevance study's methodology.

1. Hence, one can extents the concepts on business & management operations such as service delivery industries (Bank, Hospital and Pharmaceutical Distribution Agencies and Educational Institutions) and manufacturing industries (Agricultural Integrated Industrial activity, Textile and Apparel Industries)
2. Analyze market strategies, effects of human factors& SCO system's CoQ on company's productivity through merging SCM & TQM tools. This is need detail recorded and monitored data on strategy and cost utilization at various phases of SC operation.
3. Model SCN through analyzing SC operations using system model and simulation & Analytical analysis and strategic development factories to optimize phase by phase SC activities of the Food Complex Industries and develop optimal scenarios

These and other further research areas have been suggested for the scholars' works and scientific communities

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APPENDIXES

Appendix-I: QUESTIONNAIRES & SURVEY

Addis Ababa University School of Mechanical and Industrial Engineering

Post Graduate Studies Program

Master of Science in Mechanical and Industrial Engineering (Industrial System Engineering -Stream)

Subject: ***QUESTIONNAIRES ON CASE INDUSTRIES***

Prepared by: ***GETU ABDISA***

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Under the full guidance of the main advisor and co-advisor:

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My name is Getu Abdisa, I am M.Sc. student in industrial System Engineering at Addis Ababa University Institute of Technology (AAiT) postgraduate studies program. My research was entitled *"**Analyzing Supply Chain Integrations & its Performances Metrics to Enhance Overall Productivity**"* on the case of five food complex industries around Addis Ababa.

Five Food complex Industries plc. Located Around Addis Ababa

Objective: The objective of this questionnaires is to collect necessary, and relevant data on supply chain integrations (internal, external, operational, customers, and information) that may affect supply chain performance measurements (quality, delivery time, productions system reliability, flexibility, and cost opportunity in supply chain system) those can directly impact the overall supply chain system productivity & firm's profitability. The author would like to highly

inform you that, this research is purely for academic purpose and ***partial fulfillment of the requirements for Degree of Masters of Science in Industrial Engineering (Industrial System Engineering - Stream) and not affects your Industry in any aspects***.

And also, the researcher will try to conduct this study to make your company a primary beneficiary and use it as supply chain operational decisions inputs, proposing scenarios to eliminate causes of supply chain integration which improve firms supply chain performance profit &productivity.

For further information, you can contact me using the above-mentioned addresses.

SECTION – 1: Company Profile: The researcher would kindly ask you that indicate the appropriate characteristics.

1.1 Number of employees (**circle your choice)**

a. < 100 b. 101-250 c. 250- 400 d.> 400

1.2 Operating experiences of this industry in Ethiopia (**circle your choice**)

a. < 10 years b. 10-20 years c. 20- 30 years d. > 30 years

SECTION -2: Respondents' Profiles: The following questions are about the respondents' profile in the case study industry. The researcher kindly asks you that, indicate by circling the appropriate among of the followings.

2.1 Gender: a. male b. female

2.2: Respondent's current positions in industry

a. General manager b. Production manager

c. Others, write it _____?

2.3 Respondents' qualification level

a. MA/M.Sc. or above b. BA/BSc c. diploma d. other, _____?

2.4 Respondent's field of study _____?

2.5 Respondents work experiences

a. 1-3 years b.2-3 years c. 3 – 5 years d. 5-7 years e 8-10 years above 10years

SECTION - 3: Lists of Open-Ended & Close-Ended Questions on Supply Chain Integrations & its Performance Measurements (in your industry)

3.1 Close–Ended Rating of 6-Points Likert Scales Questions

3.1.1 Company's Integrations with Suppliers: This is the key characteristic of the supply chain in the processes of managing the cooperation of firms and customers to meet the pre-defined

organizational objective and to eliminate the production system failures and scarcity of the inputs. **Please, indicate your answer using (✓)** on the following statements that were articulated in the below table based on your experiences.

***The rating: **1**= Significantly Low, **2** = Low, 3 = Medium, 4 = High and 5 = Significantly High 6. = Not Applicable*

	Descriptions	**Rating Numbers**					
No	**Company's Integrations With Suppliers**	**1**	**2**	**3**	**4**	**5**	**6**
1	Stable procurement through good networking with suppliers						
2	The establishment of a quick ordering system						
3	The level of the strategic partnership with suppliers						
4	Sourcing suppliers strategically						
5	Assessments of the status of suppliers' supplying forces &take improvement actions to make system convenience						
6	Level of trust between your firm and its suppliers						
7	Evaluations and selection of suppliers for supply chain system						
8	Negotiating pricing and delivery terms with suppliers						
9	create cooperative with your suppliers and discuss your commitments in the productions system conveniences						
10	Developing optimal strategies to strengthen the relationship between potential suppliers and company						

***3.1.2 Company's Integrations with Customers*:** integrating Company with potential customers is the critical firm's operational activities in the supply chain system to be a success and be profitable. As long as the company could positively cooperate with customers, customer requirements become fulfilled, constraints of the production system can be minimized and controlled these businesses scenarios definitely, which can results enhancement of overall system productivity. **Please, indicate your answer using (✓)** on the following statements articulated in the below table based on your experiences.

***The rating: **1**= Significantly Low, **2** = Low, 3 = Medium, 4 = High and 5 = Significantly High 6. = Not Applicable*

	Description	Rating Number

No	**Company's Integrations With Customers**	*1*	*2*	*3*	*4*	*5*	*6*
1	Follow-up customers for feedback and give active responses						
2	Monitoring and measuring customer services						
3	Levels of market information sharing with major customers						
4	Frequency of contacts with major customers						
5	Monitoring outbound logistics process						
6	Evaluation of delivery speed and reliability to satisfy customers & improve supply chain system performances						
7	Assessments of order fulfillment rate in the supply chain system and use as input of consecutive decisions processes						
8	Retailors involve in demand forecasting processes						
9	Creation of exceptional values to the customers						
10	Customers' orders fulfilled accurately in terms of quality and quantity						
11	Balance customer requirement with the company's supply capability						
12	Understanding of customers' requirements and do on it						
13	Create smooth communications with key customers and prioritize their needs						
14	Share market information to customers optimally						
15	Optimize mood of delivering system and fulfillment of responses of customers' requirements						

3.1.3 Cross-Functional Integrations within Company: This is the process of cooperative and inter-relationships of various functional departments in the supply chain system of your firm's activities. **Please, indicate your answer using (✓)** on the following statements that were articulated in the below table based on your experiences.

