



**ADDIS ABABA UNIVERSITY  
ADDIS ABABA INSTITUTE OF TECHNOLOGY**

**SUPPLY CHAIN INTEGRATION PERFORMANCE MEASUREMENT  
AND IMPROVEMENT  
(CASE STUDY: HIBRET MANUFACTURING AND MACHINE  
BUILDING INDUSTRY)**

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**SUPPLY CHAIN INTEGRATION PERFORMANCE MEASUREMENT  
AND IMPROVEMENT**

**(Case study: Hibret Manufacturing and Machine Building Industries).**

**By**

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**School of Mechanical and Industrial Engineering**

This is to certify that the thesis prepared by: **Tewoldual Temesegen**, entitled: **Supply Chain Integration Performance Measurement and Improvement in HMMB** and submitted in partial fulfillments of the requirements for the degree of Master of Science (Mechanical and Industrial Engineering) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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For Post graduate programs

## **Declaration**

I hereby declare that the work which is being presented in this thesis entitled “Supply Chain Integration Performance Measurement and Improvement” A case study in Hibert Manufacturing and Machine Building is original work of my own, has not been presented for a degree of any other university and all the resource of materials used for this thesis have been duly acknowledged.

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## **Abstract**

*Ethiopian metal manufacturing and machine building industries, is characterized by very low level of supply chain integration, poor export capacity, poor production capacity, and poor performance.*

*Generally, the aim of this research study is to measure SCIP and finally to propose supply chain integration performance measurement and Improvement approach model to HMMBI.*

*To accomplish the objective, the researcher conducted a literature survey review of Supply Chain integration, the current understanding of supply chain integration, factor of SCI, different supply chain integration performance measurement model and the study creates a framework for supply chain integration measurement to improve its performance.*

*The collected data have been summarized using descriptive analysis method and analyzed by a statistical tool. Furthermore, the relationship in the SCOR model were tested using Spearman's correlation coefficient, and the regression analysis was used to analyze causal relation and to check the fitness SCOR model with data.*

*The majority responses in descriptive statistics results shows that average mean value 2.72 signifies agreement by the respondent this show that supply chain integration was very rarely practice in the case company. Furthermore artificial neural network algorithm analysis results a high number of neurons in the hidden layer indicate that SCI in HMMBI was very poor.*

*The correlation result shows that there is strong correlation ( $\rho=0.78^* - 0.921^*$ ) between supply chain integration and its performance factor metrics and the relationship is statistically significant.*

*Regression analysis confirm that the relative contribution SCI metrics factors is 65.9%-100% of variability supply chain integration performance explained by each factor metrics at (planning100%, sourcing100%, making 89.3%, delivery 65.9%, and returning100%). From the whole metrics remaining 8.2% change in change can be attributed to other factors.*

*In general, to check model fit the data different test was done on regression analysis Durbin-Watson test, R square value test, adjusted R square value test, tolerance test, variance inflation factor test, b-value test, and multicollinearity test. The proposed factor metrics measure 90.8% of supply chain integration performance. Finally, the researcher proposed SCIP Measurement and Improvement Approach model for HMMBI based on SCOR model.*

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## **List of Acronyms**

|               |  |
|---------------|--|
| <b>BSC</b>    | Balanced Score Card                                    |
| <b>ICT</b>    | Information and Communication Technology               |
| <b>ITI</b>    | Information Technology Integration                     |
| <b>VIF</b>    | Variance Inflation Factors                             |
| <b>HBMS</b>   | Hierarchical Based Measurement Systems                 |
| <b>HMMBI</b>  | Hibret Manufacturing and Machine Building Industry     |
| <b>PM</b>     | Performance Prism                                      |
| <b>PM</b>     | Performance Pyramid                                    |
| <b>PMS</b>    | Performance Measurement System                         |
| <b>SCI</b>    | Supply Chain Integration                               |
| <b>SCIP</b>   | Supply Chain Integration Performance                   |
| <b>SCIPMM</b> | Supply Chain Integration Performance Measurement model |
| <b>SPSS</b>   | Statistical Package for Social Science                 |
| <b>WB</b>     | world Bank   |

## **Chapter One**

### **Background and Justification of the Study**

#### **1.1 Introduction**

In today's turbulent world market fierce competition, the rapid creation of new products with shorter life time, increase customer satisfaction and ongoing development of communication technologies and information have forced business to invest in and direct attention to their supply chains integration (Fasika, 2013). Increasing profitability and reducing cost has always been of great concern to organizations that competing on a market. There is a high pressure on businesses to decrease costs and enhance customer satisfaction levels in order to remain in competitive position. This pressure is no exception for the manufacturing industries in developing countries specially in Ethiopia in some cases it is fiercer.

To address the above problem, companies integrate with supply chain partner to stay in a competition.

A supply chain (SC) is value adding activities concerning with the planning, controlling of the raw materials and finished products from suppliers to customers (Stevens G, 1989). Cost minimization is a traditional view of Supply chain management while assuring service level and quality throughout the supply chain. The reason for the increased focus in SCM is widely due to the complex business environment in which companies compete. Now a day Markets have become far more turbulent and dynamic with more segmented that customers have rapid various requirements for products (Jespersen & Skjott, 2005).

In addition, rapid change requirements on companies from a market to deliver multiple varieties product and provide required solutions of services and products are increasing. In addition, global competition has given pressure on industries to become better, cheaper and faster (Jespersen & Skjott, 2005). This indicate that many companies use outsourcing as a strategy. Difficulty and cost to produce the needs exclusively on their own (Gunasekaran et al, 2001). This give emphasis to build strong relationships companies with different actors in the chain in addition to satisfy customer need and to stay competitive.

Companies want to invest on Supply Chain and resources to give services and products to the market at the lowest possible cost and faster, with well-mannered product and service (Gunasekaran et al, 2001). According to (Flynn et al, 2009) supply chain integration have three dimensions: external integration that include supplier and customer which is in what level to

which a company's partners with their external partners to structure strategies of inter-organizational, processes and practices into synchronized processes collaborative.

The required factor to provide integration among different supply chain partners that focus mainly on information sharing, communication, coordination, empowerment, relationship commitment collaboration and cooperation in the processes of design and products, and joint decision-making, (Cigdem Atasevena, 2017).

According to (Xu, 2006) suggested that Coordination process is a set of methods used to manage mutually dependent in the position an companies. The system of coordination that provide tools fundamentally to manage these interactions.

According to (Prajogo, 2009) Information integration define as sharing of important information along the customer, supplier, and intra-organization that is being able by information technology. The main significance that integration of information is to take out real-time duration and processing of information required for SC decision making process.

In present the business are forcing the organization to improve and examine their system of management due to, increasing companies competition and change of external need (Michaela, 2012). According to (Taticchi, 2010, p. 2) "Measurement has been recognized as a crucial element to improve supply chain business performance". Now a day Performance measurement framework and factors metrics have gained much attention from researchers (Gunasekaran et al, 2004). From the above arguments we can improve and facilitate the whole performance across the supply chain by identifying SCI metrics factors.

Mostly supply chain performance measurement are important to evaluate the effectiveness of police in SC and to identify success factor in the future (Rolstands, 1995).

According to (Fasika, 2013) Supply chain integration and performance has not effective contribution, still now the Ethiopia supply chain performance increasing failure rate of 56% and export market firms (30%) but the local market firms (70%) From those majority being, food 19%, beverages 22%, chemicals 19%, leather products 11.3% and but metal manufacturing and metal products industry (9%) industries.

According to (Amlan Bora, 2004) Performance measurement provides the means by which a company can assess whether its supply chain has improved or degraded. It is only by means of performance measurement that one can see how much one is behind or ahead of its competitors.

Researchers and practitioners initially concentrated on the business performance, definitions for measurement, measures and measurement system (Neely et al, 2005).

In this global world Competitiveness like quicker customer responsiveness quick delivery to the customer has forced technologies and to develop new system a (Chan F. C., 2006). Competition creates big challenges for the member of supply chains and for each individual business partnership (Lee H. C., 2002). The other challenge is coordination involving and participants of different activities are the big challenge in management (Holmberg, 2000).

Generally the aim of this research study was to measure supply chain integration performance and develop improvement model in Hibert Manufacturing and Machine Building Industry(HMMBI). The paper begins by: (a) review the literature on supply chain integration performance measurement, (b) selecting proper methodology tools, and (c) discuss the empirical findings.

## **1.2 Statement of the Problem**

According to (Harland, 1996) Poor Supply chain integration performance can reduce partners shareholder value 8 to 10%. Supply chain integration performance has declined at an alarming rate resulting to decrease in global GDP to up to 4.7% (World, 2013). This indicate that identifying proper indicators and measuring supply chain integration performance is important to improve companies performance.

In Ethiopia, the concept of supply chain integration and measuring its performance for improvement is at infant stage. The existing practices of supply chain integration and performance measures, in Ethiopian manufacturing industries specially the metal manufacturing companies are very minimum (Fasika, 2013).

Mostly the research on supply chain integration and SC performance measurement concerns developed countries but in developing countries, there is a lack of significant study on measuring supply chain integration performance practices. According to (Alie, 2016) the metal manufacturing industry mainly focused on, improving efficiency and Effectiveness of Individual industries ,infrastructure and master planning. However, researchers to study SC integration issues in the metal manufacturing industry are paid little attention.

Ethiopian manufacturing industry, is characterized by lowest level of product quality, very low level of supply chain integration, poor export capacity, poor production capacity, and poor performance, such as metal manufacturing industries. Long lead times for orders, late delivery

time ,and shortage of hard currency in the business relative to increased world metal manufacturing and metal product prices the cause supply shortages (Muzeyin, 2014).

In spite of companies and managers' recognition of supply chain integration, they often lack the ability to develop effective supply chain integration performance measures and metrics (Gunasekaran et al, 2001). Most company measures focus on financial values, instead of presenting information of how key business processes perform or how well customer requirements are met within the supply chain (Lambert, 2001).

According to (Fasika, 2013) still now Ethiopia manufacturing industry, specially metal and metal product industries is relatively very low 9% SC performance. According to (Neely et al, 2005) Using traditional metrics is often problematic since they lack strategic focus and are not integrated.

This study addresses the gap by describing a proper methodology for measuring supply chain integration performance and Develop SCIP improvement approach based on company data by integrating appropriate holistic model and several statistical approaches.

### **1.3 Research question**

R1 What are the key factors that affect the supply chain integration performance of Hibret Manufacturing and machine building industry(HMMBI)?

R2 What is the current level of supply chain integration performance within Hibret Manufacturing and Machine Building Industry (HMMBI)?

R3 which conceptual model should be considered to measure supply chain integration performance for Hibret Manufacturing and Machine Building Industry (HMMBI)?

R4 What should be done to improve supply chain integration performance in Hibret Manufacturing and Machine Building Industry?

### **1.4 Research Objectives**

#### **1.4.1 General Objective**

The main objective of this study is to improve supply chain integration performance in Hibret Manufacturing and Machine Building Industry (HMMBI) .

### **1.4.2 Specific Objectives**

1. To investigate existing supply chain integration system of the Hibret Manufacturing and Machine Building Industry (HMMBI)
2. To identify the factors affecting the integration of supply chain performance
3. To develop suitable supply chain integration measurement system Hibret Manufacturing and Machine Building Industry (HMMBI)
4. To identify appropriate supply chain integration performance measurement model in Hibret Manufacturing and Machine Building Industry (HMMBI).
5. To propose a solution and develop a model which improves the supply chain integration performance in Hibret Manufacturing and Machine Building Industry (HMMBI).

## **1.5 Scope and Significance of the Research**

### **1.5.1 Research Scope**

The scope of this research is investigating the current supply chain integration performance from the perspective of supply integration, internal integration and customer integration and its effect in Hibret Manufacturing and Machine Building Industry (HMMBI).

The scope put boundaries on the study so that it objectively concentrates on research questions. SCI is a broad field of research therefore achieving expected results requires concentration on research questions.

The study uses SPSS tools to do descriptive statistics, correlation, and regression analysis .

The detail research work going on through identifying SCIP metrics factors, supply chain integration performance measurement, and improvement .

### **1.5.2 Significance of the Study**

Measuring supply chain integration performance in Ethiopian manufacturing industries are very essential especially for case company. Conducting research on supply chain integration performance measurement practices and identifying gaps will enable firms to plan improvement actions and to fill their gaps.

The findings of the study will also serve as a stepping-stone for future researchers on similar topics by suggesting areas that need further studies to be conducted.

## **Chapter Two**

### **Related Literature Review**

#### **2.1 Introduction**

In this section, the relevant literatures were explored in order to provide background information about the research. The literature review covered three main topics. The first deals with Supply Chain Management (SCM), the second with supply chain integration and the third with the supply chain performance. It looks the challenges of SCI performance, provides a summary of the main items and then identifies the literature gap.

##### **2.1.1 Definitions of Supply Chain**

Now a day many companies are forced to maximize their market share globally in order to survive. The challenge is how to expand the global logistics and distribution networks in order to ship products to customers who demand them in a dynamic and rapidly changing set of channels.

The term Supply chain defined in different ways by different scholars. For instance, (Christopher M, 1998) Supply chain the organisations network structure that are participated , through the connection of upstream and downstream , in the various value adding processes and actions in the form of services and products in the hand of customer. According to (Ballou, 2004) Supply chain is the flow of different goods, products raw materials and services, activities related with the change greatly and such as among their attendant communication level, information flows, from the supplier of raw materials to end customer .

According to some scholars definitions about Supply chains ,it is not only single company activities rather to that involving with different supply chain partner important in order stay competitive . according to (Shapiro, 2001) SC geographically comprises and dispersed facilities where raw material, intermediate products .

##### **2.1.2 The Concept of Supply Chain Management**

Many companies have aware the importance of supply chain integration and relationship with suppliers, organization and customers. Simultaneous integration of internal processes, customer requirements, and the performance of supplier is referred to as SC management (Tan, 1999).

### **2.1.3 Supply chains and supply chain management**

Always supply chain can be described in the terms of upstream(supplier) and downstream(customers) flows.

(Christopher M, 1998) in the same way definition SC. He defines that management supply chain of upstream and relationships with suppliers and customers to deliver the customer by less cost and high quality to the SC as a whole.

When we see the two scholars definitions both are stated that downstream customers , upstream suppliers and internal functions, included in the supply chain network. All organisation along the supply chain leads to process efficiencies that change into minimum cost better quality products, and enhance customer service. Consequently , it is clear that the result SCM connect context measurement achieve , In similar situation taking account of the whole SC goals and the metrics to be used. These represent a balanced approach, be classified at, tactical ,operational and strategic levels, and in addition as including financial and non-financial measures (Gunasekaran et al, 2001) . According to (Stewart, 1995) an integrated supply chain consists of four links: 1) plan 2) source 3) make//assemble and 4) delivery/customer.

## **2.2 Supply chain integration**

SC integration means the co-operation and coordination between more functions in the SC. The supply chain integration can be defined as (Sillanpää, 2010, p. 38) the extent to companies collaborates with its business partners and proper manages external and internal companies processes orderly to success effective and efficient flows of information, services, products, money and decisions.

### **2.2.1 Defining Integration**

The Dictionary definition the word that integration as combination of (one thing) with another to form a whole. According to (Bagchi et al, 2002, p. 4) define as integration define as integration the state of quality cooperation that exists belong to organization that are requested to success unity of performing by the need of the people.

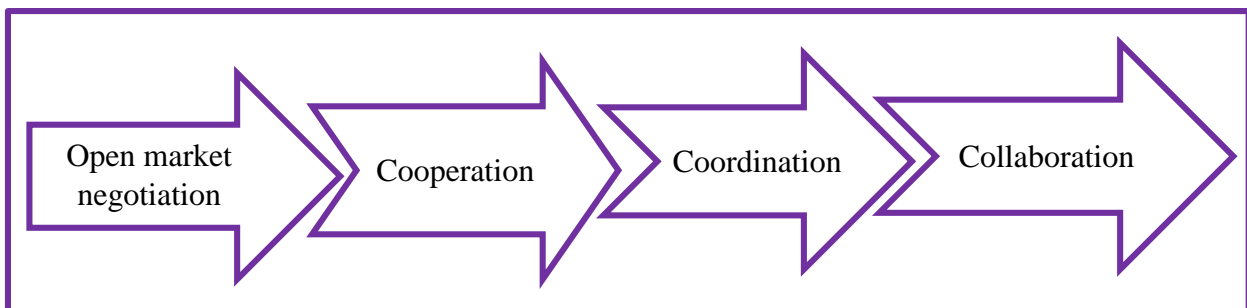
According to (Bagchi et al, 2002) Integration was classified into six different type internal integration, customer integration, material and serve supplier integration technology and planning integration measurement integration and relationship integration “the quality of the

state of collaboration that exists among departments that are required to achieve unity of efforts by the demands of the environment”.

### **2.2.1 Theoretical Background of Supply Chain Integration**

In capable of competing environment, maximizing the level of partnership among businesses Organisation is required. (Spekman, 1998) partnership development have three stages, starting from cooperation, to coordination, and then to collaboration. Cooperation is important concept to build relationship and to exchange essential information and to engage some suppliers into a long-term contract cooperation is a starting point for supply chain management and it has become a necessity for business. However, it is not a sufficient condition.

The second stage is coordination by which specifying information and material are trading among partners . It is not enough (sufficient) condition for integration due to the lack of integrated information flow however it is important. Sometimes SC integration created by highest level, collaboration, that requires all SC trading member partners throughout the SC become integrated into their suppliers’/customers’ processes (Spekman, 1998). From coordination to collaboration or integration requires high levels of trust and information sharing among partners.



*Figure 2.1: the development of the supply chain integration. Source: (Spekman, 1998)*

### **2.2.2 Defining Supply Chain Integration**

Supply chain integration concept has recently gained wide extent attention in supply chain literature (Gimenez, 2012). It is specifically directly related as the complexity of business environment requires company to work in a more cooperative characteristics to smooth the flow of information and resources between supply chain a member of business activity (Lee H. , 2000).

Companies are now under increased pressure to integrate their supply chains to become more competitive in order to meet the challenges of current business needs.

Finally attempt to achieve effective and efficient flow products and services, money and decisions, information flow, to get greatest value to customer with in high speed and low cost. Many researcher agree that the concept of SCI is still not well defined in depth literature and this show that lack of agreement on its constructs (Bagchi et al, 2002).

SC integration has operational and strategic importance business partner to become more competitive (Pagell, 2004) . Many researchers agreed SC integration have positive effect on firms performance. According to (Narasimhan, 2002) Integrated SC have cost reduction, maximize shareholders ,quick delivery , improve efficiency and coordination increase the value business partners benefits. This efforts create a capability (Koufteros, 2010). However , the validity of integration was questioned by some researchers (Cousins, 2006).

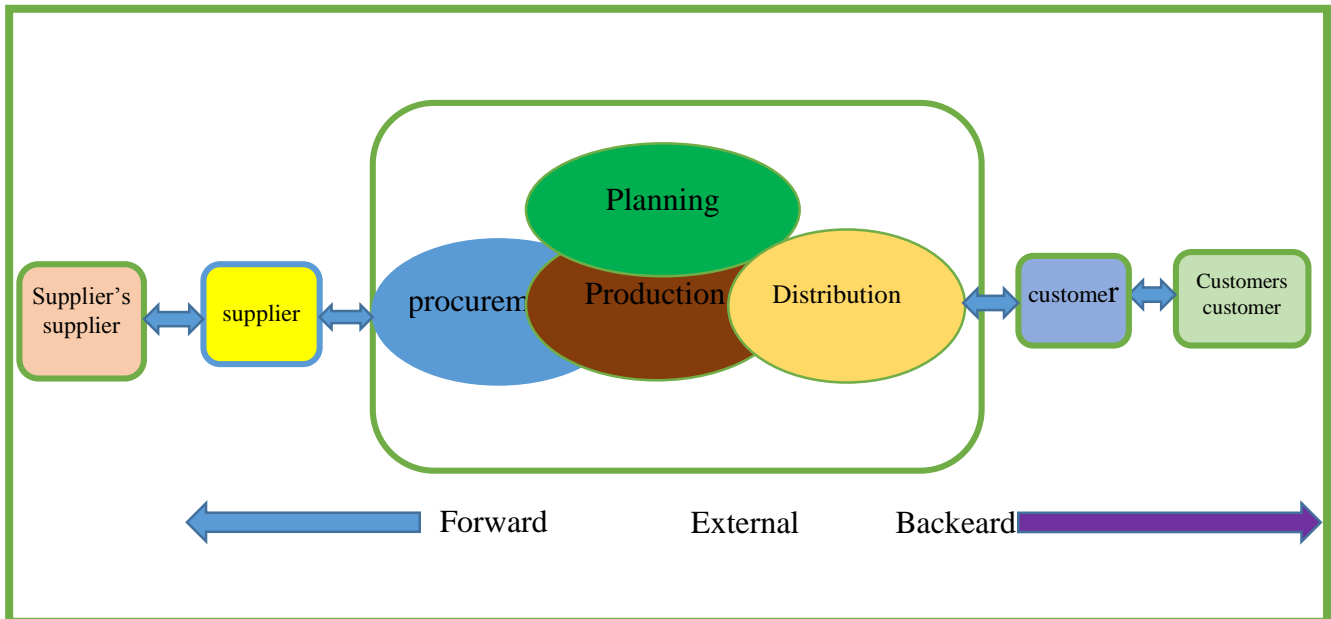
According to (Flynn et al, 2010) final verifiable result imply during improvement business and operational performance external supplier integration have effect on it .

(Das, 2006) Highlighted related to costs integration with suppliers like the costs of coordination, inflexibility and find supplier integration not important to improve the firm performance.

According to (Cousins, 2006) the potential benefits of SC integration has costs reduction but doesn't improve the supplier's operational performance.

nevertheless, in their view of SC integration was limited to supplier integration and fail the importance of customer integration and internal integration. Recently researcher (Gimenez, 2012) argue that SC integration is various dimensional SC integration the most important into three dimensions: supplier, internal, and customer.

According to (Fasika, 2014) the concepts of SC integration, importance has benefits, on cost reduction and minimize challenges of integration. Manufacturers especially must give to high attention to integrate at sourcing, supplier to synchronize with customer need, by reducing overall cost.



*Figure 2.2: Supply chain integration sourced fasika 2014*

### **2.2.3 Direction of Integration**

There are two obvious directions of integration: forward integration and backward integration (Trent, R.J, and Monczka, R.M., 1998). Forward integration refers to integration with customer while backward integration, represents integration with suppliers. Although integration could include several members of a supply chain, in reality, the dyadic integration is the most common. On the other hand, close relationship with suppliers can not only lead to better supplier performance, but also to improved manufacturing as well as product and process improvements which, in turn, can increase customer satisfaction.

### **2.2.4 Stages of Integration**

Several researchers tried to define, about the different stages of integration. (Stevens G. , 1989), defined the four stages of integration.

The first Stage describe about the functional independence and is typical for different companies that represents responsibility for activities in the supply chain to separate departments.

This first stage is characterized by:

- Company short-term planning.
- Always incompatible and independent procedures

- Organizational boundaries - purchasing control the incoming material flow, production would control flow from raw material to finished goods .
- Poor visibility of real customer demand - customer service is still reactive.
- The second stage involves functional integration with the focus mainly on the inward goods flow. This stage is characterized by:
  - Separate business functions
  - Inadequate planning and generally poor performance - focus on cost reduction rather than performance improvement.

The third stage describe that it is recognized that there is no point to only focusing on the inward flow of goods into the organization unless the flow is appropriately managed on the way to the customer.

Generally this stage, focus on integration activities that are company control and embraces direct outwards goods management, balancing supply and demand within the company's own chain. Internal integration include activities planning and control the overall system. The third stage is characterized by:

- Give attention on efficiency rather than effectiveness.
- Medium-term planning -focus on tactical rather than strategic issues.
- Broad use of EDI to facilitate faster customer response, yet reacting to customer demand rather than managing the customer.

In fourth stage , the Integration scope is increase the extent of suppliers and customers. This stage mainly focus on the change product-orientation to being customer-orientation. The attitude is altered away from adversarial to mutual support and cooperation.

The fourth stage is characterized by:

- Technology exchange and design support.
- Shared information on products, process and specification changes.
- A focus on strategic rather than tactical issues.

### **2.2.5 Areas to integrate**

The aspects of what to integrate and whom to integrate with are relatively poorly covered in the literature. According to (Fabbe et al, 2007) the integration areas classified into four flows (financial ,information and physical), technologies and systems, processes and activities, and integration of (structures and organizations).

### **2.2.6 Enablers of Supply Chain Integration**

Coordination ,collaboration , Information and communication technology (ICT) cooperation is the most enabler of efficient SC integration.

Now a day applications Information and communication technology (ICT) gained popular. This indicate that ICT help to coordinate and facilitate the flow of information across the SC (Fasika, 2014). In developed country applications Electronic Data Interchange (EDI), Internet and Enterprise Systems are largely used. But in developing country is a little bit.

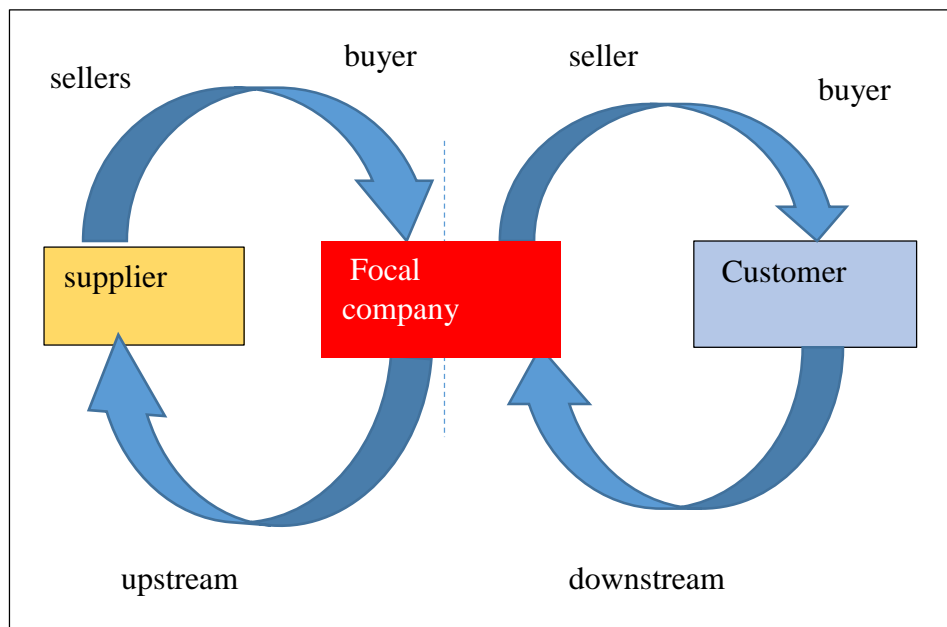
### **2.2.7 Main Drivers of Integration**

The main drivers of integration are listed by as: (Damien, 2005)

- The information revolution;
- increased levels of global competition creating a more
- demanding customer and demand direct driven markets; and

### **2.2.8 Upstream and Downstream Integration**

Upstream and downstream integration include external integration (supplier), internal integration (company) and customers. Most researcher give special attention to describe Integration with upstream suppliers and downstream customers .



**Figure 2.3:** Illustration of supply chain data acquisition process sourced from (Spekman, 1998)

Integration among supply chain partners mainly focus Information sharing, coordination, collaboration, Cooperation, and joint decision-making are while whose are factor that affecting supply chain integration during in design of processes and products (Cigdem Ataseven, 2017).

In literature revelation of external SC integration have two major areas prominences.

- Customer integration
- Supply integration.

The both focus on change in attitude away from conflict to coordination communication, and cooperation, starting from product development, sourcing high quality products, delivery instead of price, information on process and specification change, the exchange technology and design support (Baharanchi, 2009).

Some researchers have investigated supply-side integration in different dimensions according to (Power, 2005) supply chain integration have different dimensions that obtained from often deliveries in small amount, using one or more than one supplier sources, evaluating the other supplier sources on the based on those product quality trust, relationship commitment, and delivery time and product price, by considering the dimension of integration we can establish long-term contracts with suppliers.

### **2.2.9 Levels and Components of Supply Chain Integration**

Based on previous literature study on SC integration has two broad levels

- External integration
- Internal company integration.

External integration concentrated on the integration of business partner with its suppliers and customers (Schoenherr, T. and Swink, M, 2012)

Internal company integration focus on integration of the internal production process and supporting functions financing, management in the organisation.

### **2.2.10 External Supplier and Customer Integration**

External integration refers to the integration of the company with its external environment including customers and suppliers (Flynn, 2010). The main element of external are customer integration and Supplier integration (Cigdem Ataseven, 2017).

According to (Stank, 2001) external integration defend as the relationship between manufacturer partners and external partners to build inter-organizational strategies, practices and process to synchronize the processes.

In the literature external integration has studied in different perspectives. Some of them are studied external integration in terms of supplier integration and some of them external integration with company (e.g. (Ragatz, 1997). The other studies are linked external integration with both of them, supplier and customer integration and did not differentiated (e.g. (Frohlich et al, 2001).

In general the most research studies show that external integration have positive relationship with organizational performance (e.g. (Stank, 2001).

In other hand (Stank, 2001) stated that customer integration positively effect on the firm performance. According to (Ragatz, 1997) external integration means suppliers' integration that focus on product value is important for manufacturers to achieve their competitiveness.

the research work of (Frohlich et al, 2001) introduced the arcs of integration within five group for the manufacturer's degree of downstream and upstream integration in the supply chain. Customer integration involving of customers engagement opinions in decisions about the production of the goods. It also enhance manufacturer and the customer coordination by coordinating each activity (Zahra Lotfi, 2013).

According to (Frohlich et al, 2001) forward and backward integration also measure supply chain integration. Supply chain integration can be described within information technology integration (ITI) integration relationships. (Power, 2005) he was classify integration into information flow ,material flow, and inter-relationships. The five major components of supply chain integration including financial integration, information integration, technological integration material integration, , and actors integration.

### **2.2.11 External Supplier and Customer Actors' Integration**

External actors integration important to create close and long-term relationships between business partner. This also has significant advantage for mutual benefit and understanding

between suppliers and customers in the supply chain. Such integration will cover the way for material flows and information to implement successful (Prajogo D, 2012).

According to (Flynn, 2010) mutual understanding essential for in future research on SC integration.

Based upon the existing research work integrating the external actors based on mutual understanding and long-term relationships give hint to construct SC integration theoretical framework. External information integration importance to sharing for all supply chain members within high quality information.

### **2.2.12 External Supplier and Customer Information Integration**

Information integration include information flow coordination throughout the SC members. Many literature was studied on integration in terms of information flow and coordination (Lee et al., 1997). According to (Bagchi, 2002) information integration allow to management to examine the overall operations system in organisation without not fragment (Rai, 2006). In Supply chain information integration indicators each activities of the organization that include demand of customer, sales in retailer the whole sellers, production schedules production capacity, delivery schedules and performance metrics.

The above definition clearly show that information sharing the most enablers across the supply chain members which should more effective supply chain. In similar manner information integration introduced a more straightforward sharing of information and knowledge among the members in the SC, that include forecasting on daily sale, production planning, production scheduling and promotion (Bagchi, 2002) from the above two definition the purpose of information sharing not stated in well manner.

### **2.2.13 External Supplier and Customer Material**

To achieve supply chain integration material integration has the plays significant role in supply chain members (Prajogo D, 2012).

According (Rai, "Firm performance impacts of digitally enabled supply chain integration capabilities", 2006, p. 6) Material integration is the degree to which focal business companies need to optimization globally with across its supply chain partners to manage the flow of raw materials and the finished products.

The above definition tell us material flow procedures standardization the key role for supply chain actors to optimize the material flow. Flowing material across in different business

partner within efficiently and effectively increase cooperative agreement as a strategic partnerships.

Communication tools integration, like though iPhone increasing information sharing systems across the supply chain members enhance external material integration.

From literature material integration has important to improve the supply chain member that include: shorter lead time, reduced costs ,improve daily sales, and reduce production process , (Prajogo D, 2012).

#### **2.2.14 External Supplier and Customer Technological Integration**

The integration of information technology facilitates the flow of information between the different departments within the firm but also between firms occupying different positions across the supply chain (Vickery, 2003). (Rai, 2006) used a boarder term to describe supply chain technological integration.

The importance of having synchronized information systems between supply chain partners. (Prajogo D, 2012) argued that IT integration is a key element for having a successful logistics integration and information integration. On the other hand, (Rai, 2006 ) the fragmented IT infrastructure can negatively affect the coordination of information flows between firms. (Rai, 2006) Suggested that technological integration consists of two basic components being data consistency and cross-functional supply chain management application systems integration. This clearly emphasizes the importance of developing common terms for the data storage systems.

Technological integration represents an essential element of supply chain integration as it facilities logistics integration, information integration and financial integration. Firms who are technologically integrated are building long-term investments in their supply chain relationships.

#### **2.2.15 Internal Company Integration**

Internal company integration means synchronizing the overall activities in the company's that including production plan, production schedule, production process control, management ,financial to create a single unit in the organisation.

The organisation functional divisions are integrated production process and not functional silos based on traditional departmentalization and specialization (Flynn, 2010).

According to (Stock, 2000) defined as internal company integration as the able of linking internally each activities performed work into a without interruption process to fulfill customer's requirements.

According to (Pagell, 2004, p. 2) referred as internal company integration a process of interaction cooperation, coordination and collaboration in which purchasing ,manufacturing, and work together in a cooperative manner for mutually benefit.

#### **2.2.16 Internal Information Integration**

According to (Rai, 2006) Internal information integration defined as share high quality information across in the internal production and supporting functions to produces internal visibility.

Form literature internal information integration involves often personal interaction and real-time information sharing (Pagell, 2004). The system of internal information sharing to be supported by close coordination cooperation and communication between the production and supporting functions in the business firms to create higher levels of internal information integration. Information sharing across internal production and supporting functions reduces demand uncertainty and increase variability of demand in the supply chain members .It is also known as the bullwhip effect (Rai et al, 2006). Information sharing helps for companies to reduce the inventories cost , increase profits of the companies and improving business performance (Rai et al, 2006).

Generally, effective efficient information sharing increase mutual understanding information transparency, increase information transparency and reduce which reduces miscommunication across the SC members (Frohlich, 2002) .

#### **2.2.17 Internal Material Integration**

The empirical findings (Gimenez, C. and Ventura, E, 2005) suggested that internal integration between the department and the overall production process reduced stock-outs level. Material integration includes the flow of raw materials and finished product across the production and supporting functions (Pagell, 2004).

Internal material integration has portrayed to implement standard procedures for managing the material flow across the functional departments. Integrating the flow material with different functional departments and supply chain partners enhance firm performance (Flynn, 2010).

### **2.2.18 Internal Technological Integration**

Technological integration is the basis for all to joining different departments within the functional firms (Gunasekaran, A. and Ngai, 2004). Internal company integration by use of technology for information sharing across the different internal functional departments is essential (Rai, 2006).

Several authors suggested that internal technological integration facilitated the real-time access to information and improved internal visibility. The importance of information technology in integrating partnering firms in enterprise and supply chain (Gunasekaran, A. and Ngai, 2004). Using relevance technological integration and information integration enhance business performance. The study by (Williams et al, 2013) that suggest importance of technological integration increase firm capabilities.

### **2.2.19 Supplier integration**

Supplier integration a tool that help source raw material from both internal and external suppliers. and organizations to gain competitive advantage across SC members (Eltantawy et al, 2009). Supplier integration is the core competence derived from better coordination of all the critical suppliers in a company's supply chain to jointly achieve improved service capabilities at lower total supply chain cost.

According to (Narasimhan et al, 2008) balanced approach to supplier integration is essential to enhance performance.

## **2.3 Factor of supply chain integration**

### **2.3.1 Trust**

Trust is a group business partners or traders that are organized for mutual benefit to produce and distribute different raw material ,finished product and service. It is a dimensional construct that agree and closely follow one business party's belief that the other business party is reliance or dependence and both parties have agreed. Trust has critical relation within capital that facilitates collaborate and cooperative business activities among SC partners (Nahapiet, 1998).

When partner is believable , the manufacturer is vulnerable to supplier / customer based on looking forward of cooperation, to control business partners' actions (Mayer, 1995). Trust is a willingness to rely on the exchange partner. Trust has significant advantage to upholding the relationship among the SC partners

In many literature trust built confidence of the business partners and improves commitment that reduces risk of opportunistic and increase the effectiveness of the future exchange relationship (Moore, 1998).

Different researcher stated that supply chain trust has positive relationship on supply chain relationships of firms. Actually trust is importance to maintaining and developing relationships between firms in SC integrations.

High level of trust relationship produces well benefits for SC business partners to improves business performance and increase the relationship satisfaction between individual partners (Johnston, 2004).The main reason any business unsuccessful relationships is lack of trust between across the partners (Q. Su, 2008) .

The increment of transaction cost among trading partners is lack of trust between them. These transaction costs always increase out of emphasis on complex contracts, and specific continuous improvement clauses and lack of confidentiality agreements.

Trust enables members of the SC team to confidence on one another (McAllister, 1995) .

Trust involves two agents: the trustee and trustor. Trust with supplier/customer reduces uncertainties, transaction cost and increases investment.

For manufacturers give opportunities to access suppliers sources of information, reduce cost, improve information quality, relevance, and timeliness, and barriers for information acquisition (Nahapiet, 1998).

### **2.3.2 Empowerment**

According to (Benton, 1999) Still now in U.S. manufacturers maturing return of the, SC integration performing in the manufacturing industry have offer to be achieve more by issues of power and control rather than mutual intends. Particularly , the industry retains an imbalance of power as manufacturers account for almost 90% of the market share. In the supply chain integration power-effect relationship between partners and influences the performance across the chain.

According to (Hogarth, 2003) Power can be defined operationally as the ability of one member channel to influence the marketing decisions of another member channel and the two partners must be related to cooperation.

Unbalanced Power reduce reliability , relationship and decrease the levels of cooperation. (Goodman L.E., 2001) suggested that most Industrial distributors are increasing industrial

goods in the ways of mergers and acquisitions, larger and more powerful Power was becoming one of the important determinants of relationship commitment in the distributor-manufacturer relationship.

Most business company are not aware the dimensions of power and therefore not actively manage their own power (Huo, 1999)

### **2.3.3 Relationship commitment**

Relationship commitment is the willingness of a different business party associations to invest resources based on the favorable outcomes. Researcher (Morgan R.M, 1994) suggested that the propensity for relational continuity and the establishment of long-term relationship are primarily in the theme of relationship commitment.

Relationship commitment can be identified into two levels: Interpersonal commitment and Organizational commitment. Interpersonal commitment refers to the individual's willingness to contribute considerable time, work and energy for another individual(Joreskog K., 1993.)

Organizational commitment could be further two classification: inter-organizational commitment and intra-organizational commitment .

Intra-organizational commitment refers that to identification of each employee's in the organisation to acceptance their goals and values, and in addition his/her willingness to make acceptable effort to his /her organization for a favorable outcome (Mowday R.T.et.al, 1982.).

Inter-organizational commitment is willingness of a focal companies to invest in the relationship with its business partners depend on the favorable outcomes.

supply chain organizations will be develop when increase inter-organizational commitment, and closer relationships with their supply chain business partners. According to (Mathieu J.E., 1990) identified two types of relationship commitments those are affective commitment and calculative commitment.

Affective commitment this commitment happed when one party's identification with other party emotion within its values of another party, and the willingness to secure the business party relationship. Calculative commitment is one party's identify benefits and costs of exchange, and the willingness is to maintain the relationship to satisfy his/her needs. Because SC integration created by collaboration, mutually beneficial and cooperative, partnerships with supply chain members.

Willingness is to invest, physical, financial, and relationship based on resources in relationship (Mowday R.T.et.al, 1982.). Relationship commitment is an attitude of SC partners to build and stable maintain long-term relationships and mutual relationship between trading partners to behave business organization mutual benefit outcomes.

### **2.3.1 Information Communication**

SC management could defined materials coordination , financial flows thought out the supply chain to satisfy customers need (Stadtler, 2005).

Internal communication is essential to connect organization effectively that contribute companies to enhance business function and production performance and its help to have positive internal relationships (Mark A, 2003).

Now a day information is not only a resource for business partners, but also have securing a competitive advantage in collaborating and coordinating across companies activities. Information is transfer with different form through paper ,phone invoice, though media like Gmail, fax so on.

According to (Williamson et al, 2004), referred it is essential of information technology and communication networks for transmission message from different human skills and experiences is known as inter organizational information system (IOS). the evolution of as inter organizational information system (IOS) classified into four phases

**Phase One:** information that passed through paper copies where sharing of information among supply chain was limited

**Phase Two:** development of Electronic data interchange (EDI) – purchase orders, invoices as well as order status, pricing enquires and scheduling transactions were processed on it.

**Phase Three:** Enterprise Resource Planning (ERP) systems were developed to integrate the business of suppliers and customers through an integrated database environment.

**Phase four:** The use of Web Development Technologies enabled two-way flow of information among strategic partners that allow accelerating their decision making in the SCM processes.

### **2.3.2 Information sharing**

According to (Bavarsad, 2015) Properly managing of information systems has essential to transfer accurate information and to be have more effective and efficient supply chain process and easily to manage across the supply chain members.

Advanced communication systems and information system is important to ensures the flow of reliable information and to identify the problems in the circumstances (Bavarsad, 2015). uncertainty demand reduces in some extent by information sharing and in a supply chain the variability of demand also increasing (Hefu Liu, 2013, p. 7).

Information sharing helps for business organization to increase profits by reducing inventories cost and improving business performance. Information sharing has significant contribution to reduce the cost of supply chain, increase the flow of material, fast delivery, improve order fulfillment, enhance customer satisfaction, and d improve channel coordination (Ipek Koçoglua, 2004). Information sharing coordination attempts is important to accurate data collection and timely information available also has contribution on decision-makers (Togar et al, 2002)

Integration base characterized by, collaboration, trust, partnerships, cooperation, information sharing, shared technology, to manage the supply chains of processes (Damien, 2005).

In general, sharing information effectively reduce miscommunication, reduce mistake and transaction costs, and enhances mutual understanding across the supply chain.

### **2.3.3 Information Management**

Properly managing of information systems has essential to transfer accurate information and to be have more effective and efficient supply chain process and easily to manage across the supply chain members.

Managing of information across the partners will increase effects of speed, quality, accuracy, and efficiency across the supply chain.

Generally, the effects of information management effects within supply chain members on following sections:

- Logistics Management: includes supply chain information processing, transportation, processes, manufacturing, ordering, production scheduling, and changing orders.
- Data exchange between partners processing, ordering, and technical information.
- Collecting and processing data for sourcing, process analysis, selection and evaluation of suppliers.
- Collection and processing of supply and demand information in order to predict future market trends and conditions.
- Establish and improve relations between partners.

### **2.3.4 Supply chain collaboration**

Supply chain collaboration is defined as the ability of managing people, information resource, technology material to build unique value-added processes to better meet customer wants. According to (Talavera, 2013, p. 2) Managing each activities such as flow information, different goods and money from different part of the supply chain requires interplay smoothly between and belong the shareholder of the supply chain. Supply chain collaboration important to stay competitive in global competitors and need to meet the customers' requirements on accurate and timely. Supply chain collaboration involves all internal and external integration across different departments that include production, purchasing, marketing, and information systems (Talavera, 2013)

Introducing collaboration activities essential to enhancing supply chain performance. In truth, in order to have an effective supply chain members with other members in the chain (Nazila Kaveh, 2009).

#### **➤ Form of collaboration**

According to (Nazila Kaveh, 2009) Collaboration can be discussed in different view compared integrated or not-integrated, with regard to the scope of collaboration (vertical, horizontal).

In business organizational inter and intra collaboration from the range of simplicity of a partnership to the complexity of a multinational corporation.

Vertical collaboration perform internal along the supply chain partner but external supply chain collaboration doing closely across the trading to improve each partner SC efficiency. Horizontal collaboration need to cooperation with non-competing and competing companies to engage in business.

Supply chain collaboration involving the supply chain members within coordination of activities that boundaries of organization in order to satisfy customer requirement (Mathuramaytha, 2011). Collaboration across the supply chain members give competitive advantage.

According to (Mathuramaytha, 2011) suggested that strongly collaboration across the supply chain functioning and supports gain to enhance organizational performance.

### **2.3.5 Supply chain coordination**

Supply chain coordination is ability synchronization making different department, people or goods working together for organizational goal (Xu L and Beamon B, 2006).

According to (Kleindorfer P R and Saad GH, 2005) suggested that continuous cooperation, and coordination among SC members are essential to minimize risk, reduction work in process, and maximized organizational profit.

Supply chain coordination essential to identify interdependent SC partner activities across the supply chain members and manage these interdependencies (Xu L and Beamon B, 2006). Supply chain coordination is the measure the system of implementation by consisting coordination mechanisms, which helps to enhance SC performance across the supply chain members.

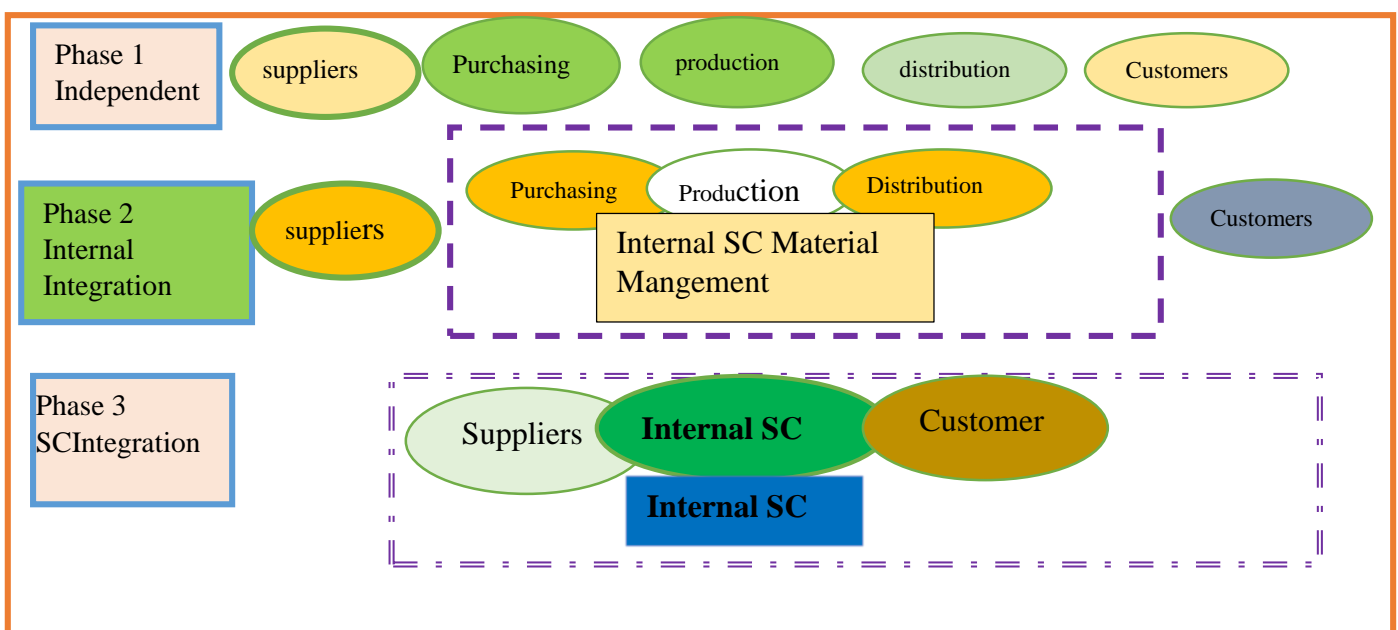
➤ **Challenges in Coordinating the Supply Chain**

The individual view and opportunistic behavior of SC members outcome in mismatch of supply and demand in the chain (Arshinder K, 2008).

According to (Arshinder K, 2008) Suggested that measuring supply chain performance traditionally based on the individual not relevant to the maximization chain profit in a coordinated manner. In general individual performance measure traditional, particularly rules, procedures, and policies are not relevant to enhance inter organizational relationship

**2.4 Framework for Developing an integrated supply chain**

In this global world managing each business activities include people, technology, and production process across extended enterprises enhance the performance of business organisation (Hussain A.H Awad, 2010).



**Figure 2.4:** Developing an integrated supply chain source: (Lee J. K., 2003)

Supply chain integration has three levels including suppliers integration, customers, and intra-organizational integration, this allows to increase business supply chain, through enable management across the extended value network including of various supply chain parties (Ipek Koçoglua, 2004).