***The rating: **1**= Significantly Low, **2** = Low, 3 = Medium, 4 = High, 5 = Significantly High 6 = Not Applicable*

	Descriptions	Rating Number					
No	**Cross-Functional Integrations Within Company**	*1*	*2*	*3*	*4*	*5*	*6*

1	Data integrations among internal functional through inter-relationship and optimally						
2	Information system integration among internal functional units						
3	Teamwork and inter-organizational coordination						
4	Extents of integrations between productions and other functional departments of supply chain system						
5	Extents of Integrations between quality, purchasing & sales department						
6	The commitment of stakeholders in the processes of managing supply chain system operational activities						
7	Periodic inter-departmental meetings and workflows evaluation						
8	inter-flows of supply chain activities and co-relations on managing operations of warehouse, suppliers, distributions in the firm						
9	Pre-evaluations of various functional departments in the supply chain system						
10	Readiness of supply chain participants for improvements and learn from each other to enhance operational productivity						
11	The commitment of the coordination of various operational departments in the supply chain system						

3.2.4 Internal supply chain Operational integrations Activities: are the processes of linking various operational activities in the supply chain system. **Please, indicate your answer using (✓)** on the following statements articulated in the below table based on your experiences.

***The rating: **1**= Significantly Low, **2** = Low, 3 = Medium, 4 = High, 5 = Significantly High 6. = Not Applicable*

	Operational Descriptions	**Rating Scales**					
No	**Internal supply chain Operational Activities**	1	2	3	4	5	6
1	Assure order –entry accuracy						
2	Identify requirements of demand& constraints from suppliers stages						
3	The design flexibility of the production system to handle order						

	patterns						
4	The extents of production processes and automation						
5	The extents of innovations to satisfy customers and stakeholders						
6	Evaluate internal and external supply chain performance measurements to identify major causes and propose solutions						
7	Management know-how supply chain system can be effectively monitored						
8	Practices of production flexible system towards to market changes						
9	Effective & Efficient resources utilization activities						
10	Extents of automated quality control and supply chain system monitoring to meet the objective of the company						
11	Analyze demand and supply trends or the past period operations in supply chain activities						
12	Coordinate various operational plans in the supply chain system and evaluate their performances phase by phase						
13	Understand, identify customers segments & create smooth co-operation to penetrate the market						
14	Monitoring lead time of delivery system in supply chain						
15	Evaluation of unnecessary costs and control of the system						

3.1.5 Supply Chain Related Information Inter-Flows or Integrations: refer to the processes of information inter-flows and critical elements in the overall supply chain system. **Please, indicate your answer using (✓)** on the following statements that were articulated in the below table based on your experiences.

***The rating: **1**= Significantly Low, **2** = Low, 3 = Medium, 4 = High, 5 = Significantly High 6. = Not Applicable*

	Operational Descriptions	**Rating Scales**					
No	**Supply Chain Related Information Inter-Flows**	*1*	*2*	*3*	*4*	*5*	*6*
1	Capacity & capability information inter-flows within inter-functional departments						

2	Sale data and sales forecast information delivered to customers and stakeholders efficiently						
3	Flows of information within the company –customers and promptly						
4	Integrate information as sources of decision making in the supply chain system						
5	Share the benefits of coordination equitably in the supply chain system						
6	Sharing of data on demand and supply plans with suppliers						
7	Exchange on-time order processes to manufacturing dep.t						
8	Inter-flows of order entry time & accuracy						
9	Processes of forwarding results of a laboratory test to purchasing departments to						
10	Demand, order issues, and productions processes coordination						

3.1.6 Suppliers and Customers Integrations: This is very important for the smooth flows of operational activities, cooperativeness, and inter-relationships within key suppliers and customers in the supply chain system to enhance the overall system profitability. **Please, indicate your answer using (✓)** on the following statements based on your experiences.

***The rating: **1**= Significantly Low, **2** = Low, 3 = Medium, 4 = High, 5 = Significantly High 6. = Not Applicable*

	Operational Descriptions	**Rating Scales**					
No	**Suppliers & Customer integrations or cooperativeness**	1	2	3	4	5	6
1	Joint product planning with major suppliers in supply chain system						
2	level of cooperativeness with customers						
3	Customer delivery adherence on time requirements						
4	Compliance with customers' delivery in - full requirements						
5	The level of cooperativeness with suppliers						
6	Joint product planning with a major customer in the supply chain system						
7	Production plan inter-flows conducted within each other						

8	Market information interflows						
9	Interaction on order receiving and supplying activities						
10	Design optimal and reliable channels to interchange key data						

3.1.7 Supply Chain Performance Measurements Activities: is the process of quantifying the efficiency & effectiveness of various supply chain system operational activities. Primarily, four main aspects are required for the analysis of the supply chain. **Please, indicate your answer using (✓)** on the following statements for A- D in the below table based on your experiences.

***The rating: **1**= Significantly Low, **2** = Low, 3 = Medium, 4 = High, 5 = Significantly High 6. = Not Applicable*

	Supply Chain Performance Measurements Activities	**Rating Scales**					
A	***Supply chain Operational performance Regarding Response Time***	1	2	3	4	5	6
1	Replenishment lead time variability						
2	Processes of order fulfillment activities in various phase						
3	On-time delivery and customer satisfaction processes						
4	Response time & customer requirements checklist analysis						
5	Develop schedule adherences in the supply chain system						
6	Delivery speed and reliability in supply chain system						
7	Monitor variability in delivery time processes						
8	Manage Customer and product finalization contact points to improve continuality of competitiveness						
9	Monitoring order time fulfillment processes in the supply chain system						
10	Warehouse monitoring in an order processing time						
11	Order cycle time in the firm's supply chain system						
12	Order turn over time variables						
13	Monitoring cycle time as per the pre-defined objective of the firm and customer specifications operations						
14	Lost time due to accidents and failures or various system						

	bottlenecks in supply chain & production system						
15	Rates of orders delivered by requisite date in supply chain order receiving processes						
B	***Supply chain Operations Regarding Quality Aspects***	1	2	3	4	5	6
1	Assure the supply chain system processes accuracy						
2	Implementations of quality management system tools to make supply chain system processes free from errors						
3	Apply optimal productions processes & evaluate the status						
4	Assure the processes of various stage based on operational plans &customers need via optimal and minimum costs						
5	Monitor order entry and invoice accuracies in the supply chain system						
6	Monitoring warehouse accidents and order fill rate process through active market data based						
7	Evaluating costs of delivery and unnecessary supply chain processes to improve productivity						
8	Assessments of various operational quality management						
9	Proper assuring of the Supply chain key activities from raw material to end product commencements						
C	***Supply chain Operations Regarding Costs Aspects***	*1*	*2*	*3*	*4*	*5*	*6*
1	Costs incurred due to poor processes & procedures in the supply chain system of your firm						
2	Expenses due to damaged products and resources in the warehouse (poor inventory mgt.)						
3	Evaluations of unnecessary delivery costs and other incurring supply chain system related failures costs						
4	Expenses incurred due to poor product quality that delivered						
5	Expenses may be incurred due to a lack of good coordination between supply chain functional departments						
6	Inventory related and excess stock expenses in supply chain						