#### 2.4.1 Challenges and obstacles of supply Chain integration

According to (Chopra, 2010), In supply chain system there are number of factors that hindering integration along the SC members , longer cycle times information distortion, stock –outs , and bullwhip effect, the output results were customer service capabilities reduction the high overall production ,transportation ,and distribution cost. In most companies the only attention payer is chief executive officer’ s to the SC integration this is misunderstanding the meaning of supply chain integration this not always for the right reasons (Hussain A.H Awad, 2010). Nevertheless, In most industries the business environment understanding competition has increased and the conditions under business is more turbulent.

according to (Hussain A.H Awad, 2010) challenge and obstacle of supply chain integration are listed below

- Lack of Trust between organisation and Incapability to adapt and Change.
- Lack of ability the common place of Product and loss of responsibility .
- Absence of Security and not similar Partner benefit.
- Independences increments and Change of expectations

#### 2.4.2 Related Research Works on Supply chain integration

**Table 2.1:** Related Research Works on Supply chain integration

| Author                                     | Title   | Methods                                       | Finding   | Journal name  |
|--|---|---|---|---|
| 1. Hussain A.H Awad, Mohammad Othman Nassa | Supply Chain Integration: Definition and Challenges | Literature review on supply chain integration | The main contributions for this paper are integrating all the of supply chain integration challenges in one source. | Proceeding of international multi conference of engineers and computer scientist 2010 Vol I, IMCES Hong- Kong |

|                            |   |  |   |   |
|----------------------------|---|--|---|---|
| 2. Paul D. Cousins         | The implications of socialization and integration in supply chain management                              | confirmatory factor analysis           | The findings reveal that socialization is essential for the development of any significant business relationship and the enhancement of a supply integration strategy   | Journal of Operations Management 24 (2006) 604–620                          |
| 1. Brent D. Williams,      | Leveraging supply chain visibility for responsiveness : The moderating role of internal integration       | Moderated regression analysis          | The findings of the current study suggest that internal integration is the missing link in establishing how supply chain visibility affects supply chain responsiveness | Journal of Operations Management  |
| 2. Mark Pagell             | Understanding the factors that enable and inhibit the integration of operations, purchasing and logistics | grounded theory development method     | The end result of the research is a testable model of how integration can be built across these three key internal supply chain functions                               | Journal of Operations Management 22 (2004) 459–487                          |
| 2. Arun Rai                | Firm Performance Impacts of Digitally Enabled Supply Chain Integration Capabilities                       | Partial least squares are used         | The results suggest that integrated IT infrastructures enable firms to develop the higher-order capability of supply chain process integration                          | MIS Quarterly Vol. 30 No. 2, pp. 225-246/June 2006                          |
| 3. Andy Neely              | Performance measurement system design: A literature review and research agenda                            | comprehensive review of the literature | The importance of performance measurement has long been recognized by academics and practitioners from a variety of functional disciplines                              | International Journal of Operations & Production Management · December 2005 |
| 7. Hefu Liu Weiling Ke, KK | Effects of Supply Chain Integration and Market  | Hierarchical                           | Operational coordination is positively associated with operational performance and business performance.  | International Journal of Operations & Production                            |

|   |   |   |   |   |
|---|---|---|---|---|
| Wei, and Zhongshe ng Hua (2013),                                  | Orientation on Firm Performance: Evidence from China  | regressio n analysis                          | Information sharing affects only operational performance; it has no impact on business performance.   | Management, 33(3), 322-346.   |
| 9. A. Gunasekar an, E.W.T. Ngai                                   | Information systems in supply chain integration and management  | critical review of literature                 | IT is an essential ingredient for business survival and improves the competitiveness of firms. IT has a tremendous influence on achieving an effective SCM.   | European Journal of Operational Research 159 (2004) 269–295                                 |
| 10. Taco van der Vaart, Cristina Giménez and Dirk Pieter van Donk | Supply chain integration and performance: the Impact of business conditions                             | Correlati on analysis                         | The results show that there are different dimensions under the integration construct (practices, patterns and attitudes) and that these are correlated.   | University of Groningen, Faculty of Management and Organisation, Groningen, The Netherlands |
| 11. Alie Wube Dametew and Frank Ebinger                           | Technological Innovations as a Potential Vehicle for Supply Chain Integration on Basic Metal Industries | Analytica l Hierarchy Process (AHP)- Analysis | the study indicates that to tackle such problems, adopting flexible innovative and sustainable technological innovation systems to manufacturing industries used as a vehicle for improving the performance and competitiveness of the firms. | International Journal of Swarm Intelligence and Evolutionary Computation                    |
| 14. Taco van der Vaart , Dirk Pieter van Donk                     | A critical review of survey-based research in supply chain integration                                  | Analyses survey-                              | the majority of the surveys do report a positive relationship between integration and performance.  | International Jourlal. Production Economics   |
| 17. Cigde m Ataseven, Anand Nair                                  | Assessment of Supply Chain Integration and Performance Relationships: A Meta-Analytic                   | using a meta analytical methodology           | provide direction for managerial decision-making, the study offers insights regarding integration dimension(s) that have largest breadth and depth of impact on various   | International Journal of Production Economics   |

|   |  |  |  |  |
|---|--|--|--|--|
|   | Investigation of the Literature  |  | performance measures.  |  |
| 19.P. Cyplik and L. Hadas                   | Measuring the level of integration in a sustainable supply chain   | Forward and backward model   | The system for measuring the level of integration in the supply represents a holistic approach towards the management of the integration process.  | Proceedings of the 19th World Congress the International Federation of Automatic Control |
| 23 .Harjeet Singh Jaggi, Mr. Sunny S. Kadam | Integration of Spark framework in Supply Chain Management  | Apache Spark framework   | using Apache Spark framework in Supply chain management for data analytics would benefit the organization and businesses.  | 7th International Conference on Communication, Computing and Virtualization 2016         |
| 24 .pek Koçolua, Salih Zeki mamolu          | The effect of supply chain integration on information sharing:<br>Enhancing the supply chain performance | Partial Least-Squares (PLS)-based Structural Equation Modeling (SEM) technique | The results suggest that the role played by SCI is critical in information sharing process as it reinforces connectedness, coordination and collaboration among SC members   | 7th International Strategic Management Conference  |
| 25 .Christine Lloyd , Prasanta Dey          | Supply chain integration in the UK bioenergy industry:<br>Findings from a pilot study                    | pilot study  | bioenergy supply chains as there is an imbalance between knowledge and practice, even understanding the terminology  | Journal of Cleaner Production  |
| 26 .Zahra Lotfi, Shahnorbannun Sahran       | The Relationships between Supply Chain Integration and Product Quality                                   | theoretical and literature review to develop model                             | study provided theoretical and literature review evidences that internal and external integration have impacts on design quality and conformance quality leading to improvements of competitive capabilities in firms. | The 4th International Conference on Electrical Engineering and Informatics (ICEEI 2013)  |

|  |  |                               |  |   |
|--|--|-------------------------------|--|---|
| 27.Chonticha Mathuramaytha                   | Supply Chain Collaboration – What’s an outcome?: A Theoretical Model                                     | variable measurement scales   | concept that SCC has positive effect (such as cost reduction and operational flexibility) on firms and that the effect is a long-term effect.                                | International Conference on Financial Management and Economics<br>IPEDR vol.11 (2011) |
| 28.Damien Power                              | Supply chain management integration and implementation: a literature review                              | A literature review           | This study shows that interdependence between integration (technologies, logistics, and partnerships), a strategic view of supply chain systems, and implementation approach | Supply Chain Management: An International Journal                                     |
| 29 .Korosh Gharibipour and Belgheis Bavarsad | Evaluating effect of supply chain Information system strategy on supply Chain performance                | analyzed using Spss software. | The results of data analysis showed that the relationship between variables is significant.  | Indian Journal of Fundamental and Applied Life Sciences ISSN: 2231– 6345              |
| 30 .Ipek Koçoglua, Salih Zeki Imamogl        | The effect of supply chain integration on information sharing:<br>Enhancing the supply chain performance | Exploratory Factor Analysis   | SCI is critical in information sharing process as it reinforces connectedness, coordination and collaboration among SC members.  | 7th International Strategic Management Conference                                     |

## **2.5 Supply Chain Performance Measurement (SCPM)**

### **2.5.1 Fundamental concept of Performance measurement in supply chain context**

Performance measurement can be defined measuring the quality , capacity , price delivery time , customer satisfaction and resource whether more work accomplished in shorter time by using fewer resource. A performance measure can be defined as a metric used to quantify the effectiveness and efficiency of an action.

According (Neely A, 1995) SC performance measures linked with Performance measurement strategies to provides necessary information for management feedback for decision makers.

Performance measurement provides to identify the potential management strategies success , and facilitating the situation.

Performance measurement is essential to improve of supply chain within business organization (Chan F. , 2003a). The scholars (Ittner CD, 2003) suggested that strategic performance measures should be meet with the business value drivers.

According to (Hervani AA, Helms MM & Sarkis J, 2005) , corporative and collaborative continues performance measuring grow and encompass both qualitative and quantitative approaches and measurements.

Measuring of Performance is important to plan, design, implement and monitor proposed systems (Ghalayini AM & Noble JS, 1996) . traditional measurement not log useful because lack of metrics to meet customer requirements, lack higher-quality products, its higher lead-time and high cost management and not more responsibility.

The researcher (Ghalayini AM, 1997) presents the most common eight cited limitations of traditional performance measures are identified.

- Lagging metrics: The reports financial are always closed at per month and the results are already decisions on past.
- Strategy corporate: Traditional measures of performance not corporates with strategy.
- Relevance to practice: The aim of traditional measure only to quantify and improve the performance efforts in financial terms.
- Inflexible: measuring in traditional ways are not flexible.
- Expensive: during preparation of traditional financial measure requires wide extent amount of data always high cost to obtain.
- Continuous improvement: standards setting need to improve continuously its performance.
- Customer requirements and management techniques: in this global market identifying customer need is the best opportunities for company but, traditional measures are not use for long time.

According to (Neely A, 1995) performance measurement system that can be examined at three different levels, individual performance, the set of performance ,the performance measurement system as an entity ,the relationship between the performance measurement system and the environment within which it operates.

According (Neely A, 1995) , the system can be analysed by exploring issues the following point.

The main essential points are identifying and checking all suitable elements which is to be covered such as external, internal, non-financial or financial. It is important to know whether the measures have been integrated, the measurement fit the culture of company, measurement are consistent with the existing structure. In addition to that identifying which measures focus on customer satisfaction and whether the measure focus on the effects of competition.

The researcher (Melnyk SA, 2004) present three basic functions provided by metrics: control, communication, and improvement.

There is no unique metrics for measuring total supply chain integration performance and always metrics have to be developed separately for each case companies.

The researcher (Gunasekaran A, 2001) state that there is a greater need to study the measures and metrics for the following reasons:

1. Lack of a balanced approach: Companies have must identified the need for two types of measurement approach: financial and non-financial metrics. Financial metrics are essential for strategic decisions and report the external circumstance. However non-financial metrics are very essential for day-today ground level operations.
2. Lack of a clear distinction between metrics at strategic, tactical and operational levels: It need identification which metrics used in most appropriate way because different metrics are suitable for different levels and hence it is difficult to get valid metrics for all management level.

### **2.5.2 Purposes of supply Chain Performance Measurement (SCPM)**

The major purposes of a performance measurement system are presented by (Gunasekaran, 2007) as follows;

- Identifying different machine bottlenecks, process waste, problems and the opportunities of improvement
- It give greater understanding of any processes
- Able to monitor and control the accomplishment
- Make easier to communicate and collaborate
- Give feedback to make decision
- Identifying customer need and success

### **2.5.3 Internal and external supply chain performance measurement**

According to (Lambert, D et al, 2001) It is extremely important that separating external and internal performance measure metrics in order to understand challenges and the problems of performance metrics in supply chains.

Internal performance measurement specially concentrate on the value chain or logistics supply chain within a single company with its sourcing inventories ,operational process and distribution (Coyle, 2003)

External performance measurement focus on measure the efficient and effective flows of products, information, financials and service from the supplier through various companies out to the customer (Coyle, 2003).

### **2.5.4 Internal supply chain performance measurement**

Internal supply chain performance measurement especially focuses on measuring lead time (Lambert, D et al, 2001). These measures are procreate within a focal company and do not evaluate the overall supply chain systems.

Moreover (Chan et al, 2006) criticized such traditional performance measurement role in lack of strategic relevance, short-term and finance oriented, inconsistent measures extremely internal focus, avoidance of overall improvements.

### **2.5.5 External supply chain performance measurement**

Performance measurement systems are rarely connected with all-encompassing SC strategies, lack harmonized approaches to integrate financial and non-financial measures, absence of system thinking and frequently encourages local optimization (Gunasekaran et al, 2001). It is essential investigate systematically performance measures due to increasing requirements of supply chain management.

The existing performance measurement systems often fail because of different vertical and horizontal influences in supply chains. So understanding how accurate performance measurement systems can meet the need of support in decision-making and continuous improvement in supply chains (Chan et al, 2006).

### **2.5.6 Performance measures and metrics connected to the type of supply chain**

The researcher (Lambert, D et al, 2001) suggested that a very well system of SC metrics can lead to competitive advantage lower costs and services. the performance of a supply chain can be intention as a system of measures like delivery quality, flexibility and price.

In traditional performance measures the relevant of profitability are less for measuring SC performance.

The main idea behind measuring performance is to obtain information about what needs to be improved.

According to (Hull, 2002) quality has been thrust onto center stage, nevertheless different companies have failed to compete because a lack of understanding and subsequent lack of direction. The failure of quality competence is due to lack clarify dimension(s) of quality to provide the best result in given markets.

**Delivery:** Delivery sub measure of performance include: delivery speed ,delivery reliability, time delivery ,faster delivery times, delivery service, delivery synchronization, and delivery frequencies are some of them (Hull, 2002).

According (Hull, 2002) suggested that a business company wins' orders through its capability to quick deliver continuously than other competitors to meet the required delivery date.

**Cost:** Cost reduction in each of them, external and internal in the supply chain is extremely essential to improve productivity. (Hull, 2002)

Many organizations concentrate on reducing direct labour cost rather than their efforts in the area of greatest cost. These costs are cost of purchasing, cost of material handling ,cost of storage , cost of financial, cost of supplier

**Flexibility:** flexibility refers company plan to give respond to market changes for significant increases in demand.

According to (Beamon, 1999) states flexibility is the supply chain management of reacting to demand change by preserving the resources of time, money, materials, people, plants and suppliers until they are specifically required.

## **2.6 Performance Measurement systems**

A performance measurement system offers the necessary information for the monitor, control, evaluation, and feedback function for operations management.. Moreover, essential to improvement continuously and to achieve strategic objectives (Olsen, 2007).

Furthermore (Tonchia, 2010) suggest a seven dimension describing the scope and purpose (intention) of a performance measurement system:

- Comparison with the performance of its best competitors (benchmarking)
- Monitor and control each operation
- Coordinate different process and operational activities
- Examining and evaluating the resources
- Motivate human resources and learn individual as well as organisation

### **2.6.1 Evolution of supply chain performance measurement system (SCPMS)**

Performance measurement has its beginning in early accounting systems. According to (Gomes, 2004) measuring of performance change through two phases.

The first phase was began in the late 1880s, as long as the second phase began in the late 1980s. the main target of first phase was to account cost orientation. A study has tell that by 1941 about half of US companies were using budgetary control in one form or other and by 1958, over 95 % of the companies, the only budgets were used for overall control of company performance (Bourne, 2003) .

Base of performance measures were accounting and finance focused internally , looking backward and extremely focus with local departmental performance than with the overall performance of the business (Bourne, 2003). The traditional performance measure only focus financial. This system failed to measure the overall the relevant factors critical to business success.

Traditional accounting performance measures were criticized not proper managing of today businesses . The mid-1980 was a turning on performance measurement in the literature, beginning of the second phase. This phase was associated with the growth of global business activities and the changes brought about by such growth.

In the late 1980s, some frameworks, which attempted to present a broader view of performance measurement started to appear (Gomes, 2004) .

They underscored the need for the alignment of financial and non-financial measures in order to be in accordance with business strategy.

The emphasis was on the development of better integrated performance measurement systems. PMS also changed with this evolution of business organization from cost accounting system (before 1980s), mixed financial and non-financial systems (1990's) to balanced integrated approach (2000's).

### **2.6.2 Supply chain performance measurement System approaches**

According to (Neely A. G., 2005) Performance measurement system used as set of metrics to quantify the efficiency and effectiveness of actions.

Supply chain performance measurement systems give more concentration on the two distinct elements of customers and competitors than internal measurement systems do.

#### **1. Balanced scorecard approach**

Balanced Scorecard (BSC) is managing tool that tracks all the important elements of a company's strategy (Kaplan and Norton, 1992). The BSC links performance measures under four essential business dimension, which are: , internal business ,financial , innovation and learning , and finally customer perspective.

However, the BSC cannot view the performance at manufacturing level. Also, the BSC has a weakness to measure long term vision and fails to identify the performance measurement specific level such as employees, suppliers and stakeholders.

According to (Ganapathy, 1997) Balance Score Card does not capture all components of the stakeholder and it does not include the supplier prospective which is important in a company.

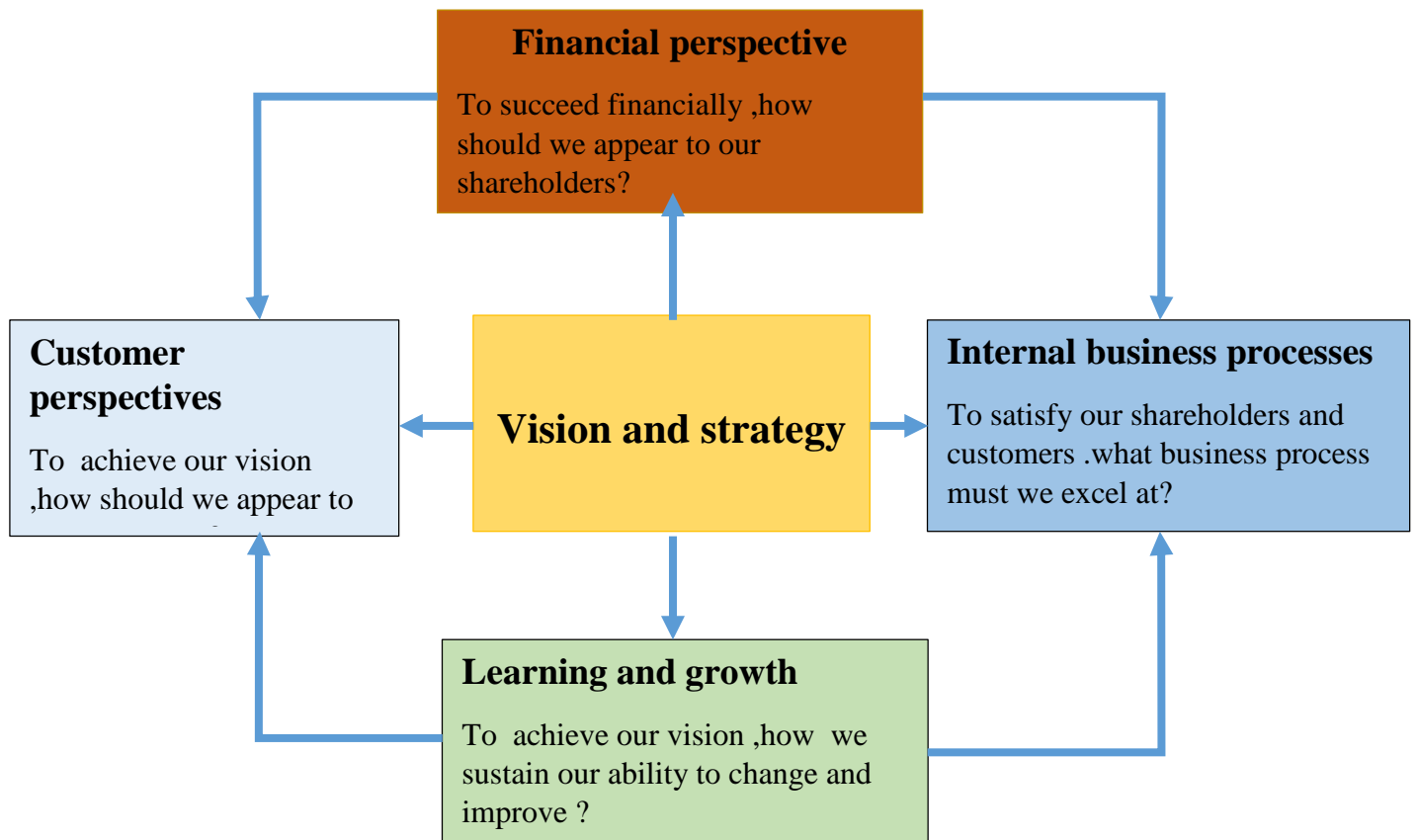
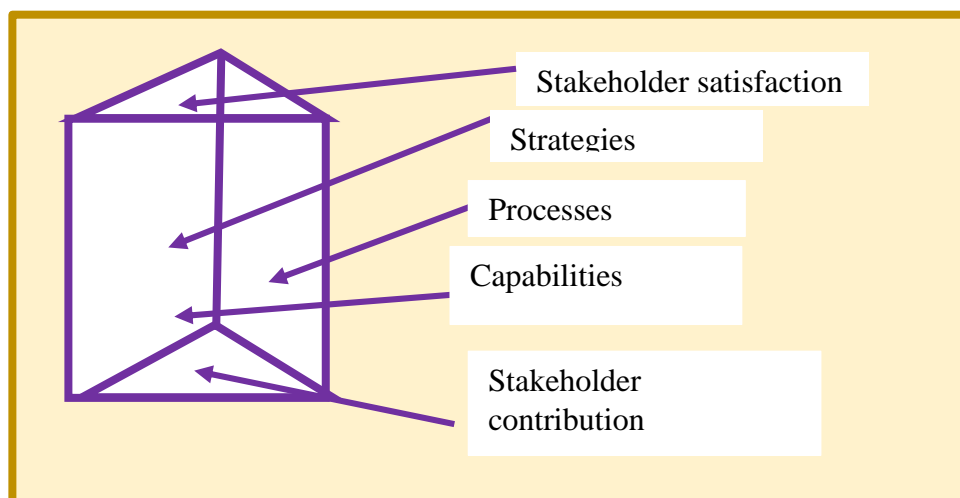


Figure 2.5: Elements of the balanced scorecard. Adapted from Kaplan and Norton (1996).

## 2. Performance Prism:

The Performance Prism (PP) is one of the older conceptual framework and is considered as a second-generation PM system (Michaela et al, 2012). The performance prism framework emphasizes that a PMS should be arranged into five distinctive but linked perspectives of performance as shown in figure (Neely A. J., 2000).



**Figure 2.6: Performance Prism (Adapted from (Tangen, 2004)**

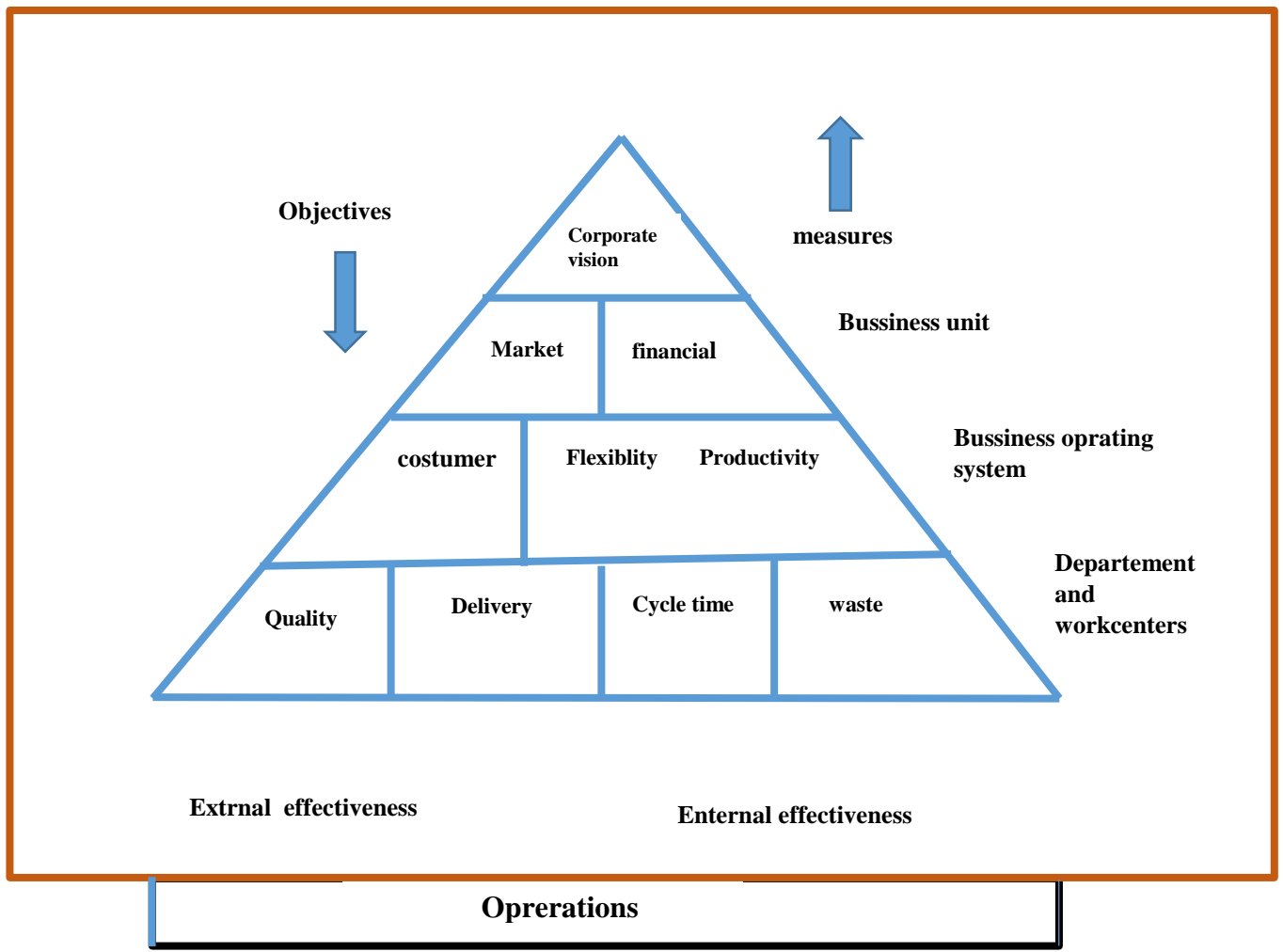
- Stakeholder satisfaction: Identifying the stakeholder requirement and met the need
- Strategies: Identifying and examining the need of stakeholder
- Processes: Which processes place to allow stakeholder strategies
- Capabilities: identifying capabilities need to require to operate stakeholder processes
- Stakeholder contributions

According to performance prism the measurement of performance doesn't need be strictly derived from the strategy: instead, strategies must be put in place to insure the needs of the stakeholders are well satisfied (Neely et al, 2001). It is tool that important management teams to assume about essential questions and strategies to address them.

According to (Michaela et al, 2012) suggested performance prism enlarge in addition to traditional performance measurement, it offers little about how the performance measures are going to be realized. The weakness of this model is little consideration is given to the existing PMSs that companies may have in place.

### **3. Performance Pyramid**

Another essential framework for measuring performance is pyramid model (Lynch, R. & Cross, K, 1991). The purpose of the performance pyramid as shown in the figure is to link strategy of organization's with its operations objectives translate from the top down (based on customer priorities) and measures from the bottom up. This performance pyramid includes four levels of objectives that address the organization's external effectiveness (left side of the pyramid) and its internal efficiency (right side of th pyramid) as demonstrated in (Tangen, 2004).



*Figure 2.7: Performance Pyramid (Adapted from (Tangen, 2004)*

Performance of pyramid begin by defining an overall companies corporate vision in the first level, the translation is based individual business unit objectives. The second-level business units are short-term targets of cash flow and profitability and long-term goals of growth and market position .

The business operating system bridges the gap between top-level and day-to-day operational measures (e.g. customer satisfaction, flexibility, productivity). Finally, four key performance measures (quality, delivery, and cycle time, waste) are used at departments and work centers on a daily basis (Tangen, 2004).

#### **4. Hierarchical-based Measurement Systems (HBMS)**

According to (Gunasekaran et al, 2004) He was developed HBMS in which measures each level of performance that are includes tactical ,strategic, and operational level. The main concept of this framework was to assign measures where they can be best dealt with by the

appropriate management level, this system create to facilitate quick and appropriate decisions (Ramaa, 2009).

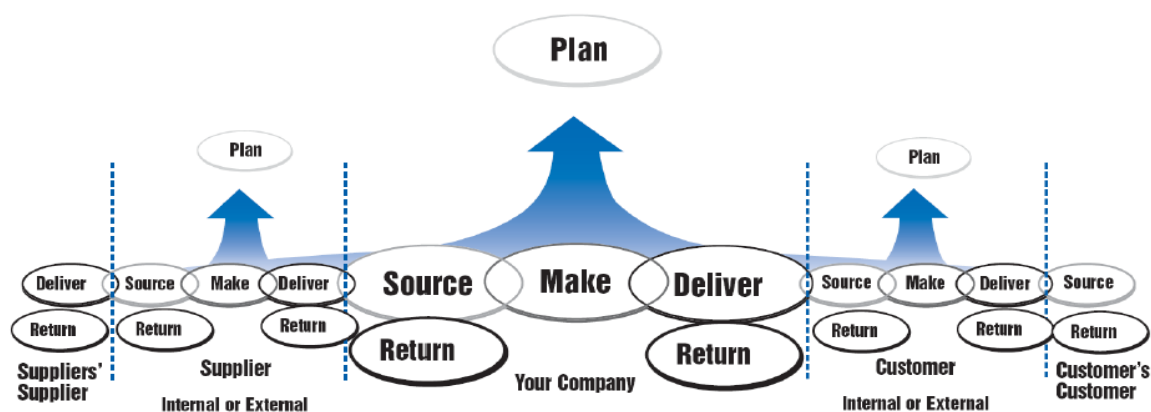
The metrics are moreover identify the financial or non-financial. Such systems tie together the hierarchical view of SC performance measurement and maps the performance measures specific to organization goals. The weaknesses of this framework it doesn't clear guide to put the measures into different levels

### **5. The Supply-Chain Operations Reference (SCOR) Model:**

The **SCOR** model was developed by the (Supply-Chain Council, 2010) to assist firms in increasing the effectiveness of their SCs, and to provide a process-based approach to SCM. This model is a unique model to make a framework to join SCIP best practices metrics, metrics, people and processes into a combined effort structure. The framework provide communication between chain partners and improve the potential accomplishment of SCI, trust, communication ,relationship commitment cooperation technology, and relevant SC improvement activities (Supply-Chain Council, 2010) .

The SCOR model was originally developed on five supply chain management processes - plan, source, make, deliver and return. Further the measures are grouped into five performance attributes: reliability, responsiveness, flexibility, cost and assets.

According to supply chain council , the SCOR-model integrates the concept of business process , process measurement , re-engineering ,benchmarking, and into a cross-functional framework. The SCOR model includes the interactions of all customer, from order entry to paid invoice; spans all product transactions, from your supplier's supplier to your customer's customer; and spans all market interactions, from the understanding of aggregate demand to the fulfillment of each order.



**Figure 2.8:** *Interrelation of five key process of SCOR model (SSC ,2010)*

In processes the management its provide standard descriptions that compensate the supply chain. The framework provide standard processes relationship and standard metrics measure and improve the companies process performance. The practices of management that make good-in-group of performance.

According to (Theeranuphattana A, & Tang JCS, 2008) , the SCOR model offers users the following benefits :

- It provide to clear identify performance gaps and It Align team skills of supply chain with objective strategy .
- Alignment of standard with software for a features and the best practices that functional enable.
- Quickly assessing the performance of supply chain and optimizing of supply chain network by redesign.
- Improved operational control from core standard processes and managing the report efficient and effectively
- Develop systematic way to manage properly the SC system by combining different methods.

The SCOR model advocates hundreds of performance metrics used in join with five performance attributes: responsiveness, reliability, flexibility, cost, and asset metrics. (Hausman, 2004) states that in modern SCM, quality is taken as a given and that factors in quality management and improvement are somewhat separate from those in SCM development.

According to (Theeranuphattana A, & Tang JCS, 2008) each performance attributives defined below.

1. Reliability: The performance of the SC in delivering the correct product to the correct place, at the correct time, in the correct condition and packaging, in the correct quantity, with the correct documentation, to the correct customer.
2. Responsiveness: The speed at which a SC provides products to the customer.
3. Flexibility: The agility of a SC in responding to marketplace changes to gain or maintain competitive advantage.
4. Costs: The costs associated with operating the SC.

5. Asset management: The effectiveness of an organization in managing assets to support demand satisfaction. This includes the management of the both assets: fixed and working capital.

## **2.7 Literature Gap and summary**

The level of integration between the supplier and customers' performance, conversation, the studies did not find the clear relationship between the dimensions of supply chain integration. lack of a clear and single formal definition of supply chain integration makes it difficult to prescribe practical solutions regarding what to integrate, the costs and the benefits of integration.

Accordingly, it has been found that most of the articles only focus on information sharing, coordination and communication.

Another gap identified from the literature review is that generally there is shortage of research done on the integration of metal manufacturing industry supply chain internationally. Especially on the subject of the supply chain integration of Ethiopian metal manufacturing and machine building industries there are limited researches done.

The question arises how can we differentiate the different levels of integration in the supply chain. Because unclear literature available on measuring SCIP in Ethiopian metal manufacturing industry. In addition, there is very little empirical evidence as how different SCI dimensions simultaneously influence different types of company performance.

- There is no common standard supply chain integration performance measurements system for all company

## **2.8 Literature summery**

Up to now definitions of supply chain management, supply chain integration, supply chain performance measurement, main driver of supply chain integration, importance of supply chain integration performance measurement has been seen deeply.

And in the previous section the measuring supply chain integration performance model challenge and obstacles of supply chain integration, level and components of supply chain integration approach, has been discussed.

The usefulness of the supply chain integration performance measurement model like BSC, SCOR and HBMS.

The factors metrics of SCIP are identified from literature such as collaboration, information sharing, communication and coordination in supply chain integration has also been seen to have general understanding.

the above literature is reviewed to have a better and elevated understanding of supply chain integration and performance measurement importance and benefits. Furthermore, supply chain integration factors and measuring supply chain integration performance model and improvement approach also illustrated.

## **Chapter Three**

### **Research Methodology**

#### **3.1 Introduction**

To accomplish the objective of the thesis, the researcher has applied the following methodologies. Complete literature surveys have been conducted regarding the concept of supply chain integration, SCI influential factors, barriers, performance measurement systems and overview the case company (Hibert manufacturing and machine building industry). Following literature survey, in order to assess the supply chain integration performance measurement and improvement of the Ethiopian metal industries.

#### **3.2 Research Design**

As per the research objectives for this paper, research strategies such as literature review, survey of the questionnaire, face-to-face interview, and observation were applied. The research process followed in this study consisted of three steps. First, at the initial stage of the research, problems were identified from preliminary review of the literature. This process involved stages of revision of the original ideas until gaps were identified within the area of research interest. Several potential research questions were generated from the research problems.

The literature is thoroughly checked to determine whether those questions had been answered. The research aim is then identified based on the final selection of research questions, and the research objectives were derived from the main aim, being refined several times in the process. Then, to answer the research aim, literature was further studied to establish an appropriate theory. Key concepts or variables involved in the subject of research were identified.

The literature review concentrated on several areas, supply chain integration, SCI factors, and performance measurement systems were explored, and finally, the issues surrounding supply chain integration performance measurement and involving the variety of frameworks and supply chain integration performance factors were focused on. Thereafter, the conceptual supply chain integration performance model will be developed.

Second, as a result of the previous step, a set of supply chain integration performance measurement factors suitable to be adopted in the context of Ethiopia metal manufacturing industries emerged. Finally, during the third step of the research, the proposed conceptual

supply chain integration performance measurement model operating in the Ethiopian metal manufacturing industries.

### **3.3 Mixed Research approaches**

This research will be undertaken by applying a combination of both qualitative and quantitative research approaches.

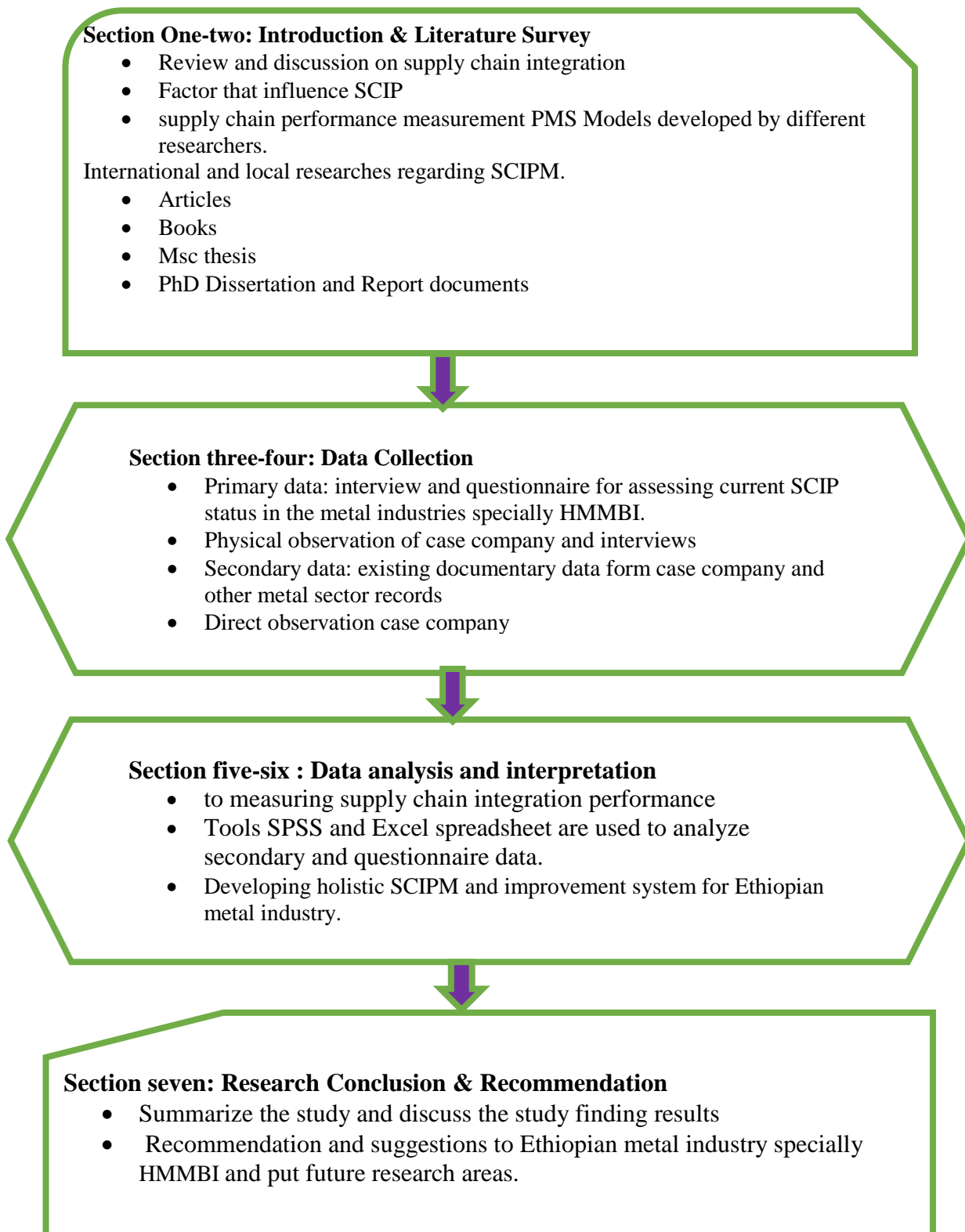
In this thesis qualitative method used to analyze non-numerical data in the form of literature, text and images drawn from observations, interviews, questionnaires and document that are gathered from Ethiopian metal industries evidences that shall be analyzed thoroughly.

On the other hand, quantitative method concerned with collecting numerical secondary data analyze by using statistical techniques that gathered from Ethiopian metal industries and case company.

Most of Ethiopian industries stored secondary data were recorded in form of numeric, text and image. In order to avoid their respective disadvantage, one important way to strengthen a research design is to use both qualitative and quantitative methods. Hence, the kinds of research strategies adopted in this study are qualitative and quantitative ones.

While semi structured interview is designed for the qualitative one, questioner survey is distributed for the quantitative. Moreover, literature review and practical observations are used to strengthen the research strategy technique.

### 3.4 Research Methodology Approach



*Figure 3.1: Research methodology approach*

### **3.5 Data Source**

The study uses both primary and secondary data source. Documentary sources such as relevant books, journals, articles, official publications, newspaper clippings, reports and seminar papers were utilized to present the facts and to substantiate the arguments in order to secure secondary data. In primary data, interviews, questionnaires, photographs, and observation, are used to collect data.

**1. Literature Survey review:** To create an understanding of the topic and to identify a gap in existing research, the first step in this thesis was to perform a literature review, the data for the review was collected from various academic databases online.

Literature Survey Review and discussion on supply chain integration, supply chain integration factors, supply chain Performance measurement system models developed by different researchers International and local researches regarding SCIPM.

**2. Primary data source:** Direct data collection from the original source of metal industries about the current dependency between sections will be major primary data collection method. The techniques used include Picture, data sheets, and semi-structured interviews.

**3. Secondary data source:** Previous data collected by other researchers and studies done metal manufacturing industries processes has been used as one of the secondary data source. The collection of secondary data relevant to the research was also undertaken. Together with the other data collection, this helped the researcher to gain a holistic overview, and in some instances helped him to clarify information collected in the interviews with the respondents. In this study, the secondary data used included work process documents, handouts and reports from the case study companies, plus other public documents and notifications.

### **3.6 Data Collection Methods**

#### **3.6.1 Direct Observation**

In this study, observation was chosen as one of data collection approaches during Number of customer complaints per year and number of orders of new customers has been collected from the sales and marketing case team. The researcher's observations were used to record the respondents' body language and implied attitudes, as this might give clues about what they really thought about the issues.

### **3.6.2 Semi structured interview**

The researcher use semi structure interviews because they allowed face-to-face communication with respondents, it is a simple and easier way or method of acquiring information that provides straight answers to research questions. Researcher interviewed different HMMBI employers General Manger, Production Manager, supply chain department, marketing department, Quality Control Supervisor, procurement department, and Marketing head

### **3.6.3 Questionnaires**

Structured questionnaires are used to get complete information about the metal manufacturing industries. The questionnaires are developed from ideas of different literatures which focused on supply chain integration performance measurement issues in in Ethiopian metal manufacturing industries. After preparation of the draft; it is pre-tested with academicians to check its content validity and modified accordingly

The questionnaires contain 89 questions requiring types of answers including;

- Brief answer for subjective questions
- Interview
- Scales including

Strongly agree

Agree

Neutral

Disagree

Strongly disagree

### **3.6.4 Independent variable and Dependent variable**

To meet the objective the researcher has put the guide for this research study. The main target of this research study is to measuring supply chain integration performance by identifying SCIP factors metrics from literature and to propose improvement solution.

### 3.7 Target population and Sample design

#### 3.7.1 Target Population

The target population for this study includes metal manufacturing and machine building industry, general manager, communication head, marketing head supply chain head, machine operator, employee supervisors, quality management head and logistics department, machine operators known local customer and maintenance head individual employees. The company have regular 900 and 120 contract workers, from which around 650 low educational level and 100 direct labors engaged in production; the remaining 150 employees are above diploma level and working in administrative area.

#### 3.7.2 Sample Size

A simple random sampling method was used to select respondents for the study. Simple random sampling ensures that each member of the population has an equal chance for selection.

Z (for the confidence level of 95%). (Actually, it relates to the area under a

Normal distribution curve, but you don't need to worry about that!) For a confidence level of 95per cent, Z=1.96; for 90 per cent, Z= 1.64; and for 99 per cent, Z=2.58. P is the degree of variability, expressed as a decimal; if you don't know this, then use 0.5. e is the level of precision, expressed as a decimal.

$$n_0 = \frac{Z^2 * p(1-p)}{c^2} \dots\dots\dots(1)$$

$$n_f = \frac{n_0}{1 + \frac{n_0 - 1}{N}} \dots\dots\dots(2)$$

Where:

$n_0$  = initial Sample Size

$n_f$ = target sample size

Z = Z-values for confidence levels are (1.645 for 90% confidence level, 1.96 for 95% confidence level and 2.576 for 99% confidence level)

p = percentage picking a choice, expressed as decimal 0.5 used for sample size needed

C = confidence interval, expressed as decimal; 0.08 = ±8

N = Population =150

$$n_0 = \frac{Zx^2 * p(1-p)}{c^2} = \frac{1.96^2 * 0.5(1-0.5)}{0.08^2} = 150.063$$

$$n_f = \frac{n_0}{1 + \frac{n_0 - 1}{N}} = \frac{150.063}{1 + \frac{150.063 - 1}{150}} = 75$$

### 3.8 Conceptual frame work for SCIPM

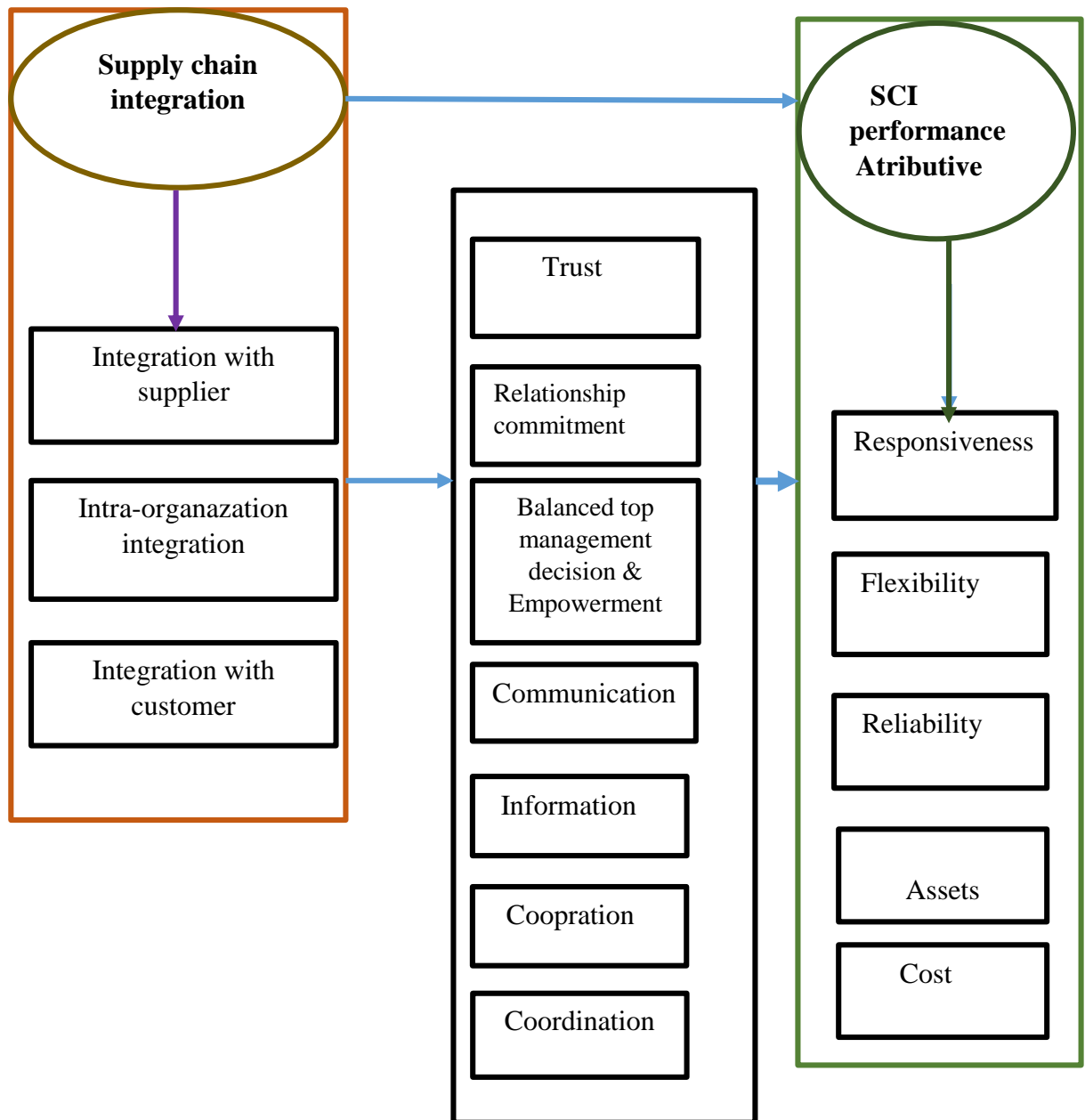


Figure 3.2: Conceptual framework for SCIPMM source: owned

### **3.9 Data Analysis and Presentation**

Data and information that is collected during the study is reduced into summary format. The findings of the research study were organized and the data were presented in the form of words, numbers and percentages by using tables, pie charts, histograms and graphs.

#### **3.9.1 Tools and Methods**

The IBM SPSS software was at first designed to analyze the data to get relevant information from large amount of data.

IBM SPSS software was applied for this research study to test the validate and reliability of the measuring scale. Descriptive statistics, correlation a neural network and regression analysis has been conducted to understand the existing supply chain integration performance measurement and improvement approach of HMMBI companies.

The researcher was used descriptive statistics for two main purpose first to measure the mean and standard deviation value to check the variance and errors of respondents, whether the model with actual data.

The variance and standard deviation are essential to measures fitness and how well the mean represents the respondents' data. When the standard deviations relatively small and close to the mean value it indicates that the data are accurate.

In SPSS Bivariate Correlation test was done to measure the level of each variable relationship. The researcher was selected Spearman correlation coefficient, Because of the data specific characteristic, and Moreover, Spearman's correlation coefficient, rho, was selected relative to others techniques the sample size is large.

Regression analysis was done to fit a model and to predict values of the dependent variable (DV) from one or more independent variables (IVs).

#### **3.10 Data Reliability and Validity**

To ensure validity and reliability of data collected during the research, pilot study was conducted. This helped the researcher to be familiar with the targeted area. In addition, the researcher frequently visited the Supervisor to get advice and consultation on the progress of the research study and check the reliability and validity of the data collected

## **Chapter Four**

### **Background of the Company**

#### **4.1 Introduction**

The company is Located in Addis Ababa, Lideta Kifle-Ketema, Kebele 07, around Mexico Square and it covers an area of 97,025 square meters. This company was established between the agreement of our country and the Czechoslovakian government here at Addis in 1945 E.C at an estimated cost of Birr 2,000,000.00 and invested capital of Birr 2,000,000.00. It was expanded in 1977 E.C with the expense of Birr 82, 000,000.00. The main objective was to produce different types of ammunition of simple bullet, woodwork and metal work, medals and badges, and tools and spare parts.

Before the current name given as Hibret Manufacturing and Machine Building Industry, it was described by different names at different time frame by different groups. The names of the company were: His Majestic H/Silassie Ammunition Factory, Addis Machine Tools Factory, Addis Metal Pressing Enterprise, Tools and Spare Parts of Design and Manufacturing Center, Addis Engineering Center and Hibret Machine Tool Engineering Complex respectively.

- Tools and Spare Parts Workshops (Mechanical workshop)
- Medals and Badges Workshops
- Metal and Product Packaging Products

#### **4.2 Company Objectives**

- To build erect and commission industrial manufacturing factories in all regional cities.
- To ensure and address industrial machineries spare parts and capital goods requirements across the country

#### **4.3 Vision of the Company**

- To see prosperous Ethiopia in industrial machines and manufacturing technologies.

#### **4.4 Mission of the Company**

- Establishing production factories, build industrial machineries, produce and address capital goods and spare parts under internationally accepted quality and competitive price.

- So as to realize national transformation in industrializing the country.
- Address our FDRE ministry of defense demands; perform continuous capacity building and technology development activities in military aspect.

#### **4.5 Purpose**

Hibret Manufacturing and Machine Building Industry (HMMBI) developed and implemented a Quality Management System (QMS) in order to document the industry's best business practices, and better satisfy the requirements and expectations of its customers and improve the overall management of the Company.

#### **4.6 General Requirements**

HMMBI determines the need for the following core Management processes that are applicable throughout the organization.