	operating system in the firm						
7	Capacity shortfall costs / expenses/						
8	Costs incurred due to poor management at various supply chain system operational stages						
9	Costs due to unusable & unaccounted stocks						
10	Supply chain Internal failures costs						
11	supply chain system external failures costs						
D	***Supply Chain Operations Regarding Production System Flexibility & Reliability Aspects***	*1*	*2*	*3*	*4*	*5*	*6*
1	Operations for meeting demand fluctuations						
2	Develop schedule adherences in supply chain system via analysis of current market situations						
3	Product families, packaging, and versus resource utilizations						
4	Analyze Plan versus actual in production system & take corrective measurements on negative factors.						
5	Monitoring variability in the production system						
6	The degree to meet customers' perceptions in every aspect						
7	Proper resource utilization in supply chain system activities in the company						
8	Readiness for responding to customer requirements						
9	Analysis of optimality of the planning in various supply chain operations						
10	Culturing the flexibility based on customers' orders						

3.2 OPEN-ENDED TYPES OF QUESTIONS

1. What do you think the impacts of the following parameters on the productivity and Supply chain performance metrics?
    a. the level of market information sharing with major customers

    _____, _____

    b. customers follow-up feedback strategy and frequencies of contacts

    _____,_____

2. Please fill the following table based on your list of key stakeholders

Raw materials Suppliers	***Retailors***	***End-users of your products***
1. 2. 3. _____Write the maximum number do you have	1. 2. 3. _____Write maximum number do you have	1. 2. 3. _____Write maximum number do you have

What ***major factors*** do you think that ***affect the positive inter-relationships between*** these key stakeholders of your company's supply chain system? _____,_____

3. What major factors do you think that affecting **efficiencies & effectiveness** of your industry's Supply chain system operations and overall productivity?

i_____,_____,_____

ii_____,_____,_____

4. Among of the following key elements of supply chain performance metrics, which do you think that impacts your firm's overall performances? **Thick (✓)** your answer (you can select more than one)

□ Time to deliver aspects , the main reason _____

□ Quality aspects, the main reason_____

□ Flexibility (demand based operational capacity), the main reason

_____,_____

5. In supply chain operational activities, various expenses or unnecessary costs are incurring due to internal and external failures. Do you agree with these scenarios?

a. Yes, try to list some causes of unnecessary costs in your industry

i. _____,_____

ii._____,_____b. No

6. Do you think that the following situations can be the causes of customers' complaints in your industrial supply chain process? **Thick (✓)** your answer (you can choose more than one letter), ***please mention the major reasons for your answer***.

□ Order response time _____

□ Products and service quality in your industry_____

□ Information inter-flows within internal and external supply chain activities_____

□ Price competiveness and lead time _____,_____

7. Did your industry introduce any method (model) or supply chain performance improvement program to measure & improve performance? [Put, **"✓"** Under your selections]

S. N	***Performance types***	Yes	No	If your answer is "yes" please specify
7.1	Customers satisfactions performance			
7.2	Supply chain Operational performances			
7.3	Suppliers interactions performance			
7.4	Market share performance			
7.5	Products or services performance			
7.6	Inventory management			

8. What factors do you think that affect inter-relationships or good management activities within your industry?

   i._____,_____

   ii._____,_____

9. Based on the performance measurements reports, please indicate the ff. for the **3 last years**

Performance items Descriptions	Units	2010 E.C	2011 E.C	2012 E.C
Supply chain productivity	%			
Internal supply chain activities	%			
External supply chain activities	%			
Sale volume	Tone			
Market share (locally/ globally)	%			
Capacity utilization	%			
Supply chain target cost achieved	%			

10. Which factor do you think that it affects the Supply chain system performance metrics of your industry? **Thick (✓)** your answer (you can choose more than one)

□ Poor inventory management practice_____,_____

□ Lack of consideration about costs of quality in Supply chain system

_____,_____, _____

□ Absences of interlinking of the Supply chain system operational activities

_____,_____,_____

□ High replenishment lead time _____,_____

11. What are the major challenges in the processes of evaluating supply chain performance measurements in your food complex processes industry? please list some of these

_____,_____,_____

12. Do you think that unnecessary costs which are due to internal and external failures of supply chain system activities affect the overall performance measurements of your firm?

If your answer is yes, please mention the major types of unnecessary costs _____

_____,_____,_____

13. Does your company exercising the supply chain performance measurements of the following

□ Cost measures □ Quality measures □ Time measures □ Non-quantitative measures

Please explain major factors of evaluations of these supply chain operational system performances_____, _____

14. Do you think that the poor inventory management activities in the supply chain system affect the overall productivity of the firm?

a. Yes I think, please mention causes

i_____,_____

ii. _____, _____ b. No

"Thank You for Your Kindly Cooperation and Valuable Information!!!"

Appendix –II: Lists of Interviews & Discussions with Sources of Data

Section -4

4.1 For Managers

1. What are supply chain integrations & their impacts on the overall productivity of your industry?
2. What are the obstacles to coordinating supply chain integrations in your industry?
3. What is the extent of managing SC integrations between your company, your suppliers, and customers?
4. What do you think the level of cooperativeness between suppliers and consumers regarding your company's Supply chain system?
5. Do you have customer-related issues and challenges?
6. What are the major causes of unnecessary (failure costs) expenses that negatively impact the profitability and market competitiveness of your firm?
7. What are the major factors for the improving supply chain system's overall performance?
8. What do you think impacts of inventory management on overall your company's productivity?
9. Is there optimal resource utilization in your company?

4.2 For Supervisors, Quality and Productions Departments

1. What are the major factors of running production processes?
2. Is there a challenge related to information inter-flows, internal operational integrations, and initiative commitment to optimally monitoring your responsibilities?
3. What are the major causes of quality issues in the supply chain system? Do you think that these factors affect a firm's performance measurement and profitability?
4. Do you have a flexible production system to meet the change in market and order?
5. Do you have any inventory-related issues or challenges in your company's supply chain system?
6. What types of costs related to poor supply chain system operations (internal failures costs, external failures costs, and assuring and preventive costs?

4.3 *For Procurement and Purchasing, Marketing & Sale Departments*

1. What do you think the major factors of supply chain system integrations (internal, external, customers, suppliers, and operations or information) and their impacts on a firm's profitability?
2. What are the challenges to achieving a delivery schedule?
3. What are the factors affecting the supply chain coordination and its performance?
4. What is the factor or constraints to achieve the required fill rate & minimum lead time?
5. What factors increase suppliers' lead time –variability in your firm's supply chain system?
6. What factors increase order lead time and make customers dissatisfy?
7. What are the major causes of poor co-operation of functional departments in your firm?

4.4 ***For Key Customers, Stakeholders & Suppliers***

1. Did you satisfied with the firm's strategies on cooperation & cooperativeness with suppliers and customers' operations in the company's Supply chain process?
2. What are the negative factors for creating optimal cooperativeness stakeholders do you expect?
3. What do you think about the sale forecast information inter-flows from the company?
4. Is there is good distribution activities in the industry based on customers' requirements?
5. How would you see the company's management activities on complaints and its handlings of operational activities?
6. Did you satisfied with the chain of the activities that carrying out your order process?
7. Are there inconveniences in the delivery and distribution processes?

4.5 ***For Some Workers and Operators***

1. Are there optimal inter-flows of information on conducting your responsibility in the system?
2. What factors affecting the smooth running of the production system and the use of the full capacity of the production line, machine, and all facilities?
3. Do you think that the operational management in the supply chain system of the firm is suitable for your daily activities?
4. Is there optimal follow-up, celebrating your good performances, recommending you on your low performances, and give some professional training to update your skills?
5. Do you think that your roles have its own impact on the SC system productivity of the firm?
6. Is there team work and frequent task evaluation and corrective measurements action?

Appendix – III: Quantitative Data from Various Supply Chain Activities

Section – 5

Demand and Supply		Units Date when order placed	Date when order received	Qty/No
Number of orders **(**demand**)** per day or month				
	1.pasta			
	2.macaroni			
	3.Floor meal			
	4.Other by products			
Total number of orders delivered **(supplied)** per day or per month				
	1.Pasta			
	2. macaroni			
	3.Floor meal			
	4.Other by products			
Sale volume per month or annually		Tone		
Batch or size order		Qty.		
Export volume per month or year		Tone		
Costs of placing the order (Co)				
Annual per unit carrying Costs (Cc)				

Section -6

Unnecessary Expenses in Supply Chain System	**Time span of operation**			
Preventive Costs due to supply chain poor quality	2018/2019		2019/2020	
	1-6 month	*6-12 month*	*1-6 month*	*6-12 Month*
Producing product Design analysis costs				
Planning the ways of SC quality problem controlling costs				
Prepare and give train costs Conducting preventive				
For Processes review costs				
Preventive maintenances expenses				
Appraisal costs due to checking poor quality operations in the supply chain –system				
Suppliers certification expenses				
For Conduct Product auditing costs				

Testing to refine poor quality in supply chain system				
grading down the prices due to quality problems costs				
Checking final product				
lost sales due to customers dissatisfaction costs				
Customer satisfaction analysis expenses				
Internal Failure Costs in Supply chain system				
Calculated scraps costs				
Costs incurred due to reworks				
Costs incurred due to conduct corrective measurement actions for poor supply chain system				
Supplying problems and late deliveries				
Accidents and injures				
Order processes cost monthly or annually				
Supply chain system failures expenses				
Damaged products and price downgrading costs				
External Failures costs in supply chain system				
Lost sales opportunities				
Product recall and product returns				
Product return costs				
Customer complains expenses				

Appendix-IV: Summary of Analysis

This summary of analysis focus on correspondents' responses on questionnaires & other 1-6 month supply chain operational activities reports in ***"Analyzing Supply Chain Integrations and Its Performance Metrics to Enhance Productivity"*** on the case of Ethiopian food complex industries (particularly five companies around Addis Ababa)

4.1 Average Correspondents Responses on Companies' Integration with suppliers

S/N	N =71 & Missing Value =0	Percentage's (%) of Correspondent's Responses							
	Descriptions about Company's Integrations With Suppliers in SCI operational activities in the case firms	Significantly Low	Low	Medium	High	Significantly High	N. Applicable	Mean	Std. D

1	Stable procurement through good networking with suppliers	1.4%	8.5%	63.4%	26.8%	0.0%	0.0%	3.0	0.7
2	The establishment of quick ordering system	1.4%	14.1%	60.6%	21.1%	2.8%	0.0%	3.0	0.9
3	The level of strategic partnership with suppliers	1.4%	11.3%	59.2%	25.4%	2.8%	0.0%	3.2	0.7
4	Sourcing suppliers strategically	1.4%	11.3%	62.0%	23.9%	1.4%	0.0%	2.9	0.7
5	Assessments of status of suppliers' supplying forces &take improvement actions to make system convenience	1.4%	7.0%	57.7%	31.0%	2.8%	0.0%	3.3	0.8
6	Level of trust between your firm and its suppliers	1.4%	22.5%	57.7%	18.3%	0.0%	0.0%	2.9	0.7
7	Evaluations and selection of suppliers for supply chain system	1.4%	2.8%	45.1%	45.1%	5.6%	0.0%	3.5	0.7
8	Negotiating of pricing and delivery terms with suppliers	1.4%	0.0%	42.3%	54.9%	1.4%	0.0%	3.5	0.5
9	create cooperative with your suppliers and discuss on your commitments in the productions system conveniences	1.4%	11.3%	66.2%	19.7%	1.4%	0.0%	2.9	0.7
10	Developing optimal strategies on strengthen relationship between potential suppliers and company	0.0%	12.7%	59.2%	25.4%	2.8%	0.0%	2.9	0.8
	Average	1.3%	10.1%	57.3%	29.2%	2.1%	0.0%		

4.2 Average Correspondents Responses on Companies' Integration with Customers

	N =71& Missing Value =0	***Percentage's (%) of Correspondent's Responses***					
S/N	***Descriptions about Company's Integrations With Suppliers in SCI operational activities in the case firms***	***Significantly Low***	***Low***	***Medium***	***High***	***Significantly High***	***Not Applicable***
1	Follow-up customers for feedback and give active responses	0.0%	14.1%	59.2%	23.9%	2.8%	0.0%
2	Monitoring and measuring customer services	0.0%	19.7%	43.7%	32.4%	4.2%	0.0%
3	Levels of market information sharing with major customers	0.0%	28.2%	56.3%	15.5%	0.0%	0.0%
4	Frequency of contacts with major customers	0.0%	1.4%	46.5%	36.6%	15.5 %	0.0%