- Management Review.
- Document and data control.
- Control of Records.
- Corrective action.
- Audit
- Purchasing.
- Store and inventory management.
- Human resources Developments management.
- Design and development.
- Finance and accounting
- Production

## 4.7 Major Supplier of the Company

Table 4.1: Major supplier of the company

| Item no | Description of goods  | Suppliers                             |
|---------|---|---------------------------------------|
| 1       | CNC machine   | Guang Dong CIMC importer and exporter |
| 2       | Filters with electro pump, vertical stainless steel tank, polyvalent, etc | Vero energia                          |
| 3       | Washing bubblin, working table  | MP Inox                               |
| 4       | Automatic tunnel pasteurizer, steam generator                             | 2M Technology                         |
| 5       | Diesel fuel storage tank  | Tecno Metal Technology                |
| 6       | Pump monho rivers with hopper   | Delta Trading,                        |
| 7       | Seam folding machine  | GSK                                   |
| 8       | Different machine tools   | BEMGIO                                |
| 9       | Metal plate in different thickness  | Metal Market                          |
| 10      | Packing   | Poly Technology                       |
| 11      | Boiler  | Pamco                                 |
| 12      | Spare part  | Harry Yeint                           |
| 13      | Tomato load table   | Light Star                            |
| 14      | Spare part  | Danubian                              |
| 15      | Disassembled spar part  | Palatin Tekestil                      |
| 16      | Machine, spare part boiler  | Ahejian Teams International           |

## 4.8 Major Customers of the Company

Table 4.2: Major customer of the company

| Sugar Factory      | Textile factory | Private company                       | Leather Industry          |
|--------------------|-----------------|---------------------------------------|---------------------------|
| Wengi              | Kombolcha       | Tekelebrihane ambaye construction plc | Ambesa shoe factory       |
| Kurazi one and two | Alemeda textile | Regional owner                        | Tikur abay shoe           |
| Kesem kebena       | Addis Garment   | Yotek construction plc                | factory Different tannery |
| Tendaho            | Akaki Garment   | Belayabe motors plc                   | Mojo tannery              |

Hibert manufacturing and machine building industries (HMMBI) has six factories section:

1. precision machinery section
2. machine building section
3. material treatment and engineering section
4. conventional manufacturing section
5. machine body structure section

Generally, the whole Hibert manufacturing and machine building industries (HMMBI) has eight management departments. General manager, Operational production, Human resource department, Purchasing department, Marketing department, Logistics department, Quality department, Finance department.

## Chapter Five

### Data Collection, Analysis and Interpretation

#### 5.1 Introduction

This chapter presents the data analysis results from questionnaires, interview and direct observation, then interpretations and discussion of findings. The primary data was obtained from the questionnaire which is designed to collect the necessary data to answer the research questions. The researcher presents the data in terms of graphical and statistical way which is developed by using SPSS data processing results software.

The chapter is organized as follows: First it the background information of the respondents then presents the response rate. Secondly questionnaires regarding supply chain integration and interview will be presents, thirdly questionnaires and interviews that are related with performance measurement well be presented.

#### 5.2 Reliability Testing

Cronbach's alpha is an important concept in the evaluation of questionnaires reliability. It is important that researchers should estimate this quantity to add validity and accuracy to the interpretation of their data. Cronbach alpha is used to estimate the proportion of variance that is systematic or consistent in a set of test scores (Brown, 2002). Accordingly ,the researcher applied Cronbach's alpha to check the consistent of each questionnaire.

**Table 5.1: Cronbach's alpha result for supply chain integration and performance measures**

| Reliability Statistics   |                  |            |
|--------------------------|------------------|------------|
| Supply chain integration | Cronbach's Alpha | N of Items |
| 1.Supplier integration   | .982             | 11         |
| 2.Customer integration   | .985             | 12         |
| 3.Quality perspective    | .743             | 13         |
| 3.Internal intergration  | .984             | 13         |
| Perfromance measurment   |                  |            |
| 1.Planning process       | .967             | 5          |
| 2.Sourcing process       | .870             | 6          |
| 3.Making process         | .916             | 6          |
| 4.Delivering process     | .943             | 6          |
| 5.Returning process      | .924             | 5          |

### **5.3 Findings from Questionnaire Analysis**

A total of 89 questionnaires were distributed for HMMBI different departments out of which above 80% were completed by the respondents. The reasons for non-response were unwillingness. The general understanding of concept supply chain integration and performance measurement in the company is higher at the top of the organization and gets lesser as it goes down.

**Profile of the respondents:** from the total number of respondents 94% of them were high level employees with managing director, marketing head, quality head, supplier head purchasing head, planning head and medium level technical head in each staff 75% respondents have more than 15 years' experience.

#### **5.3.1 Respondents Designation**

**Table 5.2: Respondents' designation**

| <b>SN</b>                       | <b>Respondent's designation</b> | <b>Number of respondents</b> | <b>Percentage (%)</b> |
|---------------------------------|---------------------------------|------------------------------|-----------------------|
| 1                               | Manager                         | 2                            | 2.99%                 |
| 2                               | Marketing department            | 12                           | 17.91%                |
| 3                               | purchasing departement          | 10                           | 14.92%                |
| 4                               | prodution departrment           | 13                           | 19.03%                |
| 5                               | supplier departrment            | 11                           | 16.15%                |
| 6                               | planning departement            | 6                            | 8.96%                 |
| 7                               | performance departement         | 5                            | 7.46%                 |
| 8                               | Quality departement             | 8                            | 11.94%                |
| <b>Total retured resondents</b> |                                 | <b>=67</b>                   | <b>99.38%</b>         |

Most of the respondents were production head 19.03%, marketing head 17.91%, supplier heads 16.15% purchasing teams 14.92%, quality department 11.94%, planning head 8.96%, performance heads 7.46% and the remain management directors are 2.99%

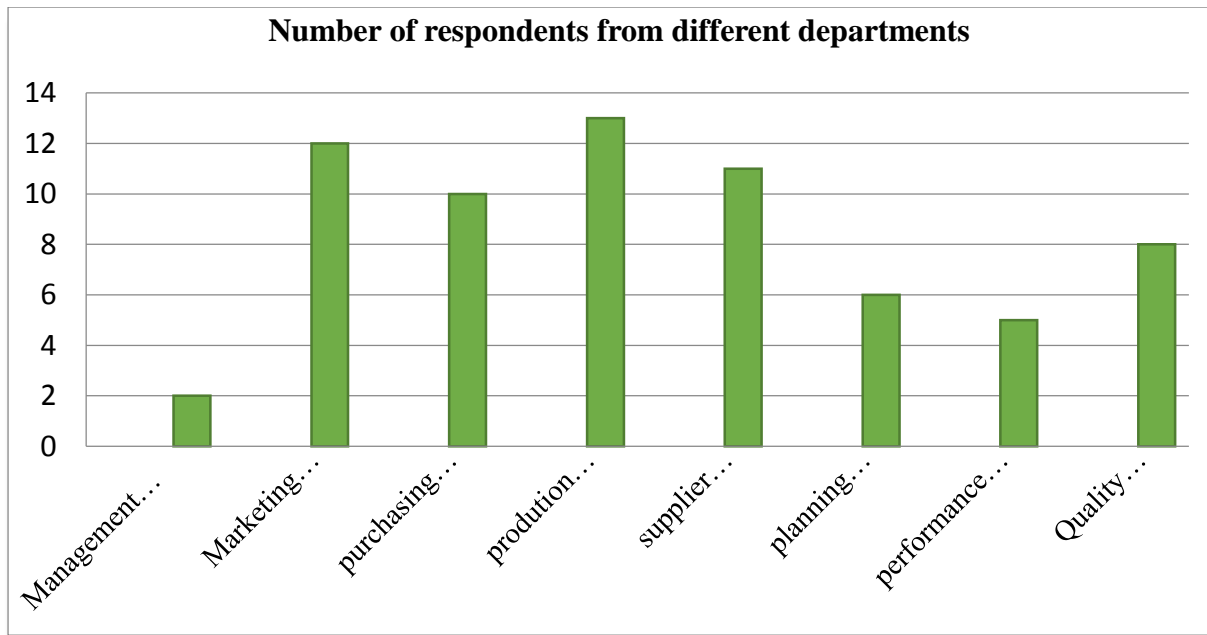


Figure 5.1: Number of respondents from different departments

Table 5.3: Total respondents educational level

| Educational level       | Respondent's designation | Number Respondents | MSc | Degree | Diploma |
|-------------------------|--------------------------|--------------------|-----|--------|---------|
| 1                       | Management Director      | 2                  | 1   | 1      |         |
| 2                       | Marketing departement    | 12                 | 2   | 5      | 5       |
| 3                       | purchasing departement   | 10                 | 2   | 5      | 3       |
| 4                       | production departement   | 13                 | 2   | 4      | 7       |
| 5                       | supplier departement     | 11                 | 3   | 5      | 3       |
| 6                       | planning departement     | 6                  | 1   | 3      | 2       |
| 7                       | performance departement  | 5                  | 1   | 2      | 2       |
| 8                       | Quality departement      | 8                  | 3   | 2      | 3       |
| Total educational level |                          | 67                 | 15  | 27     | 25      |

Most of the respondents were diploma holders which account for 37.31 % and followed by BSc holders which accounts for 40.29% and the rest 22.39. % are master degree.

### 5.4 Content of Data Analysis

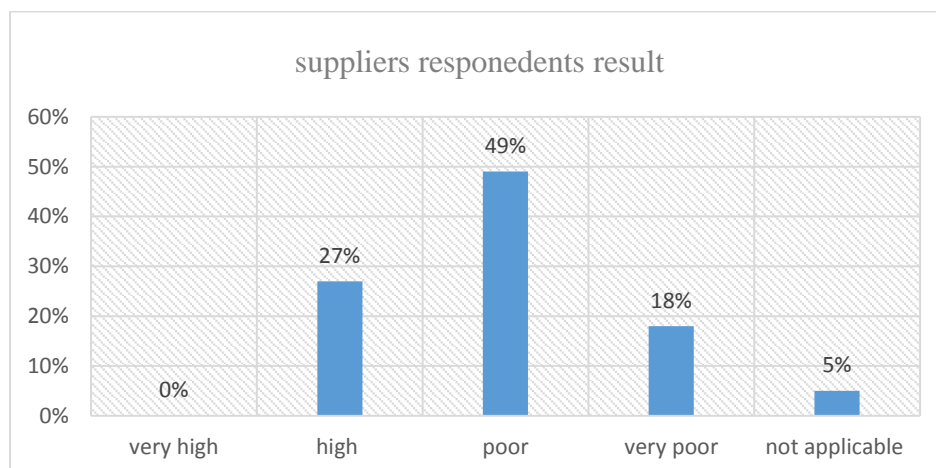
The analysis is done in seven categories with which the survey has been conducted targeting on the research aims and objectives. Under each category major problems and achievements are discussed based on the findings from the interviews and questionnaire.

These are obtained through by conducting interviews, recorded data and personal observations  
These data have been analyzed by segmenting the supply chain integration in to seven stages.

1. Suppliers (Inbound Logistics) department
2. production department
3. marketing /Customers department
4. Purchasing department
5. Planning department
6. Quality management department
7. Performance department

### **5.5 Data Analysis and Interpretation in Supplier perspective**

Above 74% of the respondent Believed that the company they are poorly engaged to supply chain integration and also awareness is not well good (49% of them poor, 18% of them said vary poor, and 5% of them put not applicable response). However, 27% of them respond said high.



**Figure 5.4:** *Suppliers respondents result*

From the above data analysis, one can infer that the majority of employees with diploma and above do not have good awareness about the concept of supply chain integration. This result might in turn leads to the generalization that the other department whose educational background is below diploma might not have a better awareness to Supply chain integration in any circumstances.

HMMBI have local and international suppliers. Most of the suppliers are from Indian, china, Dubai etc. Since local suppliers are very infant. The company doesn't have long term agreement with any of the international suppliers. The companies procure raw materials from

the suppliers always by using open tender procedure. The average lead time from the supplier to the companies is 2 up to 5 months this is a very long lead. In addition to procurement the raw material companies mostly select by giving bill they choose the list price at the time they ask sample to check the quality.

The companies have criteria to select Potential suppliers who supply different metal plate, spare part and partially assembled spare part are list price comparing the other suppliers.

HMMBI their relationship with their suppliers is traditional mostly sometimes they have been seeing as a partner but there is no chance to collaborate.

With regard to the extent of the companies and supplier share technical information, 100% of the respondents are against the companies to use the system in a better manner (42% poor, 18% very low, and 14% with no response and 24% respondent are said high).

From the above data, one can conclude that the companies and their suppliers doesn't share technical information. They mostly the companies they are not consider that the indicators of information integration include information sharing related to demand, sales, production schedules, delivery schedules and performance metrics.

With regard to how do the companies communicate with their supplier to place an order 92% of respondents confirmed by visiting and with telephone. This show that the companies was not well integrated with IT.

The main factors accounting for the failure in securing partnership between parties during outsourcing process are poor communication, lack of top-management support, lack of trust, lack of a total quality management program of the provider company and inadequate upfront planning.

With regard to who are your companies' supplier, 95% of the respondents are know the suppliers but doesn't know how much supplier they have. In general, effective information sharing enhances mutual understanding, which reduces miscommunication and prevents unnecessary mistakes, thereby decreasing transaction costs across the supply chain.

Lastly the respondents were requested to respond about the most obstacle to the companies to import the raw material form their suppliers mostly the obstacles are:

- Lack of Currency
- Price fluctuation
- Sample and imported are misaligned

- Late delivery time
- Communications problems with suppliers etc.

All the above obstacle are directly affects the company's suppliers.

### **5.5.1 Financial flow in the supplier perspective**

Most of above 95% respondents are agreed that lack currency, management commitment, trust and collaboration are the main problem that faced the companies during procurement. In HMMBI the flow of finance for international procurement from the suppliers is through national bank of Ethiopia by opening letter of credit (LC) in the form of hard currency. Most of the time HMMBI raw materials are not given priority, due to lack hard currency (dollar) this also affect the delivery time to be very late.

### **5.5.2 Information Material flow in supplier perspective**

The information flow is need to both local and international suppliers through telephone, fax and direct visiting. An open tender will be prepared with required contents and all the necessary documents, quantification of the need, order visibility etc. will be performed through by direct contacting with Ethiopia Customs Agency and transit service(ECATS).

the companies also to procure different required amount of partly assembled products and raw materials from local suppliers by direct contacting.

### **5.5.3 Collaboration, Coordination, cooperation and Integration among Suppliers perspective**

#### **➤ Collaboration**

Collaboration among different partners of a supply chain strengthens long-term relationships based on personal trust, bringing benefits such as the joint creation of knowledge, information sharing and understanding the intentions of the partner, and creating values for a supply chain.

With regard to suppliers 74% of the respondents said that the companies have not effective cooperation, collaboration, coordination, communications and information sharing with their suppliers. Still now weak collaboration, integration & coordination with local and international suppliers. the flow of goods, information, and money from supplier to the companies were not a smooth interplay between and among the different partners. Due to this

the companies always don't meet the customers' requirements on time and accurately.

The companies are no long term agreement with potential raw material suppliers and vender; they are not collaborating and well integrated with information technologies.

➤ **Trust and relationship commitment**

Trust plays a major role in improving the relationships between parties. But in HMMBI the main cause of social and economic crises is the loss of trust. Still now, trust was found to be a crucial factor that affects supply chain integration and collaboration in the companies.

Most respondents said that the companies in the supply chain integration they are not actively working together towards common objectives with other companies. Nowadays, trust is an important determinant of the development of modern companies. In developed countries trust can provide preventive tools for avoiding, mitigating and managing the negative effects of the companies' economic processes but in Ethiopia specially HMMBI the concept of trust is very infant. The degree of trust in the companies that exists between different partners' relationship are not honesty, generosity and overall competence of the others partners. According to the respondents the companies had no trust between partners' due to problems arise; for instance, they become less motivation and unwilling to pass on sensitive information. Also it difficult to agree about how finances should be managed. In short HMMBI do not work to promote collaboration.

Commitment refers to an exchange partner's belief that an ongoing relationship with another is so important as to warrant maximum efforts at maintaining it; that is, the committed party believes the relationship endures indefinitely has to be scrutinized and verified, increasing the transaction costs.

A commitment is important ways between trading partners refers to the willingness of suppliers' and buyers to exert effort on behalf of the relationship. HMMBI are not committed their supply chain partners due to lack of top management commitment.

Top management in the companies is not critical with it being responsible for all activities at every level of companies, for decision making. Mostly the supplier doesn't fully trust retailers and they don't work with full capacity

Generally, due to low commitment and lack trust a partnership will lead to a failure to meet objectives.

#### **5.5.4 Survey data analysis with SPSS tool in supplier perspective**

To identify and evaluate the level supply chain integration practice in HMMBI

In which respondent were told to rate their opinions on the Likert scale ranging from strongly disagree (1) to strongly agree (4). Strongly agree =5, Agree=4, Neutral=3 Disagree=2 and Strongly disagree=1.

The mean and standard deviation (S.D) were evaluated to compare the level of supply chain integration in the companies.

To interpret the obtained data, the following numerical values and interpretations were used to measure their application in supply chain integration in HMMBI.

**Table 5.4: Response mode and interpretation**

| Mean Range  | Response Mode     | Interpretation    |
|-------------|-------------------|-------------------|
| 1.00 - 1.75 | Strongly Disagree | Not used          |
| 1.75 - 2.75 | Disagree          | Used rarely       |
| 2.75- 3.25  | Agree             | Used occasionally |
| 3.25 - 4.00 | Strongly Agree    | Used frequently   |

**Table 5.5: Descriptive Statistics parameters value for supplier perspective**

| Code               | N | Mean   | Std. Deviation | Interpretation    |
|--------------------|---|--------|----------------|-------------------|
| SV1                | 8 | 3.0000 | .92582         | Used occasionally |
| SV2                | 8 | 2.3750 | 1.06066        | Used rarely       |
| SV3                | 8 | 2.7500 | 1.16496        | Used occasionally |
| SV4                | 8 | 2.5000 | 1.06904        | Used rarely       |
| SV5                | 8 | 2.1250 | 1.12599        | Used rarely       |
| SV6                | 8 | 2.8750 | .83452         | Used occasionally |
| SV7                | 8 | 2.3750 | .91613         | Used rarely       |
| SV8                | 8 | 2.3750 | 1.40789        | Used rarely       |
| SV9                | 8 | 2.8750 | 1.24642        | Used occasionally |
| SV10               | 8 | 2.0000 | .92582         | Used rarely       |
| SV11               | 8 | 2.3750 | 1.18773        | Used rarely       |
| Valid N (listwise) | 8 |        |                |                   |

Average means =2.72 signifies agreement by the respondent this show that supply chain integration was very rarely practice in HMMBI. Generally, the overall level of supply chain integration was very poor condition in the companies.



your company with your supplier are good) and SV1 (the company have effective communications with their suppliers) ( $\rho=0.915^{**}$ )  $P=0.001$  have strong and positive correlation and the relationship is statistically significant. This shows that, coordination has positive effect on communication.

The correlation between SV2 (company and supplier have transparent information about inventory status) and SV4 (company collaborate with their supplier’s development programs) ( $\rho=0.929^{**}$ ) have strong and positive relation with significant level  $P=0.001$

SV3 (company and suppliers provide each other with production plan.) and SV4 (company collaborate with their supplier’s development programs) ( $\rho=0.940^{**}$ ) have strong positive relationship with significant level  $P=0.001$ . the correlation between SV3 (company and suppliers provide each other with production plan.) and SV7 (You have long-term relationships with your suppliers) ( $\rho=0.940^{**}$ )  $P=0.001$  have strong and positive relation.

**Table 5.6: Bivariate Correlation analysis and Interpretation in suppliers perspective**

| Code           |    | SV1                     | SV2    | SV3    | SV4    | SV5    | SV6    | SV7    | SV8    | SV9     | SV10   | SV11  |        |
|----------------|----|-------------------------|--------|--------|--------|--------|--------|--------|--------|---------|--------|-------|--------|
| Spearman's rho | S1 | Correlation Coefficient | 1.000  | .727*  | .927** | .878** | .981** | .933** | .878** | 1.000** | .863** | .727* | .915** |
|                | S1 | Sig. (2-tailed)         | .      | .041   | .001   | .004   | .000   | .001   | .004   | .       | .006   | .041  | .001   |
|                | S2 | Correlation Coefficient | .727*  | 1.000  | .809*  | .929** | .763*  | .829*  | .877** | .727*   | .738*  | .730* | .856** |
|                | S2 | Sig. (2-tailed)         | .041   | .      | .015   | .001   | .028   | .011   | .004   | .041    | .037   | .040  | .007   |
|                | S3 | Correlation Coefficient | .927** | .809*  | 1.000  | .940** | .909** | .848** | .940** | .927**  | .960** | .723* | .909** |
|                | S3 | Sig. (2-tailed)         | .001   | .015   | .      | .001   | .002   | .008   | .001   | .001    | .000   | .043  | .002   |
|                | S4 | Correlation Coefficient | .878** | .929** | .940** | 1.000  | .881** | .851** | .979** | .878**  | .832*  | .730* | .934** |
|                | S4 | Sig. (2-tailed)         | .004   | .001   | .001   | .      | .004   | .007   | .000   | .004    | .010   | .040  | .001   |
|                | S5 | Correlation Coefficient | .981** | .763*  | .909** | .881** | 1.000  | .948** | .901** | .981**  | .846** | .799* | .917** |
|                | S5 | Sig. (2-tailed)         | .000   | .028   | .002   | .004   | .      | .000   | .002   | .000    | .008   | .017  | .001   |
|                | S6 | Correlation Coefficient | .933** |        | .848** | .851** | .948** | 1.000  | .818*  | .933**  | .814*  | .771* | .902** |
|                | S6 | Sig. (2-tailed)         | .001   |        | .008   | .007   | .000   | .      | .013   | .001    | .014   | .025  | .002   |
|                | S7 | Correlation Coefficient | .878** | .877** | .940** | .979** | .901** | .818*  | 1.000  | .878**  | .832*  | .774* | .914** |
|                | S7 | Sig. (2-tailed)         | .004   | .004   | .001   | .000   | .002   | .013   | .      | .004    | .010   | .024  | .001   |

|  |                         |         |        |        |        |        |        |        |        |        |        |        |
|--|-------------------------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| SV8  | Correlation Coefficient | 1.000** | .727*  | .927** | .878** | .981** | .933** | .878** | 1.000  | .863** | .727*  | .915** |
|  | Sig. (2-tailed)         | .       | .041   | .001   | .004   | .000   | .001   | .004   | .      | .006   | .041   | .001   |
| SV9  | Correlation Coefficient | .863**  | .738*  | .960** | .832*  | .846** | .814*  | .832*  | .863** | 1.000  | .708*  | .826*  |
|  | Sig. (2-tailed)         | .006    | .037   | .000   | .010   | .008   | .014   | .010   | .006   | .      | .050   | .012   |
| SV10   | Correlation Coefficient | .727*   | .730*  | .723*  | .730*  | .799*  | .771*  | .774*  | .727*  | .708*  | 1.000  | .856** |
|  | Sig. (2-tailed)         | .041    | .040   | .043   | .040   | .017   | .025   | .024   | .041   | .050   | .      | .007   |
| SV11   | Correlation Coefficient | .915**  | .856** | .909** | .934** | .917** | .902** | .914** | .915** | .826*  | .856** | 1.000  |
|  | Sig. (2-tailed)         | .001    | .007   | .002   | .001   | .001   | .002   | .001   | .001   | .012   | .007   | .      |
| *. Correlation is significant at the 0.05 level (2-tailed).  |                         |         |        |        |        |        |        |        |        |        |        |        |
| **. Correlation is significant at the 0.01 level (2-tailed). |                         |         |        |        |        |        |        |        |        |        |        |        |
| c. Listwise N = 8  |                         |         |        |        |        |        |        |        |        |        |        |        |

The correlation between SV4 (company collaborate with their supplier's development programs) and SV11 (level of coordination and cooperation your company with your supplier are good) ( $\rho=0.902^*$ )  $P=0.002$  has strong correlation and the relationship is statistically significant.

The correlation between SV6 (company and your suppliers share technical information with each other) and SV11 (level of coordination and cooperation your company with your supplier are good) ( $\rho=0.902^{**}$ )  $P=0.002$  has strong correlation and the relationship is statistically significant. SV8 (company reward for suppliers based on their performance.) and SV11 (level of coordination and cooperation your company with your supplier are good) ( $\rho=0.915^{**}$ )  $P=0.001$  has strong correlation and the relationship is statistically significant. The correlation between SV9 (During procurement your supplier have quick ordering system) and SV11 (level of coordination and cooperation your company with your supplier are good) ( $\rho=0.826^*$ )  $P=0.012$ , SV10 (your company and your supplier have good trust and relationship commitment) and SV11 (level of coordination and cooperation your company with your supplier are good) ( $\rho=0.856^{**}$ )  $P=0.007$  has strong correlation and the relationship is statistically significant.

## 5.6 Data analysis and Interpretation customers perspective

From total respondents in marketing /customer perspective 16% agree ,19% neutral ,48% disagree,15% strongly disagree with regards customers and company relations.

With regard to delivery time to the customers 95% the respondents said that customers always complaints with delivery lead times.

The customer of HMMBI are mostly local governmental factory/project likes Ethiopian renaissance dam, sugar factories, textile factories, Yayu fertilizer factories and different private companies are the main customers of the company.

The products of HMMBI are different spare parts, machine part nitrogen tanker, brake pad, plates etc.

The companies have no criteria to select their potential customers, this indicate that the companies have no supply chain integration systems with customers.

Most of the respondents above 80% said that the company doesn't recognized their customers.

### **5.6.1 Factors affecting SCI in customers perspective**

#### **➤ Communication**

With regard to customer communication to place an order 95% of the respondents said that the customers place an order by use direct visiting and with telephone.

64% of the respondents are disagree with the companies have effective communication system with their customers. The company managers should not focus their effort on improving customer satisfaction.

In the HMMBI most of a time there is no incorporating feedback and listening, and facilitating between companies with customers.

#### **➤ Trust and Relationship commitment**

Any business has its own risk, trust has significant importance and to become one of the top priorities to hold up the relationship among different supply chain partners. But HMMBI are not stable long lasting mutual relationship with different regional partners. According to the respondents above 70% said that specially trust increases the confidence of the supply chain partners and improves commitment that reduces risk between the two partners but in the company there was no strong relationship and commitment between among different partners.