5	Monitoring outbound logistics process	0.0%	18.3%	64.8%	14.1%	2.8%	0.0%
6	Evaluation of delivery speed and reliability to satisfy customers & improve supply chain system performances	0.0%	21.1%	54.9%	19.7%	4.2%	0.0%
7	Assessments of order fulfillment rate in the supply chain system and use as input of consecutive decisions processes	0.0%	31.0%	46.5%	19.7%	2.8%	0.0%
8	Retailors involve in demand forecasting processes	1.4%	22.5%	57.7%	14.1%	4.2%	0.0%
9	Creation of exceptional values to the customers	0.0%	21.1%	63.4%	15.5%	0.0%	0.0%
10	Customers' orders fulfilled accurately in terms of quality and quantity	0.0%	15.5%	64.8%	14.1%	5.6%	0.0%
11	Balance customer requirement with company's supply capability	0.0%	12.7%	56.3%	31.0%	0.0%	0.0%
12	Understanding of customers' requirements and do on it	0.0%	23.9%	56.3%	16.9%	2.8%	0.0%
13	Create smooth communications with key customers and prioritize their needs	0.0%	19.7%	47.9%	28.2%	4.2%	0.0%
14	Share market information to customers optimally	0.0%	25.4%	50.7%	21.1%	2.8%	0.0%
15	Optimize mood of delivering system and fulfillment of responses of customers' requirements	1.4%	23.9%	50.7%	18.3%	5.6%	0.0%
	Average	**0.2 %**	**19.9 %**	**54.6 %**	**21.4 %**	**3.8 %**	**0.0%**

4.3 Average Correspondents Responses on Cross-Functional Integration (CFI) within Company

N= 71 & Missing Value =0 for all items	**Percentages(%) of Correspondents Responses**							
Descriptions about CFI Within Company in SCI operational activities in the case firms	***Significantly Low***	***Low***	***Medium***	***High***	***Significantly High***	***Not Applicable***	***Mean***	***Std. D***
1. Data integrations among	2.8%	18.3%	52.1%	22.5%	4.2%	0.0%	3.1	0.8

internal functional through inter-relationship and optimally								
2. Information system integration among internal functional units	1.4%	9.9%	60.6%	26.8%	1.4%	0.0%	3.2	0.7
3. Teamwork and inter - organizational coordination	4.2%	18.3%	46.5%	31.0%	0.0%	0.0%	3.0	0.8
4. Extents of integrations between productions and other functional departments of supply chain system	2.8%	15.5%	56.3%	21.1%	4.2%	0.0%	3.1	0.8
5. The extents of Integrations between quality , purchasing & sales department	1.4%	7.0%	54.9%	32.4%	4.2%	0.0%	3.3	0.7
6. Commitment of stakeholders in the processes of managing supply chain system operational activities	1.4%	15.5%	70.4%	12.7%	0.0%	0.0%	2.9	0.6
7. Periodic inter-departmental meetings and work flows evaluation	1.4%	32.4%	49.3%	15.5%	0.0%	1.4%	2.8	0.8
8. Inter-flows of supply chain activities and co-relations on managing operations of warehouse, suppliers , distributions in the firm	2.8%	22.5%	56.3%	15.5%	2.8%	0.0%	2.9	0.8
9. Pre-evaluations of various functional departments in the supply chain system	5.6%	9.9%	46.5%	32.4%	5.6%	0.0%	3.2	0.9
10. Readiness of supply chain participants for improvements and learn from each other to enhance operational productivity	1.4%	26.8%	52.1%	18.3%	1.4%	0.0%	2.9	0.8
11. Commitment of the coordination of various operational departments in the supply chain system	1.4%	8.5%	56.3%	26.8%	7.0%	0.0%	3.3	0.8
Averages of the Responses	**2.4%**	**16.8%**	**54.7%**	**23.2%**	**2.8%**	**0.1%**		

4.4 Average Correspondents Responses on Internal SCI Operational Activities in the case firms

N=71 & Missing Value =0	Correspondents' percentages (%) of Responses							
Descriptions about Internal SCI operational activities in the case of the firms	***Significantly Low***	***Low***	***Medium***	***High***	***Significantly High***	***Not applicable***	***Mean***	***Std. D***
1.Assure order –entry accuracy	1.4%	28.2%	47.9%	22.5%	0.0%	0.0%	3.2	0.7
2. Understand requirements of demand & constraints from suppliers stages	1.4%	2.8%	53.5%	35.2%	7.0%	0.0%	3.2	0.8
3. Design flexibility of production system to handle order patterns	1.4%	39.4%	40.8%	12.7%	5.6%	0.0%	2.9	0.7
4. The extents of production processes and automation	2.8%	7.0%	64.8%	19.7%	5.6%	0.0%	3.7	0.8
5. The extents of innovations to satisfy customers and stakeholders	1.4%	18.3%	66.2%	14.1%	0.0%	0.0%	3.0	0.7
6. Evaluate internal and external supply chain performance measurements to identify major causes and propose solutions	8.5%	22.5%	45.1%	23.9%	0.0%	0.0%	3.1	0.8
7. Management know how supply chain system can be effectively monitored	1.4%	12.7%	71.8%	14.1%	0.0%	0.0%	3.0	0.8
8. Practices of production flexible system to wards to market changes	2.8%	33.8%	40.8%	18.3%	4.2%	0.0%	3.0	0.8
9. Effective & Efficient resources utilization activities	2.8%	43.7%	39.4%	11.3%	2.8%	0.0%	2.9	0.6
10.Extents of automated quality control and supply chain system monitoring to meet objective of the company	1.4%	12.7%	64.8%	21.1%	0.0%	0.0%	3.1	0.7
11. Analyze demand and supply trends or the past period	1.4%	9.9%	28.2%	42.3%	18.3%	0.0%	3.2	0.6

operations in supply chain activities								
12. Coordinate various operational plans in supply chain system and evaluate their performances phase by phase	1.4%	22.5%	57.7%	18.3%	0.0%	0.0%	3.0	0.7
13. Understand , identify customers segments & create sooth co-operation to penetrate market	4.2%	25.4%	45.1%	23.9%	1.4%	0.0%	3.2	0.8
14. Monitoring lead time of delivery system in supply chain	2.8%	26.8%	49.3%	19.7%	1.4%	0.0%	3.0	0.8
15. Evaluation of unnecessary costs and control the system	1.4%	16.9%	67.6%	14.1%	0.0%	0.0%	3.1	0.8
Average	**0.2%**	**19.9%**	**52.6%**	**21.4%**	**3.8%**	**0.0%**		