From literature Trust is a key factor for the development of partnerships among the different agents of a supply chain. And trust also has positive significant effect on firm performance. But in HMMBI due to lack of trust among the supply chain integration often results in inefficient and ineffective performance

with regard to cooperation, Collaboration, Coordination and integration companies with customers 63% of the respondent disagree with the companies and customers have good relationship. Still now the companies have weak collaboration cooperation & coordination with customers.

Information sharing to the customer reduces demand uncertainty but HMMBI doesn't have advanced information, Coordination and communication systems and flexibility to ensures the flow of reliable information with regard to problems and adapts with changing circumstance

Mostly the obstacle in marketing /customer with companies are listed below.

- Lack of top management proper commitment
- Lack of coordination, cooperation, collaboration with the custom
- Delivery lead time
- Quality
- Quantity of product
- Trust and relationship commitment

### **5.6.2 Survey data analysis with SPSS tool in customer perspective**

*Table 5.7: Descriptive Statistics for customer perspective*

| <b>Descriptive Statistics</b> |    |        |                |
|-------------------------------|----|--------|----------------|
| Code                          | N  | Mean   | Std. Deviation |
| CV1                           | 13 | 2.3077 | 1.10940        |
| CV2                           | 13 | 2.8462 | .80064         |
| CV3                           | 13 | 2.4615 | .96742         |
| CV4                           | 13 | 2.3846 | 1.04391        |
| CV5                           | 13 | 2.6923 | .94733         |
| CV6                           | 13 | 2.4615 | 1.05003        |
| CV7                           | 13 | 2.2308 | .92681         |
| CV8                           | 13 | 2.4615 | .77625         |
| CV9                           | 13 | 1.9231 | .75955         |
| CV10                          | 13 | 2.2308 | 1.09193        |
| CV11                          | 13 | 2.3846 | .96077         |
| CV12                          | 13 | 2.0000 | .81650         |
| Valid N<br>(listwise)         | 13 |        |                |

From the above tabulation the average mean value is 2.189 signifies agreement by the respondent this show that the company's overall level of supply chain integration was very poor condition in the companies.

From the respondents' response the companies had lower practice in their consideration of customer deliver time with material requirement and capacity. The companies did not meet the requirement of the customers.

The companies have not transparency and effective communication, collaboration and cooperation to the customer about inventories status and product plan.

The companies had not a systematic way to measure constantly customer satisfaction and technical information.

**Table 5.8: Bivariate Correlation analysis and Interpretation in customer perspective**

| Code           |                         | CV 1                    | CV 2   | CV 3   | CV 4   | CV 5   | CV 6   | CV 7   | CV 8   | CV9    | CV 10 | CV1 1  | CV 12  |        |
|----------------|-------------------------|-------------------------|--------|--------|--------|--------|--------|--------|--------|--------|-------|--------|--------|--------|
| Spearman's rho | C V1                    | Correlation Coefficient | 1.000  | .874** | .867** | .912** | .871** | .916** | .929** | .854** | .829* | .967** | .893*  | .890** |
|                |                         | Sig. (2-tailed)         | .      | .000   | .000   | .000   | .000   | .000   | .000   | .000   | .000  | .000   | .000   | .000   |
|                | C V2                    | Correlation Coefficient | .874** | 1.000  | .853** | .874** | .923** | .855** | .843** | .776** | .700* | .871** | .830*  | .781** |
|                |                         | Sig. (2-tailed)         | .000   | .      | .000   | .000   | .000   | .000   | .000   | .002   | .008  | .000   | .000   | .002   |
|                | C V3                    | Correlation Coefficient | .867** | .853** | 1.000  | .969** | .902** | .927** | .900** | .776** | .747* | .840** | .945*  | .836** |
|                |                         | Sig. (2-tailed)         | .000   | .000   | .      | .000   | .000   | .000   | .000   | .002   | .003  | .000   | .000   | .000   |
|                | C V4                    | Correlation Coefficient | .912** | .874** | .969** | 1.000  | .897** | .893** | .939** | .768** | .824* | .894** | .911*  | .899** |
|                |                         | Sig. (2-tailed)         | .000   | .000   | .000   | .      | .000   | .000   | .000   | .002   | .001  | .000   | .000   | .000   |
|                | C V5                    | Correlation Coefficient | .874** | .923** | .902** | .897** | 1.000  | .891** | .858** | .784** | .689* | .858** | .870*  | .769** |
|                |                         | Sig. (2-tailed)         | .000   | .000   | .000   | .000   | .      | .000   | .000   | .002   | .009  | .000   | .000   | .002   |
|                | C V6                    | Correlation Coefficient | .912** | .855** | .927** | .893** | .891** | 1.000  | .934** | .832** | .718* | .883** | .985*  | .795** |
|                |                         | Sig. (2-tailed)         | .000   | .000   | .000   | .000   | .000   | .      | .000   | .000   | .006  | .000   | .000   | .001   |
|                | C V7                    | Correlation Coefficient | .923** | .843** | .900** | .939** | .858** | .934** | 1.000  | .777** | .853* | .890** | .942*  | .870** |
|                |                         | Sig. (2-tailed)         | .000   | .000   | .000   | .000   | .000   | .000   | .      | .002   | .000  | .000   | .000   | .000   |
|                | C V8                    | Correlation Coefficient | .854** | .776** | .776** | .768** | .784** | .832** | .777** | 1.000  | .527  | .761** | .826*  | .681*  |
|                |                         | Sig. (2-tailed)         | .000   | .002   | .002   | .002   | .002   | .000   | .002   | .      | .064  | .003   | .000   | .010   |
|                | C V9                    | Correlation Coefficient | .829*  | .700** | .747** | .824** | .689** | .718** | .853** | .527   | 1.000 | .857** | .736*  | .933** |
|                |                         | Sig. (2-tailed)         | .000   | .008   | .003   | .001   | .009   | .006   | .000   | .064   | .     | .000   | .004   | .000   |
| C V10          | Correlation Coefficient | .967**                  | .871** | .840** | .894** | .858** | .883** | .890** | .761** | .857*  | 1.000 | .851*  | .921** |        |
|                | Sig. (2-tailed)         | .000                    | .000   | .000   | .000   | .000   | .000   | .000   | .003   | .000   | .     | .000   | .000   |        |

|  |                         |        |        |        |        |        |        |        |        |       |        |       |        |
|--|-------------------------|--------|--------|--------|--------|--------|--------|--------|--------|-------|--------|-------|--------|
| C<br>V1<br>1   | Correlation Coefficient | .893** | .830** | .945** | .911** | .870** | .985** | .942** | .826** | .736* | .851** | 1.000 | .829** |
|  | Sig. (2-tailed)         | .000   | .000   | .000   | .000   | .000   | .000   | .000   | .000   | .004  | .000   | .     | .000   |
| C<br>V1<br>2   | Correlation Coefficient | .890** | .781** | .836** | .899** | .769** | .795** | .870** | .681*  | .933* | .921** | .829* | 1.000  |
|  | Sig. (2-tailed)         | .000   | .002   | .000   | .000   | .002   | .001   | .000   | .010   | .000  | .000   | .000  | .      |
| **. Correlation is significant at the 0.01 level (2-tailed). |                         |        |        |        |        |        |        |        |        |       |        |       |        |
| *. Correlation is significant at the 0.05 level (2-tailed).  |                         |        |        |        |        |        |        |        |        |       |        |       |        |
| c. Listwise N = 13   |                         |        |        |        |        |        |        |        |        |       |        |       |        |

As we have shown in the above tabulation matrix each variables of customer perspective have strong and positive relation with each and have a significance level of 0.001 and 0.05.

The correlation between CV2 (Company and customers have transparent information about each other's inventory status.) and CV8 (Your company have a systematic way to constantly measure customer satisfaction) ( $\rho=0.776^{**}$ )  $P=0.002$  have strong positive relation and the relationship is statistically significant. CV2 (Company and customers have transparent information about each other's inventory status.) and CV12(company have trust with their customer) ( $\rho=0.781^{**}$ )  $P=0.002$  have strong positive correlation and the correlation is statistically significant. From the above customer satisfaction and trust has positive effect on transparent information.

The correlation between CV3 (company and your customers provide each other with production plan.) and CV8 (Your company have a systematic way to constantly measure customer satisfaction) ( $\rho=0.776^{**}$ ) have strong positive relation with significant level  $P=0.002$ . CV4 (Your company collaborate with your customer's development program.) and MV9 (Company and customer have good relationship commitments) ( $\rho=0.824^{**}$ )  $P=0.001$  have strong positive relation and the correlation is statistically significant.

CV6 (You company and your customers share technical information with each other) and CV12 (Company have trust with their customer) ( $\rho=0.784^{**}$ ) have strong positive relation with significance level  $P=0.002$ .

The correlation between CV7 (your company have long-term relationships with your customers) and CV8 (Your company have a systematic way to constantly measure customer satisfaction) ( $\rho=0.777^{**}$ )  $P=0.002$  have strong correlation and the correlation is statistically significant.

MV9 (Company and customer have good relationship commitments) and MV3 (company and your customers provide each other with production plans) ( $\rho=0.747^{**}$ ) have strong positive relation, with significance level  $P=0.003$ .

The correlation between CV10 (company have quick ordering and delivery time to customers) and CV8 (Your company have a systematic way to constantly measure customer satisfaction) ( $\rho=0.761^{**}$ )  $P=0.003$  have strong correlation and the correlation is statistically significant.

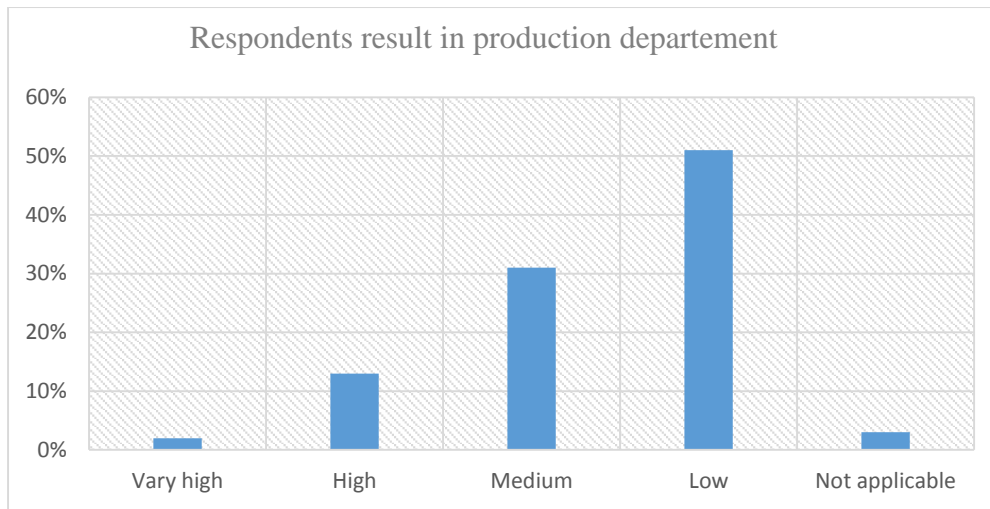
## **5.7 Data analysis and Interpretation internal company integration perspective**

Under production operation department of HMMBI consist five main factory section listed below.

- Precision manufacturing factory section
- Conventional manufacturing factory section
- Machine body structures factory section
- Machine building factory section
- Material heat treatment factory section

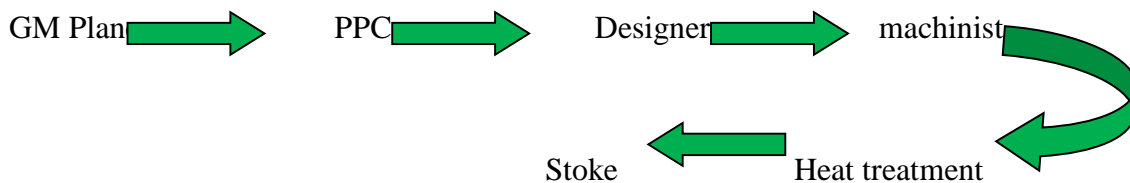
Processes for the manufacturing, inspection, test installation and servicing of products are identified, planned and carried out under controlled conditions, in order to ensure the quality of those products and services.

Documented procedures defining those processes are provided by means of drawing, specifications, workmanship standards and work instruction workmanship, including accept and reject criteria, is specified in written standards or by means of representative samples. Planned inspections and tests are performed at specific points during the manufacturing cycle. Work instructions are used to ensure that inspection and test personnel accurately evaluate the products and processes to be carried out at various stages of manufacturing



**Figure 5.8:** Respondent results in HMMBI production process

The production process in HMMBI first the general manager or planer receive customer request work from different governmental and private companies by negotiating the price and quality. Next the planer immediately affords the order to PPC to assign the designer engineer. The designer draws each part the objects according to specifications. Again the designer return back the drawing to PPC then PPC Schedule a time and assign the job in workshop for each machinist to do the out product. After the product machined goes to heat treatment to get the required material properties. Lastly the final output product checked its quality by quality department and goes to stoke until the ordered customer come.



In HMMBI mostly product quality improvement techniques are calibration and follow up. The was no statistical quality controller tools like six sigmas, three sigma and others tools. In the company there was no proper waste reduction system even if the concept also infant.

**5.7.1 Factor affecting supply chain integration in the company**

➤ **Domination of top management decision making**

In HMMBI companies domination of top management decision making have its own factors internally. The total employee in the company are categorized into two groups the first group is military and the second is civil group. The military are mostly high level manager and each

staff heads those are relatively less experience, less awareness about company polices and strategy. They did not know about production process, companies working system, how to communicate with employers, how to integrate company with customers and suppliers. But still now they are dominating in decision making and each activities in the company are controlled military. The board of companies fire the managers after two or three years and assign the new manager from military ones. This new assigned manager also reassigned after two years by other manager from military groups this has its own impact on supply chain integration and firm performance. The power is un balanced always on the hand of military group.

On other hand the civil categories they have good management skill and experience but the companies are not assign them as manager why because each power are dominated by the military force. Due to this most of a time the company's employers are not motivated and more reworks are happened during production. Finally, the customers are not well satisfied because they are not get their order at the right time and at the right quantity. Now a day the companies loss a lot of money .

➤ **Internal Communication**

communication is fundamental to the success of the companies. It is important that company grasp that communicating with employees is a critical success factor. According respondents' response 70% said that in HMMBI there is no effective communication between manager with low employees, one staff heads with other staff heads because employee social structures that include a range of formal and informal communication mechanisms between individual employees, teams, project groups, and between staff and line management was not well good. During production process the PPC receives the customer orders and assign the order to the designer engineer. The designer draft each component drawing part with specification and again assign to for machinist without checking the availability of cutter, caliper, machine, without selecting the skilled machinist randomly assigned for one person. machinist also carelessly done his duty after that the rework happed due to misunderstanding and lack of communication this cause late delivery time and customer dissatisfaction.

In the company's mostly there is no incorporating feedback , listening, and facilitating between employees and top management. Communication, in fact, incorporates all employees to enhance strategic information sharing across functional areas in the other hand high levels of communication tend to be much more productive in problem solving and goal attainment. In

HMMBI the employees not well motivated due to top management problem this result lead to customer dissatisfaction.

Managers should not focus their effort on improving employee satisfaction, and unsatisfied employees will not enable to facilitate, sharing of real-time data and information across business functions.

The cause of poor product quality in the companies listed as follow.

- Lack of management commitment
- Migration /turn over
- Lack of worker experience /skill
- Training are given mostly for few employees
- Low educational status of employees
- Lack of willingness and motivation
- Lack proper accessories

The listed the above are the main cause of poor product quality in the companies. The cause of problem is employee migration from the companies due to less salaries paid. the other cause is lack of motivation and willingness. According to the respondents' response racism and political situation the most obstacle in the companies. The companies' employer is categorized by two High level of manager, medium level manager and each department head are first categories and the second categories are lower worker. The first categories come from militaries with political case and those are low educational level and they had no experience about the companies' system but the government assign without criteria. the second categories are civilian they had educational and good experience even some of them are 20-year experience but still now they are machinist.

The main obstacle in the companies are listed below

- Political problem
- Lack of hard currency
- Lack of communication, information sharing each process
- Lack of motivation etc.

According to the respondents lack of management commitment, communication and political race are the root cause of for the company during production. Mostly HMMBI hire the employer with regard the person of the same race or family that are no experience even without field.

During my observation I had seen more rework in each production factories due to less experience lack of skill, motivation, willingness. Most of a time the machinist and the other worker enter to the jobs by its family that means by corruption. Due to this the designer and the machinist even the PPC they are not communicating well enough.

**Table5.9: Descriptive Statistics for company productions perspective**

| Code  | Mean   | Std. Deviation | N  |
|-------|--------|----------------|----|
| POV1  | 2.7500 | .78640         | 20 |
| POR2  | 2.6500 | .81273         | 20 |
| POR3  | 2.1500 | .67082         | 20 |
| POR4  | 2.8000 | .83351         | 20 |
| POR5  | 2.7500 | .78640         | 20 |
| POR6  | 2.7000 | .57124         | 20 |
| POR7  | 2.8000 | 1.10501        | 20 |
| POR8  | 2.6500 | .87509         | 20 |
| POR9  | 2.5000 | .76089         | 20 |
| POR10 | 2.7000 | .80131         | 20 |
| POR11 | 2.4500 | .60481         | 20 |
| POR12 | 2.5500 | .99868         | 20 |
| POR13 | 2.5000 | .60698         | 20 |

From the above tabulation Likert scale respondents’ response such as Very high= 5, High=4 Medium=3 Low=2, Not applicable=1 POR3 (production simplification mean value is 2.15), POR9(waste reduction from product defect mean value is 2.5) and POR1 (flexible work force is 2.75). In general, the average mean value results from respondents’ response was 1.97 this indicate that production process were low.

**5.7.2 Bivariate Correlation analysis and Interpretation in Intra company perspective**

**Table 5.10: Bivariate Correlation analysis and Interpretation in Intra company perspective**

| Code     |         |                         | PO R V1 | PO R V2 | PO R V3 | PO R V4 | PO R V5 | PO RV 6 | PO R V7 | PO RV 8 | PO RV 9 | PO R V10 | PO RV 11 | PO RV 12 | PO RV 13 |
|----------|---------|-------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|----------|----------|----------|
| Spearman | PO RV 1 | Correlation Coefficient | 1.000   | .900**  | .754**  | .976**  | 1.000** | .786**  | .918**  | .877**  | .804**  | .947**   | .811**   | .867**   | .847**   |

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|          |                         |        |        |        |        |        |        |        |        |        |        |        |        |        |
|----------|-------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|          | Sig. (2-tailed)         | .      | .00    | .00    | .00    | .      | .00    | .00    | .00    | .00    | .00    | .00    | .00    | .00    |
|          |                         | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      |
| PO RV 2  | Correlation Coefficient | .900** | 1.000  | .743** | .894** | .900** | .680** | .918** | .982** | .878** | .946** | .908** | .940** | .962** |
|          | Sig. (2-tailed)         | .000   | .      | .000   | .000   | .000   | .001   | .000   | .000   | .000   | .000   | .000   | .000   | .000   |
| PO RV 3  | Correlation Coefficient | .754** | .743** | 1.000  | .714** | .754** | .605** | .775** | .707** | .730** | .746** | .656** | .819** | .633** |
|          | Sig. (2-tailed)         | .000   | .000   | .      | .000   | .000   | .005   | .000   | .000   | .000   | .000   | .002   | .000   | .003   |
| PO RV 4  | Correlation Coefficient | .976** | .894** | .714** | 1.000  | .976** | .776** | .936** | .876** | .823** | .932** | .830** | .864** | .856** |
|          | Sig. (2-tailed)         | .000   | .000   | .000   | .      | .000   | .000   | .000   | .000   | .000   | .000   | .000   | .000   | .000   |
| PO RV 5  | Correlation Coefficient | 1.000* | .900** | .754** | .976** | 1.000  | .786** | .918** | .877** | .804** | .947** | .811** | .867** | .847** |
|          | Sig. (2-tailed)         | .      | .000   | .000   | .000   | .      | .000   | .000   | .000   | .000   | .000   | .000   | .000   | .000   |
| PO RV 6  | Correlation Coefficient | .786** | .680** | .605** | .776** | .786** | 1.000  | .749** | .701** | .594** | .731** | .663** | .741** | .717** |
|          | Sig. (2-tailed)         | .000   | .001   | .005   | .000   | .000   | .      | .000   | .001   | .006   | .000   | .001   | .000   | .000   |
| PO RV 7  | Correlation Coefficient | .918** | .918** | .775** | .936** | .918** | .749** | 1.000  | .913** | .842** | .964** | .857** | .924** | .892** |
|          | Sig. (2-tailed)         | .000   | .000   | .000   | .000   | .000   | .000   | .      | .000   | .000   | .000   | .000   | .000   | .000   |
| PO RV 8  | Correlation Coefficient | .877** | .982** | .707** | .876** | .877** | .701** | .913** | 1.000  | .874** | .925** | .913** | .957** | .977** |
|          | Sig. (2-tailed)         | .000   | .000   | .000   | .000   | .000   | .001   | .000   | .      | .000   | .000   | .000   | .000   | .000   |
| PO RV 9  | Correlation Coefficient | .804** | .878** | .730** | .823** | .804** | .594** | .842** | .874** | 1.000  | .838** | .893** | .837** | .818** |
|          | Sig. (2-tailed)         | .000   | .000   | .000   | .000   | .000   | .006   | .000   | .000   | .      | .000   | .000   | .000   | .000   |
| PO RV 10 | Correlation Coefficient | .947** | .946** | .746** | .932** | .947** | .731** | .964** | .925** | .838** | 1.000  | .856** | .899** | .900** |

|  |                         |        |        |        |        |        |        |        |        |        |        |        |        |        |
|--|-------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|  | Sig. (2-tailed)         | .000   | .000   | .000   | .000   | .000   | .000   | .000   | .000   | .000   | .      | .000   | .000   | .000   |
| PORV11   | Correlation Coefficient | .811** | .908** | .656** | .830** | .811** | .663** | .857** | .913** | .893** | .856** | 1.000  | .874** | .915** |
|  | Sig. (2-tailed)         | .000   | .000   | .002   | .000   | .000   | .001   | .000   | .000   | .000   | .000   | .      | .000   | .000   |
| PORV12   | Correlation Coefficient | .867** | .940** | .819** | .864** | .867** | .741** | .924** | .957** | .837** | .899** | .874** | 1.000  | .935** |
|  | Sig. (2-tailed)         | .000   | .000   | .000   | .000   | .000   | .000   | .000   | .000   | .000   | .000   | .000   | .      | .000   |
| PORV13   | Correlation Coefficient | .847** | .962** | .633** | .856** | .847** | .717** | .892** | .977** | .818** | .900** | .915** | .935** | 1.000  |
|  | Sig. (2-tailed)         | .000   | .000   | .003   | .000   | .000   | .000   | .000   | .000   | .000   | .000   | .000   | .000   | .      |
| **. Correlation is significant at the 0.01 level (2-tailed). |                         |        |        |        |        |        |        |        |        |        |        |        |        |        |
| b. Listwise N = 20   |                         |        |        |        |        |        |        |        |        |        |        |        |        |        |

From above relationship matrix each variable in production process perspective the correlation between (PORV2) Work in progress and (POR6) Continuous improvement ( $\rho=0.680^{**}$ ) have strong and positive relation with significance level  $P=0.001$ . (POR3) Production simplification and (POR11) Productions lead time and set-up time ( $\rho=0.680^{**}$ )  $P=0.001$  correlate positively and strongly the relationship is statistically significant.

The correlation between (POR6) Continuous improvement, (POR8) Work team quality control and (POR11) Productions lead time and set-up time( $\rho=0.741^{**}$ ) has strong and positive relation with significance level  $P=0.001$ . The correlation between (POR13) Waste reduction overproduction and (POR3) Production simplification ( $\rho=0.633^{**}$ ) have weak and positive relation with significance level  $P=0.006$ .