4.5Average of Correspondents Responses on SC Information Integration in the case firms

N = 71 & Missing Value = 0	**Percentage's (%) of Correspondent's Responses**							
Description About SC Information Integration in the case firms	Significantly Low	Low	Medium	High	Significantly high	Not Applicable	Mean	Std. D
1.Capacity & capability information inter-flows within inter-functional departments	2.8%	9.9%	56.3%	28.2%	2.8%	0.0%	3.2	0.8
2. Sale data and sales forecast information delivered to customers and stakeholders efficiently	1.4%	33.8%	35.2%	29.6%	0.0%	0.0%	2.9	0.8
3. Flows of information within company –customers and in a time manner	2.8%	21.1%	54.9%	18.3%	2.8%	0.0%	3.0	0.8
4. Integrate information as sources of decision making in the supply chain system	2.8%	8.5%	43.7%	42.3%	2.8%	0.0%	3.3	0.8
5. Share the benefits of coordination equitably in supply chain system	2.8%	16.9%	40.8%	39.4%	0.0%	0.0%	3.2	0.8
6. Sharing of data on demand and supply plans with suppliers	2.8%	12.7%	64.8%	16.9%	2.8%	0.0%	3.0	0.7
7. Exchange on time order processes to manufacturing dep.t	1.4%	7.0%	70.4%	18.3%	2.8%	0.0%	3.1	0.6

8. Inter-flows of order entry time & accuracy	2.8%	25.4%	45.1%	22.5%	4.2%	0.0%	3.0	0.9
9. Processes of forwarding results of laboratory test to purchasing departments to	1.4%	7.0%	42.3%	35.2%	14.1 %	0.0%	3.5	0.9
10. Demand, order issues and productions processes coordination	1.4%	22.5%	62.0%	14.1%	0.0%	0.0%	2.9	0.6
Average	**2.3%**	**16.5%**	**51.5%**	**26.5%**	**3.2%**	**0.0%**		

4.6 Average Correspondents Responses on SC Suppliers & Customers Integration in the case firms

	N=71 & Missing Value =0	*Percentage's (%) of Correspondent's Responses*							
S.N	**Descriptions about Suppliers & Customers Integration in the case firms**	**Significantly Low**	**Low**	**Medium**	**High**	**Significantly High**	**Not Applicable**	**Mean**	**Std. D**
1	Joint product planning with major suppliers in supply chain system	1.4%	8.5%	54.9%	29.6%	5.6%	0.0%	3.0	0.7
2	level of cooperativeness with customers	1.4%	15.5%	59.2%	22.5%	1.4%	0.0%	3.0	0.9
3	Customer delivery adherence on time requirements	1.4%	31.0%	45.1%	21.1%	1.4%	0.0%	3.2	0.7
4	Compliance with customers' delivery in - full requirements	1.4%	4.2%	52.1%	36.6%	5.6%	0.0%	2.9	0.7
5	The level of cooperativeness with suppliers	1.4%	25.4%	57.7%	12.7%	2.8%	0.0%	3.3	0.8
6	Joint product planning with major customer in supply chain system	1.4%	9.9%	52.1%	25.4%	11.3%	0.0%	2.9	0.7
7	Production plan inter-flows conducted within each other	1.4%	9.9%	49.3%	32.4%	7.0%	0.0%	3.5	0.7
8	Market information interflows	1.4%	14.1%	49.3%	28.2%	7.0%	0.0%	3.5	0.5
9	Interaction on order receiving and supplying	1.4%	15.5%	57.7%	19.7%	5.6%	0.0%	2.9	0.7

	activities								
10	Design optimal and reliable channels to interchange key data	1.4%	28.2%	46.5%	21.1%	2.8%	0.0%	2.9	0.8
	Overall Average	***1.4%***	***16.2%***	***52.4%***	***24.9%***	***5.1%***	***0.0%***		

4.7A Average Correspondents Responses on SCPM regarding Response time in the case firms

N=71 & Missing Value = 0	***Percentage (%) Correspondents Responses***							
Descriptions about SCPM regarding Response Time	**Significantly Low**	**Low**	**Medium**	**High**	**Significantly High**	**Not Applicable**	**Mean**	**Std. D**
1.Replenishment lead time variability	1.4%	16.9%	52.1%	29.6%	0.0%	0.0%		
2. Processes of order fulfillment activities in various phase	1.4%	21.1%	59.2%	18.3%	0.0%	0.0%	3.1	0.7
3.On time delivery and customer satisfactions processes	1.4%	12.7%	70.4%	14.1%	1.4%	0.0%	2.9	0.7
4. Response time & customer requirements check list analysis	1.4%	19.7%	33.8%	40.8%	4.2%	0.0%	3.0	0.6
5. Develop schedule adherences in supply chain system	1.4%	4.2%	49.3%	33.8%	11.3 %	0.0%	3.3	0.9
6. Delivery speed and reliability in supply chain system	1.4%	25.4%	52.1%	21.1%	0.0%	0.0%	3.5	0.8
7. Monitor variability in delivery time processes	1.4%	22.5%	52.1%	22.5%	1.4%	0.0%	2.9	0.7
8. Manage Customer and product finalization contact points to improve continuality of competitiveness	1.4%	2.8%	47.9%	43.7%	4.2%	0.0%	3.0	0.8
9. Monitoring order time fulfillment processes in supply chain system	1.4%	15.5%	54.9%	23.9%	4.2%	0.0%	3.5	0.7
10. Warehouse monitoring in	2.8%	12.7%	47.9%	32.4%	4.2%	0.0%	3.1	0.8

an order processing time								
11. Order cycle time in the firm's supply chain system	1.4%	4.2%	63.4%	31.0%	0.0%	0.0%	3.2	0.8
12. Order turn over time variables	1.4%	11.3%	47.9%	38.0%	1.4%	0.0%	3.2	0.6
13. Monitoring cycle time as per pre-defined objective of the firm and customer specifications operations	1.4%	19.7%	57.7%	16.9%	4.2%	0.0%	3.3	0.7
14. Lost time due to accidents and failures or various system bottlenecks in supply chain & production system	2.8%	0.0%	53.5%	33.8%	9.9%	0.0%	3.0	0.8
15. Rates of orders delivered by requisite date in supply chain order receiving processes	1.4%	12.7%	60.6%	23.9%	1.4%	0.0%	3.5	0.8
Average	**0.00 %**	**21.50 %**	**50.01 %**	**22.90 %**	**3.10 %**	**0.00%**	**3.1**	**0.7**