### 5.7.3 Data analysis with neural network representation in supply chain integration factors metrics

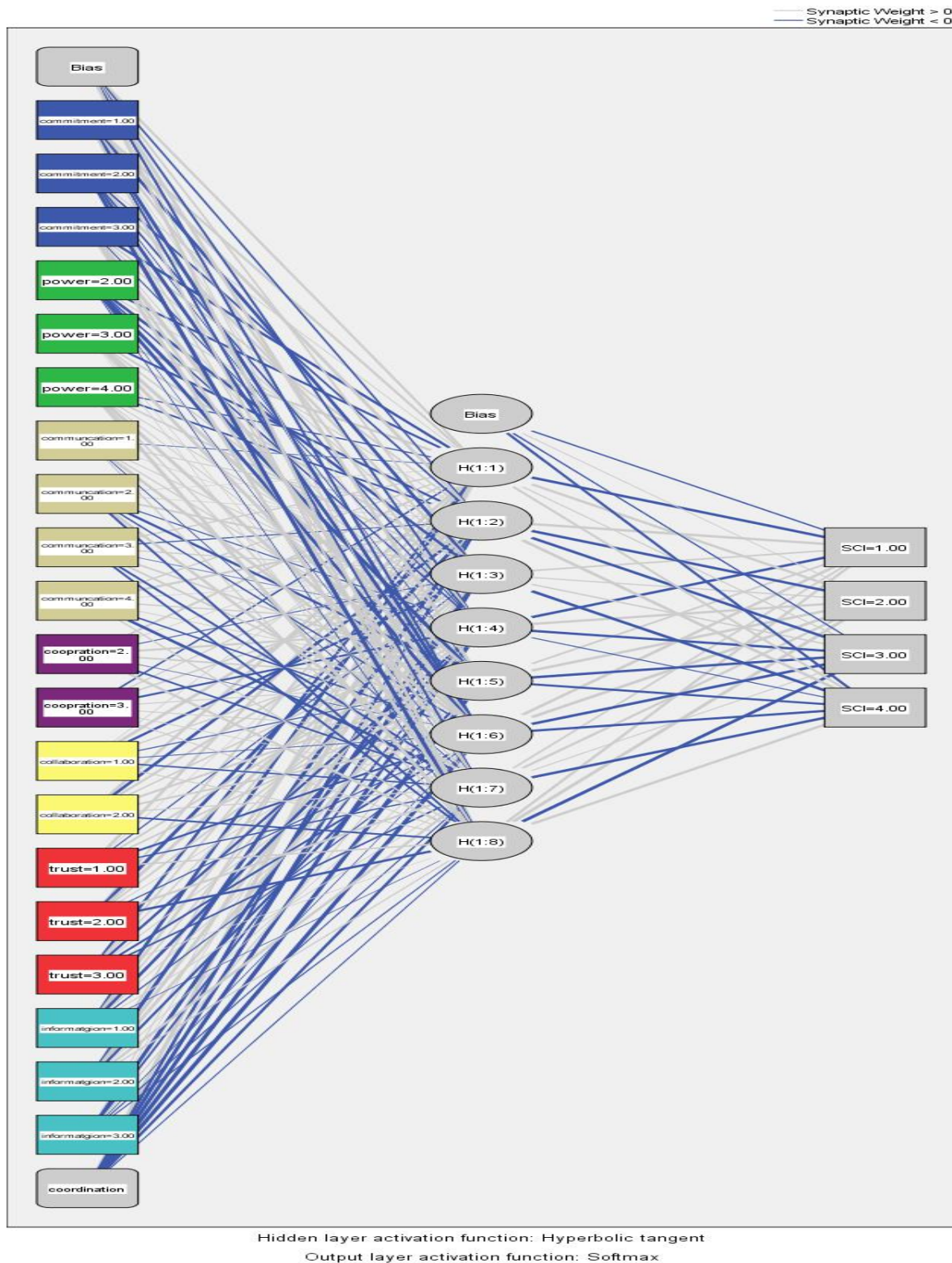


Figure 5.4: Neural network representation for supply chain integration factors metrics

#### **5.7.4 IBM SPSS Regression Neural Networks Model Analysis**

Neural Networks in IBM SPSS provides further an alternative option approaches to predictive the level of supply chain integration performance in the companies. SPSS propose different neural network algorithms in this scenario the researcher used Multilayer Perceptron (MLP) why because the predictors are more than two. Neural networks Predictive are especially important in applications where the data more complex.

The algorithms neural network representation is known as ‘supervised networks’ in the value that the results model-predicted can be compared with target variables values.

One of the main advantage of neural networks it is flexibility when compared to the other classical statistical techniques. Neural Networks used to predict both categorical and continuous outcomes. The output layer contains the predictions or responses of the respondent and the input layer are hidden node are units of respondents.

The neutral network is continually build again in order that the synaptic (junction weights) in the nodes predict the outcome value correctly.

Actual output from Neural Networks model used to predict the supply chain integration metrics factors predicts in what level SCIP of the current situation. From the result indicate that supply chain integration performance very low.

### **5.8 Data Analysis and Interpretation in Quality Management Perspective**

The management of HMMBI is not well committed to the development and implementation of the Quality management system and continually improving its effectiveness by communicating to the different section employees. Even there are not meeting customer as well as regulatory and legal requirements. The responsibility, authority and the inter-relation of personnel, are not good enough.

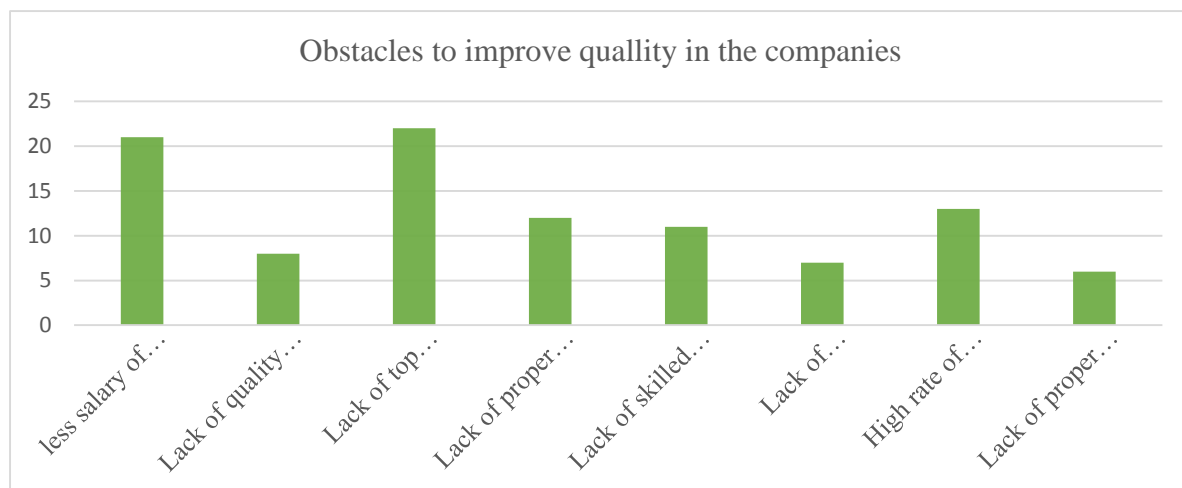
#### **5.8.1 Quality related problem in the company**

Most of a time the causes of poor quality products in the companies is employees lack of skill, lack of experience, employee turnover (leave) due to less salary paid. In this case company hire a new works those are less awareness about quality and customers’ needs, skill and zero-year experience. In other case the most worker also low educational level and less understanding about the concept of quality.

The system of the organization such as policies, rules and procedures are the primary obstacle to improve quality in the company. Lack of required knowledge and skill of employees is the second major contributor. The quality related problems faced HMMBI company are as follow:

- less salary of employees
- Lack of quality awareness
- Lack of top management commitment to quality
- Lack of proper training
- Lack of skilled manpower
- Lack of motivation of workers
- Customer dissatisfaction because of late delivery
- High rate of rework/rejects
- Lack of proper inspection techniques
- Customers are not fully confidential by the company because of the machinist some time produce the product out of specification and the companies also does not produce less ten-piece but customer requested single or two piece due to is the customer are not satisfied.

**Figure 5.9:** *Obstacle to improve quality in the company*



According to the respondents training given to the employees is very low and mostly the company give training only for a few employees. Education and training is not imparted to employees to enhance the skills and competence of the personnel. The effectiveness of the training is not evaluated periodically. Information sharing, collaboration, cooperation, coordination and team work between department to department is not well good.

Ensures that the employees are not aware of the relevance and importance of their activities and how they contribute to the achievement of the quality objectives. 80% of the respondent are agree with the company have no supply chain integration. the company sell the product form different supplier that leads the supplier may not deliver the ordered item according specification.

According to the respondents, most of the HMMBI do not identify customer requirements. There is a large gap between customer requirement and the products of the companies. The degree of communication with the customers and suppliers to understand their requirement and translating into products is not well satisfactory. It is not recognized that in order to achieve customer satisfaction, objective, and the customer requirements not be determined and identified. Typically, customer requirements shall not be recorded to include such items as availability, product description delivery requirement and any other supportive activity that is required to satisfy HMMBI requirement.

About 62% of the respondents agreed that the existence of favorable system for customers to express their feelings is very low. HMMBI has not well capable to meet defined requirements the review will not include and satisfy both the customer and our own requirements.

These company don't have quality improvement programs and most of a time they spend of their time on detecting the defects of the products rather than preventing the defects. Lastly as a result, the quality control activities are inspection by caliper instead of prevention. Most of a time quality control management of HMMBI trying only to measure after defects happened to know the level of defect in what extent. They used visual inspection techniques which are not an effective method and there is no awareness and application of statistical process control tools. Due to poor quality management commitment the company employees do not involve to improve quality. The customer of HMMBI they are not communicating to all employees involved in the product delivery to ensure customer requirements are not understood.

**Table 5.11: Descriptive Statistics for quality perspective**

| Descriptive Statistics |   |         |                |
|------------------------|---|---------|----------------|
| Code                   | N | Mean    | Std. Deviation |
| QV1                    | 8 | 2.25000 | .707107        |
| QV2                    | 8 | 1.75000 | .707107        |
| QV3                    | 8 | 2.00000 | .755929        |
| QV4                    | 8 | 2.25000 | .707107        |
| QV5                    | 8 | 2.25000 | .707107        |
| QV6                    | 8 | 2.25000 | .707107        |
| QV7                    | 8 | 2.00000 | .534522        |

|                    |   |         |         |
|--------------------|---|---------|---------|
| QV8                | 8 | 2.12500 | .834523 |
| QV9                | 8 | 2.25000 | .707107 |
| QV10               | 8 | 2.12500 | .834523 |
| QV11               | 8 | 1.75000 | .462910 |
| QV12               | 8 | 1.75000 | .707107 |
| QV13               | 8 | 2.00000 | .755929 |
| Valid N (listwise) | 8 |         |         |

When we see the quality management in HMMBI from the above tabulation scale response from 1 to 5 such that Strongly agree =5 Agree=4 Neutral =3 Disagree=2 Strongly disagree=1 Your customer (s) is satisfied with the quality of your company product(s) (evidence of customer feedback is required) (mean value=2.25), Degree of identification of customer requirement (mean value=2.25), Consideration of customers' satisfaction, and Degree of communication company with its customers (mean value=1.87), Extent of handling customer complaints quickly and positively (mean value=2.25) generally the average mean value is 2 signifies agreement by the respondent this show that the company’s overall level of quality management was very poor condition in the companies.

**5.8.2 Bivariate Correlation analysis and Interpretation in quality management perspective**

*Table5.12: Bivariate Correlation analysis and Interpretation in quality perspective*

| Code           |                 | QV1   | QV2   | QV3   | QV4   | QV5   | QV6   | QV7   | QV8   | QV9   | QV10  | QV11  | QV12  | QV13  |
|----------------|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Spearman's rho | QV1             | 1.000 | .729* | .211  | .121  | .821* | .471  | .000  | -.062 | .121  | .642  | -.207 | .729* | .507  |
|                | Sig. (2-tailed) | .     | .040  | .615  | .775  | .012  | .238  | 1.000 | .884  | .775  | .086  | .623  | .040  | .200  |
|                | QV2             | .729* | 1.000 | .296  | -.121 | .479  | .229  | .418  | .028  | .129  | .800* | -.276 | .471  | .296  |
|                | Sig. (2-tailed) | .040  | .     | .477  | .775  | .230  | .586  | .302  | .948  | .762  | .017  | .508  | .238  | .477  |
|                | QV3             | .211  | .296  | 1.000 | .085  | -.211 | -.211 | .354  | .000  | .592  | .408  | .000  | .296  | .000  |
|                | Sig. (2-tailed) | .615  | .477  | .     | .842  | .615  | .615  | .390  | 1.000 | .122  | .315  | 1.000 | .477  | 1.000 |
|                | QV4             | .121  | -.121 | .085  | 1.000 | .300  | .650  | .418  | -.559 | -.379 | .469  | -.207 | .729* | .803* |
|                | Sig. (2-tailed) | .775  | .775  | .842  | .     | .470  | .081  | .302  | .150  | .355  | .241  | .623  | .040  | .016  |
|                | QV5             | .821* | .479  | -.211 | .300  | 1.000 | .650  | .000  | -.269 | .129  | .469  | -.207 | .729* | .507  |
|                | Sig. (2-tailed) | .012  | .230  | .615  | .470  | .     | .081  | 1.000 | .519  | .762  | .241  | .623  | .040  | .200  |

*Supply Chain Integration Performance Measurement and Improvement in HMMBI*

|              |                         |       |       |       |       |       |        |       |        |        |       |       |       |       |
|--------------|-------------------------|-------|-------|-------|-------|-------|--------|-------|--------|--------|-------|-------|-------|-------|
| Q<br>V<br>6  | Correlation Coefficient | .471  | .229  | -.211 | .650  | .650  | 1.000  | .418  | -.800* | -.729* | .469  | -.690 | .729* | .803* |
|              | Sig. (2-tailed)         | .238  | .586  | .615  | .081  | .081  | .      | .302  | .017   | .040   | .241  | .058  | .040  | .016  |
| Q<br>V<br>7  | Correlation Coefficient | .000  | .418  | .354  | .418  | .000  | .418   | 1.000 | -.635  | -.299  | .635  | -.577 | .418  | .354  |
|              | Sig. (2-tailed)         | 1.000 | .302  | .390  | .302  | 1.000 | .302   | .     | .091   | .472   | .091  | .134  | .302  | .390  |
| Q<br>V<br>8  | Correlation Coefficient | -.062 | .028  | .000  | -.559 | -.269 | -.800* | -.635 | 1.000  | .642   | -.213 | .800* | -.469 | -.449 |
|              | Sig. (2-tailed)         | .884  | .948  | 1.000 | .150  | .519  | .017   | .091  | .      | .086   | .612  | .017  | .241  | .264  |
| Q<br>V<br>9  | Correlation Coefficient | .121  | .129  | .592  | -.379 | -.129 | -.729* | -.299 | .642   | 1.000  | -.028 | .621  | -.121 | -.507 |
|              | Sig. (2-tailed)         | .775  | .762  | .122  | .355  | .762  | .040   | .472  | .086   | .      | .948  | .100  | .775  | .200  |
| Q<br>V<br>10 | Correlation Coefficient | .642  | .800* | .408  | .469  | .469  | .469   | .635  | -.213  | -.028  | 1.000 | -.267 | .800* | .694  |
|              | Sig. (2-tailed)         | .086  | .017  | .315  | .241  | .241  | .241   | .091  | .612   | .948   | .     | .523  | .017  | .056  |
| Q<br>V<br>11 | Correlation Coefficient | -.207 | -.276 | .000  | -.207 | -.207 | -.690  | -.577 | .800*  | .621   | -.267 | 1.000 | -.276 | -.408 |
|              | Sig. (2-tailed)         | .623  | .508  | 1.000 | .623  | .623  | .058   | .134  | .017   | .100   | .523  | .     | .508  | .315  |
| Q<br>V<br>12 | Correlation Coefficient | .729* | .471  | .296  | .729* | .729* | .729*  | .418  | -.469  | -.121  | .800* | -.276 | 1.000 | .803* |
|              | Sig. (2-tailed)         | .040  | .238  | .477  | .040  | .040  | .040   | .302  | .241   | .775   | .017  | .508  | .     | .016  |
| Q<br>V<br>13 | Correlation Coefficient | .507  | .296  | .000  | .803* | .507  | .803*  | .354  | -.449  | -.507  | .694  | -.408 | .803* | 1.000 |
|              | Sig. (2-tailed)         | .200  | .477  | 1.000 | .016  | .200  | .016   | .390  | .264   | .200   | .056  | .315  | .016  | .     |

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

b. Listwise N = 8

From above relationship of each variable in quality management perspective they have strong relation with significance level of 0.05 and the spearman's correlation coefficient variable the correlation between QV1 (Your customer (s) is satisfied with the quality of your company product), QV2 Understanding customers' expectations concerning your products and QV12 Understanding customers' expectations concerning your products) ( $\rho=0.729^*$ )  $P=0.040$ , has strong and positive relation. QV2 (Degree of communication about product quality with its customers) and QV10 Quality improvement techniques strongly correlated with the value ( $\rho=0.800^*$ )  $P=0.04$  and the relationship is statistically significant.

QV12 (Understanding customers' expectations concerning your products) (QV5) Degree of identification of customer requirement, and QV4 Your products are differentiated from

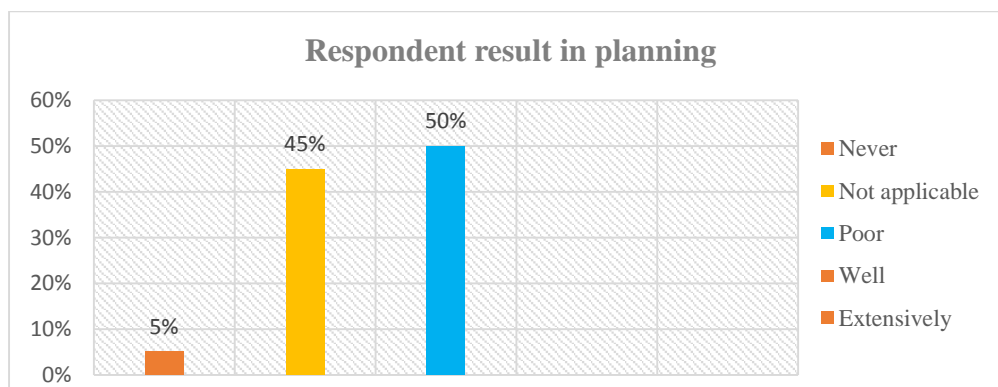
competitors” because of their quality ( $\rho=0.729^*$ ) has strong and positive relation with significant level  $P=0.040$ .

In other hand the correlation between QV9 (Customers' satisfaction with the quality your products with QV6) Extent of handling customer complaints quickly and positively ( $\rho=0.800^*$ )  $P=0.04$ , (QV8) Quality awareness in the company and (QV9) Customers' satisfaction with the quality your products ( $\rho=0.800^*$ )  $P=0.04$  has strong and positive relationship and the relationship is statistically significant.

## **5.9 Data Analysis and Interpretation Performance Perspective**

### **5.10 Data Analysis and Interpretation in Planning Perspective**

The respondents participate in planning department are 5 most of them have above 15 years' work experiences. Out of 5 respondents 17% master ,50% degree,33% diploma educational levels.



**Figure 5.10:** Respondent results in planning department

Planning is the most time consuming set of activities but valuable if done properly. Making estimations are not difficult, but to establish accurate and realistic estimates is one of the most important activities in planning.

According to 95% companies' respondents' activities that relating to balancing of products lines on a daily basis demand management driven by customer information. In HMMBI forecasting is followed by prediction of the total volume growth by X% across all department.

Most respondents said that companies use historical data in the development of forecasts. But out of this 50% are said that the companies use information systems in their forecasting activity poorly.

With regard to planning process is the systematic organization of ideas, concepts, and intellectual property into products / service that will meet customer requirements and regulatory requirements 74% companies' respondents said that not well good.

95% the respondent said that planning process followed a traditional forecasting procedure mostly based on previous three years' or four sales historical data. They are not used direct feedback data from customers.

The companies high level management also did not define the performance indicators to check their planning process level. Due to low level of collaboration, coordination cooperation activities between different departments team based cross functional planning are low level practice.

The respondents are agreed that Computer software use forecasting activities also very minimum.

**Table5.13: Descriptive Statistics for planning perspective**

| Code               | N | Mean   | Std. Deviation |
|--------------------|---|--------|----------------|
| PL1                | 5 | 2.0000 | 1.00000        |
| PL2                | 5 | 1.4000 | 1.34164        |
| PL3                | 5 | 1.0000 | 1.00000        |
| PL4                | 5 | 1.6000 | 1.14018        |
| PL5                | 5 | 1.6000 | 1.14018        |
| Valid N (listwise) | 5 |        |                |

From the above tabulation Likert scale respondents' response from 1 to 4 such that extensively =4well =3 poor =2 not applicable =1 never=0 production planning activities (mean value=2.40), balancing of product lines on a daily (mean value=2.00), company use information in forecasting activities (mean value=2.0) and company frequently contact retailers to get information about market demand (mean value=1.60), The company use information in forecasting activities (mean value=1.00), from tabulation the average mean value is 1.52 this indicates that the planning activities in the company is mostly very poor. Generally, the overall planning in HMMBI still now at infant stage.

**5.10.1 Bivariate Correlation Analysis and Interpretation in Planning Perspective**

**Table 5.14: Bivariate Correlation analysis and Interpretation in planning perspective**

| Code   |      | PL1                     | PL2    | PL3    | PL4    | PL5   |        |
|--|------|-------------------------|--------|--------|--------|-------|--------|
| Spearman's rho   | PL 1 | Correlation Coefficient | 1.000  | .917*  | 1.000* | .892* | .892*  |
|  |      | Sig. (2-tailed)         | .      | .029   | .      | .042  | .042   |
|  | PL 2 | Correlation Coefficient | .917*  | 1.000  | .917*  | .730  | .973** |
|  |      | Sig. (2-tailed)         | .029   | .      | .029   | .161  | .005   |
|  | PL 3 | Correlation Coefficient | 1.000* | .917*  | 1.000  | .892* | .892*  |
|  |      | Sig. (2-tailed)         | .      | .029   | .      | .042  | .042   |
|  | PL 4 | Correlation Coefficient | .892*  | .730   | .892*  | 1.000 | .658   |
|  |      | Sig. (2-tailed)         | .042   | .161   | .042   | .     | .227   |
|  | PL 5 | Correlation Coefficient | .892*  | .973** | .892*  | .658  | 1.000  |
|  |      | Sig. (2-tailed)         | .042   | .005   | .042   | .227  | .      |
| *. Correlation is significant at the 0.05 level (2-tailed).  |      |                         |        |        |        |       |        |
| **. Correlation is significant at the 0.01 level (2-tailed). |      |                         |        |        |        |       |        |
| c. Listwise N = 5  |      |                         |        |        |        |       |        |

From above analysis correlation matrix, the relationship each variable in planning perspective PLV1 Production planning activity and PLV2 Balancing of product lines on a daily basis have strong and positive relation( $\rho=0.917^*$ ) with significant level  $P=0.029$ . (PLV4) company use guide line for forecasting and (PLV5) Your company frequently contacts retailers to get information about market demand have strong and positive relation with PLV1 Production planning activity( $\rho=0.892^*$ )  $P=0.029$  and the correlation is statistically significant.

PLV3 company use information in forecasting activities and (PLV4) company use guide line for forecasting have strong positive relation ( $\rho=0.892^*$ ) with significant level  $P=0.042$ .

The correlation between PLV5 Your company frequently contacts retailers to get information about market demand and PLV2 The balancing of product lines on a daily basis have strong and positive relation( $\rho=0.91^*$ ) with significant level  $P=0.029$ .

**5.11 Data Analysis and Interpretation in Sourcing Perspective**

**Table 5.15: Descriptive statistics for Sourcing process**

| Descriptive Statistics |   |        |                |
|------------------------|---|--------|----------------|
| Code                   | N | Mean   | Std. Deviation |
| SRV1                   | 5 | 1.8000 | 1.30384        |
| SRV2                   | 5 | 1.0000 | 1.22474        |
| SRV3                   | 5 | 1.6000 | 1.14018        |
| SRV4                   | 5 | 1.6000 | 1.14018        |
| SRV5                   | 5 | 1.4000 | 1.14018        |
| SRV6                   | 5 | 1.6000 | 1.14018        |
| Valid N (listwise)     | 5 |        |                |

HMMBI sourcing the raw material mostly from china and Indian during sourcing information exchange, customer and supplier distance gap, the imported unavailability in locally, hard currency are the main challenge for the company.

According to the respondents' response from descriptive statistics delivery time from supplier (SRV2) mean value is 1 this indicates just-in time delivery main problem relative to the others challenge.

Another problem was lack frequent performance feedback to the supplier most of a time HMMI procure raw material from different foreign company but always they never give up to performance feedback to the suppliers

### 5.11.1 Bivariate Correlation analysis and Interpretation in sourcing perspective

Table 5.16: Bivariate Correlation analysis and Interpretation in sourcing perspective

| Code           |      |                         | SRV1  | SRV2   | SRV3   | SRV4  | SRV5  | SRV6 |
|----------------|------|-------------------------|-------|--------|--------|-------|-------|------|
| Spearman's rho | SRV1 | Correlation Coefficient | 1.000 | .892*  | .816   | .132  | .789  | .684 |
|                |      | Sig. (2-tailed)         | .     | .042   | .092   | .833  | .112  | .203 |
|                | SRV2 | Correlation Coefficient | .892* | 1.000  | .973** | .081  | .865  | .730 |
|                |      | Sig. (2-tailed)         | .042  | .      | .005   | .897  | .058  | .161 |
|                | SRV3 | Correlation Coefficient | .816  | .973** | 1.000  | -.132 | .921* | .658 |
|                |      | Sig. (2-tailed)         | .092  | .005   | .      | .833  | .026  | .227 |
|                | SRV4 | Correlation Coefficient | .132  | .081   | -.132  | 1.000 | -.342 | .289 |
|                |      | Sig. (2-tailed)         | .833  | .897   | .833   | .     | .573  | .637 |
|                | SRV5 | Correlation Coefficient | .789  | .865   | .921*  | -.342 | 1.000 | .368 |

|  |      |                 |      |      |      |      |      |       |
|--|------|-----------------|------|------|------|------|------|-------|
|  |      | Sig. (2-tailed) | .112 | .058 | .026 | .573 | .    | .542  |
|  | SRV6 | Correlation     | .684 | .730 | .658 | .289 | .368 | 1.000 |
|  |      | Coefficient     |      |      |      |      |      |       |
|  |      | Sig. (2-tailed) | .203 | .161 | .227 | .637 | .542 | .     |
| *. Correlation is significant at the 0.05 level (2-tailed).  |      |                 |      |      |      |      |      |       |
| **. Correlation is significant at the 0.01 level (2-tailed). |      |                 |      |      |      |      |      |       |
| c. Listwise N = 5  |      |                 |      |      |      |      |      |       |

When we see the above correlation matrix the relationship of each variable in sourcing process perspective (SRV1) Long term relationships with strategic supplier with (SRV2) just in time delivery from supplier strongly correlated performance ( $\rho=0.892^*$ )  $P=0.042$  and the relationship statistically significant. The relationship between (SRV2) just in time delivery from supplier with (SRV3) Just-in time delivery from suppliers ( $\rho=0.973^{**}$ ) have strong and positive relation and the significant level  $P=0.005$ . The relationship between (SRV3) frequent measurement suppliers' performance and (SRV5) The company use of information system in procurement process ( $\rho=0.921^*$ )  $P=0.026$  have strong and positive relation. The relationship also statistically significant

company use information system in procurement process and availability of imported raw materials have strong and positive correlation( $\rho=-0.968^{**}$ ) with significant level  $P=0.007$ . It has also strong and negative relationship between frequent performance feedback to supplier and company use of information system in procurement process( $\rho=-0.913^*$ ) with significance level  $P=0.003$ .