4.7B Average Correspondents Responses on SCPM regarding Quality aspects in the case firms' operations

S/N	N= 71 & Missing Value =0	Percentages (%) of Correspondents' Responses							
	Descriptions on SCPMs regarding Quality aspects in the case firms' operations	***Significantly Low***	***Low***	***Medium***	***High***	***Significantly High***	***Not Applicable***	***Mean***	***Std. D***
1	Assure the supply chain system processes accuracy	1.4%	28.2%	50.7%	19.7%	0.0%	0.0%	2.9	0.7
2	Implementations of quality management system tools to make supply chain system processes free from errors	2.8%	23.9%	60.6%	9.9%	2.8%	0.0%	2.9	0.7
3	Apply optimal productions processes & evaluate the status	1.4%	12.7%	52.1%	32.4%	1.4%	0.0%	3.2	0.7
4	Assure the processes of various stage based on operational plans &customers need via optimal and minimum costs	1.4%	32.4%	56.3%	9.9%	0.0%	0.0%	2.7	0.6
5	Monitor order entry and invoice accuracies in supply chain system	1.4%	19.7%	36.6%	38.0%	4.2%	0.0%	3.2	0.9
6	Monitoring warehouse accidents and order fill rate process through	1.4%	14.1%	70.4%	12.7%	1.4%	0.0%	3.0	0.6

	active market data based								
7	Evaluating costs of delivery and unnecessary supply chain processes to improve productivity	2.8%	15.5%	70.4%	11.3%	0.0%	0.0%	2.9	0.6
8	An assessments of various operational quality management	1.4%	18.3%	54.9%	25.4%	0.0%	0.0%	3.0	0.7
9	Proper assuring of the Supply chain key activities from raw material to end product commencements	1.4%	2.8%	70.4%	25.4%	0.0%	0.0%	3.2	0.6
	Average	***1.7%***	***18.6%***	***58.1%***	***20.5%***	***1.1%***	***0.0%***		

4.7C Average Correspondents Responses on SCPM regarding Costs

S/N	Descriptions about SCPMs regarding Costs aspects in the case firms' operations	Percentages(%) of Correspondents' Responses							
		Significantly Low	Low	Medium	High	Significantly High	Not Applicable	Mean	Std. D
1	Costs incurred due to poor processes & procedures in supply chain system of your firm	4.2 %	18.3 %	64.8 %	12.7 %	0.0%	0.0%	2.9	0.7
2	Expenses due to damaged products and resources in warehouse (poor inventory mgt.)	2.8 %	7.0%	67.6 %	22.5 %	0.0%	0.0%	3.1	0.6
3	Evaluations of unnecessary delivery costs and other incurring supply chain system related failures costs	2.8 %	35.2 %	53.5 %	8.5%	0.0%	0.0%	2.7	0.7
4	Expenses incurred due to poor product quality that delivered	11.3 %	49.3 %	39.4 %	0.0%	0.0%	0.0%	2.3	0.7
5	Expenses those may incurred due to lack of good coordination between supply chain functional departments	2.8 %	1.4%	60.6 %	29.6 %	5.6%	0.0%	3.3	0.7
6	Inventory related and excess stock expenses in supply chain operational system in the firm	2.8 %	18.3 %	63.4 %	12.7 %	2.8%	0.0%	2.9	0.7
7	Capacity shortfall costs / expenses/	5.6 %	29.6 %	63.4 %	1.4%	0.0%	0.0%	2.6	0.6
8	Costs incurred due to poor managements at various supply chain	2.8 %	12.7 %	53.5 %	29.6 %	1.4%	0.0%	3.1	0.8

	system operational stages								
9	Costs due to unusable & unaccounted stocks	2.8 %	26.8 %	66.2 %	4.2%	0.0%	0.0%	2.7	0.6
10	Supply chain Internal failures costs	2.8 %	0.0%	56.3 %	40.8 %	0.0%	0.0%	3.4	0.6
11	supply chain system external failures costs	4.2 %	35.2 %	60.6 %	0.0%	0.0%	0.0%	2.6	0.6
	Average	4.1 %	21.3 %	59.0 %	14.7 %	0.9%	0.0%		

4.7D Average Correspondents Responses on SCPM regarding Flexibility and Reliability in the case firms' operations

	N=71 & Missing Value =0	**Percentage(%) of Correspondents' Responses**							
S/N	***Descriptions about SCPMs regarding Flexibility & Reliability in the case firms operations***	***Significantly Low***	***Low***	***Medium***	***High***	***Significantly High***	***Not Applicable***	***Mean***	***Std. D***
	Operations for meeting demand fluctuations	1.4%	1.4%	64.8 %	31.0 %	1.4%	0.0%	3.3	0.6
1	Develop schedule adherences in supply chain system via analysis of current market situations	1.4%	2.8%	46.5 %	40.8 %	8.5%	0.0%	3.5	0.8
2	Product families , packaging and versus resource utilizations	1.4%	8.5%	43.7 %	43.7 %	2.8%	0.0%	3.4	0.7
3	Analyze Plan versus actual in production system & take corrective measurements on negative factors.	2.8%	12.7 %	62.0 %	22.5 %	0.0%	0.0%	3.0	0.7
4	Monitoring variability in production system	1.4%	32.4 %	50.7 %	14.1 %	1.4%	0.0%	2.8	0.7
5	Degree to meet customers' perceptions in every aspects	1.4%	5.6%	69.0 %	22.5 %	1.4%	0.0%	3.2	0.6
6	Proper resource utilization in supply chain system activities in the company	4.2%	18.3 %	63.4 %	14.1 %	0.0%	0.0%	2.9	0.7
7	Readiness for responding customer requirements	1.4%	1.4%	25.4 %	62.0 %	9.9%	0.0%	3.8	0.7
8	Analysis of an optimality of the planning in various supply chain	4.2%	11.3 %	49.3 %	29.6 %	5.6%	0.0%	3.2	0.9

	operations								
9	Culturing the flexibility based on customers' orders	2.8%	12.7 %	63.4 %	16.9 %	4.2%	0.0%	3.1	0.8

Appendix V: Regression Analysis

Parameter Estimates on Regression Analysis of Multivariate							
						95% Confidence Interval	
Dependent Variable	Parameter Independent Variables	B	Std. Error	t	Sig.	Upper Bound	Lower Bound
SCPM response time aspects	Intercept	.365	.218	1.677	.050	.800	-.070
	SIwC	.005	.104	.048	.962	.212	-.202
	CIwC	.136	.103	1.310	.195	.342	-.071
	SCIOI	.019	.119	.161	.872	.258	-.219
	SCCFI	-.135	.095	-1.419	.161	.055	-.326
	SCII	.281	.125	2.252	.028	.530	.032
	CIwS	.575	.099	5.805	.000	.772	.377
SCPM quality aspects	Intercept	.374	.326	1.147	.025	1.025	-.277
	SIwC	.120	.155	.774	.042	.431	-.190
	CIwC	-.037	.155	-.239	.812	.272	-.346
	SCIOI	.037	.179	.209	.835	.394	-.319
	SCCFI	-.114	.143	-.800	.427	.171	-.399
	SCII	.438	.187	2.343	.022	.811	.064
	CIwS	.423	.148	2.857	.006	.719	.127
SCPM cost aspects	Intercept	2.889	.374	7.733	.000	3.636	2.143
	SIwC	-.051	.178	-.284	.777	.305	-.406
	CIwC	-.020	.177	-.114	.909	.334	-.375
	SCIOI	-.211	.205	-1.029	.307	.198	-.619
	SCCFI	.197	.164	1.203	.234	.523	-.130
	SCII	-.043	.214	-.200	.842	.385	-.471
	CIwS	.148	.170	.873	.386	.488	-.191
SCPM reliability and flexibility aspects	Intercept	2.187	.522	4.188	.000	3.231	1.144
	SIwC	.213	.249	.856	.395	.710	-.284
	CIwC	.229	.248	.922	.360	.724	-.267
	SCIOI	.222	.286	.777	.440	.794	-.349
	SCCFI	-.195	.229	-.854	.397	.262	-.652
	SCII	.116	.299	.387	.700	.714	-.482
	CIwS	-.323	.237	-1.360	.179	.151	-.797

*** CIwS = customers integration with suppliers, SCII =supply chain information integration, SCCFI =supply chain cross functional integration, CIwC = customers integration with company, SIwC = suppliers integration with company*

ANOVA Analysis on SCPM (Response time Aspects with SC integration)

ANOVA[a] Analysi						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.710	6	.618	31.705	.000[b]
	Residual	1.248	64	.020		

	Total	4.959	70			

Appendix VI: Down Time and Wastages in SC Operational Activities

	1-6 months production system operational reports								
		Case Company A ½ Operational Report					*Case Company C ½ Operational Report*			
S/N	*Month*	*Time (hours*	*etti Film Wastage*	*Sweeping Pasta (Qt)*	*Sweeping Flour (Qt)*		*Time (hours*	*etti Film Wastage*	*Sweeping Pasta (Qt)*	*ping Flour*
1	*September*	*126.18*	*19.5*	*217.2*	*39*		*154.2*	*90.5*	*17.2*	*98*
2	*October*	*160.3*	*21.3*	*113.5*	*23.9*		*188.1*	*121.3*	*213.5*	*201.2*
3	*November*	*113.9*	*39.1*	*33.41*	*76.1*		*192.3*	*89.1*	*133.71*	*29*
4	*December*	*96.7*	*90.8*	*119.6*	*103.4*		*137.4*	*67.8*	*114.9*	*38.7*
5	*January*	*102.4*	*109*	*148*	*29*		*197.34*	*98.7*	*214.8*	*129.3*
6	*February*	*149.1*	*78.7*	*53.5*	*82.7*		*164.15*	*56.9*	*153.5*	*93*
	Total	*748.58*	*358.4*	*685.21*	*354.1*		*1043.94*	*524.3*	*847.61*	*589.2*
		Case Company B ½ Operational Report								
1	*September*	*146.6*	*56.7*	*213.2*	*139*					
2	*October*	*160.76*	*121.3*	*213.5*	*33*					
3	*November*	*117.9*	*239.1*	*133.41*	*299*					
4	*December*	*196.5*	*290.8*	*111.6*	*163.4*					
5	*January*	*171.1*	*109.8*	*148.9*	*329*					
6	*February*	*187.9*	*178.4*	*253.5*	*89.1*					
	Total	*980.76*	*996.1*	*1074.11*	*1052.5*					

Appendix VII: Summary of SC Activities' Unnecessary Expenses

	Case Company "A"				Case Company "B"			
Unnecessary Expenses in SC operational System	Time span				Time span		Time span	
	2018/2019		2019/2020		2018/2019		2019/2020	
	1-6 month	6-12 month	1-6 month	6-12 month	1-6 month	6-12 month	1-6 month	6-12 month
Maintenance and repair costs	54100.8	4949.6	34529	45782.7	17980	23455	51018.2	42671.3
Planning the ways of SC quality problem controlling	4345	2314.3	5641	6724	1902	11017	4512.85	9001.9

cost								
Prepare and give train costs Conducting preventive	4568	2989.45	23401	17001	9003.9	7813.2	1673.1	9123.8
For Processes review costs	8912	5641	1121.9	9000.89	4568	9011.35	12317.9	9134.2
Frequently purchasing items in stocks costs	34521.8	789	2341	902	1891	8971.35	25146.5	
Suppliers certification expenses	541	8701	781	1101	8912			1231
For Conduct Product auditing costs	3451	8712	8924.0	8911	2312	8914	9341	9127
Testing to refine poor quality in SCOs	1009	3452	1901		6753	2945	887	2212
Checking final product	890		7810	1243		8961		9231.0
Customers' expectations analysis	7811		6712.9	11615		7716.3		9012
Lost sales opportunities	15569.5	34561	17812	44562	23141	12139	51284	19088.1
Costs incurred due to reworks	5431.9		6756			8934		9034
Corrective measurement actions for poor SC activities	12315	1675		8971		1898		6734
Supplying problems and late deliveries	13542	7823	11872	23215	8714	9013	41231	19183
Accidents and injures	13516			19191.4		15561		
Order processes costs in SC operational system	4531	1002.0	900.2	1290	671.9	892	1201	1000.9
Supply chain system failures expenses	17881	19823	23151.5	10983	23726	11091	90234	21425
Missed schedule SC system expenses	7627	12354	15432	7865	9836	4526.25	2718	2192.0
SC system Processes Down Time costs/expenses	26615.7	342671.6	432651	15647	19073	31234	42094	21342
Poor coordination of SC operations related costs	5624.8	7682.2	17181	1191	6771	7821	6753.0	11231
poor suppliers -customer coordination	6712	8971	8171	6134	7134	9911	1199.6	
Lost sales opportunities	6756	11238	2515.9	7865	8974.7	6151.8	1765	18975
Raw material problems or impurity costs	1126	5423	3456	9801	917	786	6754	9002