## 5.12 Data Analysis and Interpretation in Making Perspective

*Table 5.17: Descriptive Statistics for make perspective*

| Code               | N | Mean   | Std. Deviation |
|--------------------|---|--------|----------------|
| MV1                | 6 | 2.1667 | 1.16905        |
| MV2                | 6 | 2.1667 | 1.16905        |
| MV3                | 6 | 1.8333 | .75277         |
| MV4                | 6 | 1.8333 | .75277         |
| MV5                | 6 | 2.0000 | 1.09545        |
| MV6                | 6 | 2.0000 | .89443         |
|                    |   |        |                |
| Valid N (listwise) | 6 |        |                |

From descriptive statistics table result Planning procedure and processes related to material and capacity planning aligned with actual demand mean values is 1.8, the current production

processes met with capacity internal customer needs and material requirement planning for customers are integrated with company departments mean values is 2.2 are the mostly not applicable manufacturing practice in accompany. Relatively information sharing and communication between departments poorly practice.

HMMBI doesn't validates any processes for production and service provision where the resulting output cannot be verified by subsequent monitoring or measurement. This includes any processes where deficiencies become apparent only after the product is in use or the service has been delivered. Production equipment, tools and programs are not validated prior to use.

**5.12.1 Bivariate Correlation Analysis and Interpretation in Making Perspective**

**Table 5.18: Bivariate Correlation analysis and Interpretation in making perspective**

| Code           |  | MV1                     | MV2    | MV3   | MV4    | MV5   | MV6   |        |
|----------------|--|-------------------------|--------|-------|--------|-------|-------|--------|
| Spearman's rho | MV1  | Correlation Coefficient | 1.000  | .758  | .953** | .636  | .636  | .985** |
|                |  | Sig. (2-tailed)         | .      | .081  | .003   | .175  | .175  | .000   |
|                | MV2  | Correlation Coefficient | .758   | 1.000 | .636   | .318  | .318  | .739   |
|                |  | Sig. (2-tailed)         | .081   | .     | .175   | .539  | .539  | .094   |
|                | MV3  | Correlation Coefficient | .953** | .636  | 1.000  | .733  | .583  | .904*  |
|                |  | Sig. (2-tailed)         | .003   | .175  | .      | .097  | .224  | .013   |
|                | MV4  | Correlation Coefficient | .636   | .318  | .733   | 1.000 | -.017 | .645   |
|                |  | Sig. (2-tailed)         | .175   | .539  | .097   | .     | .975  | .166   |
|                | MV5  | Correlation Coefficient | .636   | .318  | .583   | -.017 | 1.000 | .581   |
|                |  | Sig. (2-tailed)         | .175   | .539  | .224   | .975  | .     | .227   |
|                | MV6  | Correlation Coefficient | .985** | .739  | .904*  | .645  | .581  | 1.000  |
|                |  | Sig. (2-tailed)         | .000   | .094  | .013   | .166  | .227  | .      |
|                | **. Correlation is significant at the 0.01 level (2-tailed). |                         |        |       |        |       |       |        |
|                | *. Correlation is significant at the 0.05 level (2-tailed).  |                         |        |       |        |       |       |        |
|                | c. Listwise N = 6  |                         |        |       |        |       |       |        |

From tabulation matrix the relationship in making process between MKV1 Planning procedure and processes related to material capacity and MKV3 delivery time important for department planning( $\rho=0.913^*$ )  $P=0.030$  have strong and positive relationship and also the correlation is significant. Similarly, MKV6 internal and external customer needs for martial capacity and

MKV1 Planning procedure and processes related to material capacity( $\rho=0.913^*$ ) strong relation with significance level of  $P=0.030$ .

### **5.13 Data Analysis and Interpretation in Making Perspective**

*Table 5.19: Descriptive Statistics for make delivering perspective*

| Code                  | N | Mean   | Std. Deviation |
|-----------------------|---|--------|----------------|
| DRV1                  | 6 | 1.5000 | 1.04881        |
| DRV2                  | 6 | 1.0000 | .89443         |
| DRV3                  | 6 | 1.3333 | 1.03280        |
| DRV4                  | 6 | 1.5000 | 1.04881        |
| DRV5                  | 6 | 1.5000 | 1.04881        |
| DRV6                  | 6 | 1.1667 | .75277         |
| Valid N<br>(listwise) | 6 |        |                |

According to the respondents' responses the company was challenged for a long period of time by late delivery times. The main aim customer order and delivery time is to provide the requested product with a short lead time.

The challenge is coming from two side the first challenge is suppliers side late delivery time. this challenge mostly comes due to lack of hard currency and the company also haven't long time relationship with the suppliers

The second challenge comes from customers and internal company process side this challenge comes mainly due to the company haven't proper supply chain integration system for delivery process like wholesaler, distributor and retailers. The other one is internal production process of the company is big challenge because of lack of top management commitment, lack of employers' experience, lack of motivation, employers' turnover are the main cause of the late delivery time to customers' order

With regard to delivery time to the customers 79% the respondents said that customers always complaints with delivery lead times. When we see the above descriptive statistics result company respond to major customers need quickly the mean value is 2 this indicate that HMMBI delivery process poor level. The company deliver products for major customer on just- in time the mean value is 1.8 and real time visibilities of order tacking is 1.66 this shows that mostly delivery process is not implemented in the company

5.13.1 Bivariate Correlation Analysis and Interpretation in Delivery Perspective

Table 5.20: Bivariate Correlation analysis and Interpretation in delivery perspective

| Code  |      | DRV1                    | DRV2  | DRV3  | DRV4  | DRV5  | DRV6  |       |
|---|------|-------------------------|-------|-------|-------|-------|-------|-------|
| Spearman's rho  | DRV1 | Correlation Coefficient | 1.000 | .862* | .719  | .864* | .758  | .683  |
|   |      | Sig. (2-tailed)         | .     | .027  | .107  | .027  | .081  | .135  |
|   | DRV2 | Correlation Coefficient | .862* | 1.000 | .635  | .862* | .615  | .904* |
|   |      | Sig. (2-tailed)         | .027  | .     | .176  | .027  | .193  | .013  |
|   | DRV3 | Correlation Coefficient | .719  | .635  | 1.000 | .907* | .719  | .656  |
|   |      | Sig. (2-tailed)         | .107  | .176  | .     | .013  | .107  | .157  |
|   | DRV4 | Correlation Coefficient | .864* | .862* | .907* | 1.000 | .621  | .874* |
|   |      | Sig. (2-tailed)         | .027  | .027  | .013  | .     | .188  | .023  |
|   | DRV5 | Correlation Coefficient | .758  | .615  | .719  | .621  | 1.000 | .365  |
|   |      | Sig. (2-tailed)         | .081  | .193  | .107  | .188  | .     | .476  |
|   | DRV6 | Correlation Coefficient | .683  | .904* | .656  | .874* | .365  | 1.000 |
|   |      | Sig. (2-tailed)         | .135  | .013  | .157  | .023  | .476  | .     |
| *. Correlation is significant at the 0.05 level (2-tailed). |      |                         |       |       |       |       |       |       |
| b. Listwise N = 6   |      |                         |       |       |       |       |       |       |

From above relationship matrix each variable in delivery process perspective the correlation between DRV1 company responds to major customer quickly and DRV2 deliver product for major customer on just in time delivery have positive strong correlation ( $\rho=0.862^*$ ) the relationship also statistically significant  $P=0.027$ . DRV1 company responds to major customer quickly and with leads times with DRV4 company have single point of contact for all orders have positive and strong relationship ( $\rho=0.864^*$ ) with significance level  $P=0.027$ . The correlation between DRV2 deliver products for major customer on just-in-time and DRV4 company have single point of contact for all orders have positive and strong relationship ( $\rho=0.862^*$ )  $P=0.027$  the relation is statistically significant. DRV2 deliver products for major customer on just-in-time and DRV6 consolidate orders by customer source carriers have strong and positive relation ( $\rho=0.904^*$ ) with significant level  $P=0.013$ . DRV3 Company always

delivers orders with leads times and DRV4 company have single point of contact for all orders ( $\rho=0.874^*$ ) have positive strong relationship also significant.

### 5.14 Data Analysis and Interpretation in Returning Perspective

**Table 5.21: Descriptive Statistics for make returning**

| Code                  | N | Mean   | Std. Deviation |
|-----------------------|---|--------|----------------|
| RV1                   | 5 | 1.6000 | 1.14018        |
| RV2                   | 5 | 1.4000 | 1.14018        |
| RV3                   | 5 | 1.2000 | .83666         |
| RV4                   | 5 | 1.6000 | .54772         |
| RV5                   | 5 | 1.6000 | 1.14018        |
| Valid N<br>(listwise) | 5 |        |                |

The above descriptive statistics result shows that the mean value of each returning process in the company (RV1) product return process is easy for our major customer to follow (mean value= 1.6000), (RV2) company have documentation describing our product return (mean value= 1.4000), (RV3) company allocate resource for our product return during planning(mean value= 1.2000), (RV4) company have accurate forecasts of our product return(mean value= 1.6000) and (RV5) company have a set of specifications to verify the quality of returned (mean value= 1.6000) and average mean value is 1.48. This shows that mostly returning process is not implemented in the company.

#### 5.14.1 Bivariate Correlation Analysis in Returning Perspective

**Table 5.22: Bivariate Correlation analysis in returning perspective**

| Code              |  | RV1                     | RV2     | RV3   | RV4   | RV5   |         |
|-------------------|--|-------------------------|---------|-------|-------|-------|---------|
| Spearman's rho    | RV1  | Correlation Coefficient | 1.000   | .763  | .703  | .889* | 1.000** |
|                   |  | Sig. (2-tailed)         | .       | .133  | .185  | .044  | .       |
|                   | RV2  | Correlation Coefficient | .763    | 1.000 | .730  | .740  | .763    |
|                   |  | Sig. (2-tailed)         | .133    | .     | .161  | .152  | .133    |
|                   | RV3  | Correlation Coefficient | .703    | .730  | 1.000 | .761  | .703    |
|                   |  | Sig. (2-tailed)         | .185    | .161  | .     | .135  | .185    |
|                   | RV4  | Correlation Coefficient | .889*   | .740  | .761  | 1.000 | .889*   |
|                   |  | Sig. (2-tailed)         | .044    | .152  | .135  | .     | .044    |
|                   | RV5  | Correlation Coefficient | 1.000** | .763  | .703  | .889* | 1.000   |
|                   |  | Sig. (2-tailed)         | .       | .133  | .185  | .044  | .       |
|                   | *. Correlation is significant at the 0.05 level (2-tailed).  |                         |         |       |       |       |         |
|                   | **. Correlation is significant at the 0.01 level (2-tailed). |                         |         |       |       |       |         |
| c. Listwise N = 5 |  |                         |         |       |       |       |         |

Correlation test shows that in returning process perspective RV1 Company have a set of specifications to verify the quality of returned and RV4 company have accurate forecasts of our product return ( $\rho=0.889^*$ )  $P=0.044$  have positive strong relationship and the correlation is statistically significant. RV5 return process is easy for our major customer to follow and RV4 company have accurate forecasts of our product return ( $\rho=0.889^*$ ) have positive strong relationship with significant level  $P=0.044$ .

**5.14.2 Bivariate Correlation Analysis and Interpretation in each performance process**

*Table 2.23: Bivariate Correlation analysis in each performance process*

| Code           |  | planning process        | sourcing process | making process | delivery process | returning process | Performance in each process |       |
|----------------|--|-------------------------|------------------|----------------|------------------|-------------------|-----------------------------|-------|
| Spearman's rho | planning process   | Correlation Coefficient | 1.000            | 1.000**        | .763             | .921*             | .921*                       | .918* |
|                |  | Sig. (2-tailed)         | .                | .              | .133             | .026              | .026                        | .028  |
|                | sourcing process   | Correlation Coefficient | 1.000**          | 1.000          | .763             | .921*             | .921*                       | .918* |
|                |  | Sig. (2-tailed)         | .                | .              | .133             | .026              | .026                        | .028  |
|                | making process   | Correlation Coefficient | .763             | .763           | 1.000            | .921*             | .921*                       | .918* |
|                |  | Sig. (2-tailed)         | .133             | .133           | .                | .026              | .026                        | .028  |
|                | delivery process   | Correlation Coefficient | .921*            | .921*          | .921*            | 1.000             | 1.000**                     | .918* |
|                |  | Sig. (2-tailed)         | .026             | .026           | .026             | .                 | .                           | .028  |
|                | returning process  | Correlation Coefficient | .921*            | .921*          | .921*            | 1.000**           | 1.000                       | .918* |
|                |  | Sig. (2-tailed)         | .026             | .026           | .026             | .                 | .                           | .028  |
|                | Performance in each process                                  | Correlation Coefficient | .918*            | .918*          | .918*            | .918*             | .918*                       | 1.000 |
|                |  | Sig. (2-tailed)         | .028             | .028           | .028             | .028              | .028                        | .     |
|                | **. Correlation is significant at the 0.01 level (2-tailed). |                         |                  |                |                  |                   |                             |       |
|                | *. Correlation is significant at the 0.05 level (2-tailed).  |                         |                  |                |                  |                   |                             |       |
|                | c. Listwise N = 5  |                         |                  |                |                  |                   |                             |       |

From the above correlation matrix each variable in performance process, panning process have strong positive correlation with making process ( $\rho=0.763^*$ ) ( $\rho=0.026^*$ ), delivery process ( $\rho=0.921^*$ ) ( $\rho=0.026^*$ ), returning process ( $\rho=0.921^*$ ) ( $\rho=0.026^*$ ), and performance ( $\rho=0.918^*$ )

( $\rho=0.028^*$ ). Sourcing process have strong positive correlation with delivery process ( $\rho=0.921^*$ ) ( $\rho=0.026^*$ ), returning process ( $\rho=0.921^*$ )( $\rho=0.026^*$ ), and performance( $\rho=0.918^*$ ) ( $\rho=0.028^*$ ). Performance has strong positive relation with all variable process.

### **5.15 Multiple Regression Analysis**

In the correlation analysis researcher had measured the relationships between each variable. These correlations can be very useful but regression analysis take this process a step further and predict one variable from another. Regression analysis used to fit a model and to predict values of the dependent variable (DV) from one or more independent variables (IVs). Regression analysis is a way of predicting an outcome variable from one predictor variable (simple regression) or several predictor variables (multiple regression). Results of the regression analysis show the effect of planning, sourcing, making, and returning (independent variables) with (performance measure). We predict the output any data using the following general equation

$$\text{Outcome} = (\text{model}) + \text{error} \dots \dots \dots \text{equation 1}$$

Multiple regression is a logical extension of these principles to situations in which there are several predictors but this time the model is slightly more complex.

$$Y_i = (b_0 + b_1X_{i1} + b_2X_{i2} + \dots + b_nX_{in}) + \varepsilon_i \dots \dots \dots \text{equation 2}$$

Where  $Y$  is the outcome variable,  $b_1$  is the coefficient of the first predictor ( $X_1$ ),  $b_2$  is the coefficient of the second predictor ( $X_2$ ),  $b_n$  is the coefficient of the  $n^{\text{th}}$  predictor ( $X_n$ ), and  $\varepsilon_i$  is the difference between the predicted and the observed value of  $Y$  for the  $i^{\text{th}}$  participant  $b_0$  is intercept. we seek to find the linear combination of predictors that correlate maximally with the outcome variable.

Where  $Y$  is = dependent variables;

$b_0$  = intercept

$b_1, b_2 \dots b_n$  = coefficients

$X_1, X_2 \dots X_n$  = independent Variables

$\varepsilon_i$  = error/ residual term

**5.15.1 Data Analysis and Model validation in planning process**

➤ **SPSS out summary of model**

The model summary table describes the overall model that means it tells us whether the model is successful in predicting production planning) adjusted.

The table SPSS tells us what the dependent variable (outcome) was and what the predictors were in each of the two models. In the column labelled *R* are the values of the multiple correlation coefficient between the predictors and the outcome. PLV1(production planning) is the outcome (dependent variable) PLV2, PLV3, PLV4, PLV5 is used as a predictor. The value of *R*<sup>2</sup>, is a measure of how much of the variability in the outcome is accounted for by the predictors. For the first model its value is 1, which accounts for 100% of the variation in production planning. PLV2, PLV3, PLV4 similar to the first predictor because there is no residual variance. There is difference between the predictor that means zero.

. In Stein’s equation, *R*<sup>2</sup> is the unadjusted value, *n* is the number of participants and *k* is the number of predictors in the model *n* =5 and *k* =5 using this equation to cross-validate a regression model.

$$R^2 = 1 - \left[ \left( \frac{n-1}{n-k-1} \right) \left( \frac{n-2}{n-k-2} \right) \left( \frac{n+1}{n} \right) \right] (1 - R^2)$$

| Model Summary  |                    |          |                   |                            |                   |          |     |     |               |               |
|--|--------------------|----------|-------------------|----------------------------|-------------------|----------|-----|-----|---------------|---------------|
| Model  | R                  | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics |          |     |     |               | Durbin-Watson |
|  |                    |          |                   |                            | R Square Change   | F Change | df1 | df2 | Sig. F Change |               |
| 1  | 1.000 <sup>a</sup> | 1.000    | 1.000             | .00000                     | 1.000             | .        | 1   | 3   | .000          | 1.23          |
| 2  | 1.000 <sup>b</sup> | 1.000    | 1.000             | .00000                     | .000              | .        | 2   | 1   | .000          | 2.192         |
| a. Predictors: (Constant), PL3                         |                    |          |                   |                            |                   |          |     |     |               |               |
| b. Predictors: (Constant), PL3, PL4, PL2               |                    |          |                   |                            |                   |          |     |     |               |               |
| c. Not computed because there is no residual variance. |                    |          |                   |                            |                   |          |     |     |               |               |
| d. Dependent Variable: PL1                             |                    |          |                   |                            |                   |          |     |     |               |               |

When we see the above model summary table there is causal relationship between PLV1(production planning) and PLV2 Balancing of product lines on a daily, PLV4 company use guide line for forecasting, PLV3 company use information in forecasting activities. The adjusted R Square is 1, which implies that PLV2, PLV3, PLV4 can account for 100% of the

variation in production planning. The factor PLV2, PLV3, PLV4 value of (100%) contribution on PLV1.

The significance value of 0.000 shows that the regression relationship is significant in predicting the effects PLV2, PLV3, PLV4 of on PLV1 of the firm.

When we replace the value of participants and predictors in the Stein’s equation the value is  $R^2=0$ . This value implies that is very similar to the observed value of  $R^2=0$  indicating that the cross-validity of this model is very good.

➤ **SPSS Output Coefficients of the regression model**

| Coefficient                |                             |            |                           |      |      |                                 |             |              |            |         |                         |           |
|----------------------------|-----------------------------|------------|---------------------------|------|------|---------------------------------|-------------|--------------|------------|---------|-------------------------|-----------|
| Model                      | Unstandardized Coefficients |            | Standardized Coefficients | T    | Sig. | 95.0% Confidence Interval for B |             | Correlations |            |         | Collinearity Statistics |           |
|                            | B                           | Std. Error |                           |      |      | Beta                            | Lower Bound | Upper Bound  | Zero-order | Partial | Part                    | Tolerance |
| 1 (Constant)               | 1.000                       | .000       |                           | .001 | .000 | 1.000                           | 1.000       |              |            |         |                         |           |
| PL3                        | 1.000                       | .000       | 1.000                     | .000 | .000 | 1.000                           | 1.000       | 1.000        | 1.000      | 1.000   | 1.000                   | 1.000     |
| 2 (Constant)               | 1.000                       | .000       |                           | .000 | .000 | 1.000                           | 1.000       |              |            |         |                         |           |
| PL3                        | 1.000                       | .000       | 1.000                     | .000 | .000 | 1.000                           | 1.000       | 1.000        | 1.000      | .276    | .076                    | 13.091    |
| PL2                        | .000                        | .000       | .000                      | .000 | .000 | .000                            | .000        | .932         | 1.000      | .000    | .127                    | 7.855     |
| PL4                        | .000                        | .000       | .000                      | .000 | .000 | .000                            | .000        | .877         | 1.000      | .000    | .223                    | 4.491     |
| a. Dependent Variable: PL1 |                             |            |                           |      |      |                                 |             |              |            |         |                         |           |

If we replace the *b*-values in equation below we find that we can define the model as follows

$$Y_i = (b_0 + b_1X_{i1} + b_2X_{i2} + \dots + b_nX_{in}) + \epsilon_i$$

In the above multiple regression, the first part of the table shows that estimated *b*-values and these values indicate the individual contribution of each predictor to the model.

The values of *b* tell us about the relationship between production planning activities and each predictor. the above *b* value is positive this tell as predictor and outcome have positive relationship the, whereas a negative coefficient represents a negative relationship.

$$PLV_i = b_0 + b_1 PLV_1 + b_2 PLV_2 + b_3 PLV_3 + b_4 PLV_4$$

(PLV<sub>i</sub>) Production planning = 1 + 1(PLV<sub>3</sub>) Company use information in forecasting activities + 0(PLV<sub>2</sub>) The balancing of product lines on a daily basis + 0(SRV<sub>4</sub>) company use guide line for forecasting.

The value of  $R^2$ (PLV<sub>i</sub>) Production planning = 1, Similarly the value of  $R^2$  PLV<sub>2</sub>, PLV<sub>3</sub>, PLV<sub>4</sub> = 1

All predictors have positive relationships  $b$ -values in production planning indicating that, use information in forecasting activities and balancing of product lines on a daily basis have positive impact on production planning when we use more information during forecasting it meet the plan.

In generally the  $b$ -values tell us to what degree each predictor affects the outcome. In generally the model implies that, the production planning activity in the company were very low due to lack of information during forecasting, balancing of product lines on daily base and forecasting guide line.

➤ **Interpreting the variance inflection factor (VIF)**

variance inflection factor ranges from 1 upwards. the numerical value for VIF tells us what percentage the variance in inflated for each coefficient. VIF of 1.9 tells us that the variance of a particular coefficient is 90%

a rule of thumb for interpreting the variance inflation factor

- ✓ 1 = not correlated
- ✓ Between 1 and 5 moderately correlated
- ✓ Greater than 5 = highly correlated
- ✓ Tolerance below 0.1 indicates a serious problem.
- ✓ Tolerance below 0.2 indicates a potential problem (Menard, 1995).

Variance inflation factor (VIF) is commonly used to detect any collinearity problem (Stevens, 1992) (Stevens J. , 1992). As a guideline, a VIF greater than 10 indicates a multicollinearity problem (Myers, 1990).

This model the VIF values of PLV<sub>2</sub>, PLV<sub>3</sub>, PLV<sub>4</sub> and PLV<sub>5</sub> are 7.579, 4.333, 4.333 and 28.600 respectively except PLV<sub>5</sub> all well below 10 but the value of PLV<sub>5</sub> is 28.60 this indicate that collinearity is a problem for only PLV<sub>5</sub>.

the tolerance statistics all well above PLV1, PLV4 and PLV5 0.132 ,0.231,0.231 therefore, we can safely conclude that there is no collinearity within PLV4 and PLV5 data in the first model but in the second model the tolerance of and PLV5 value is 0.035 this indicate that collinearity serious problem in second variables the final model showed that multicollinearity was partially PLV5 is a potential problem. But when we see the average value of VIF is 1.75 so in this case as a whole collinearity is not a problem for this model. To calculate the average VIF we simply add the VIF values for each predictor and divide by the number of predictors (*k*):

$$\overline{VIF} = \frac{\sum_{i=1}^K VIF}{k}$$

$$VIF_{avg} = \frac{0.231+0.231+0.132+0.035+0.231}{5} = 0.175$$

The researcher could summarize by saying that production planning model appears, in most senses, to be both accurate for the sample and generalizable to the population. slightly some problem affecting in some concern Therefore, researcher could conclude that in the sample balancing of product lines on a daily basis, use information in forecasting activities and use guide line for forecasting are fairly equally important to predict Production plan. frequently contacts retailers to get information about market demand is a significant predictor of Production plan but is less important than the other predictors

**5.15.2 Data Analysis and Model validation in sourcing process**

➤ **SPSS out summary of model**

*Table 2.24:Regression analysis in sourcing process summary model*

| Model Summary                                     |                    |          |                   |                            |                   |          |      |      |               |                 |
|---|--------------------|----------|-------------------|----------------------------|-------------------|----------|------|------|---------------|-----------------|
| Model   | R                  | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics |          |      |      |               | Durbin - Watson |
|   |                    |          |                   |                            | R Square Change   | F Change | df 1 | df 2 | Sig. F Change |                 |
| 1   | 1.000 <sup>a</sup> | 1.000    | 1.000             | .000                       | 1.000             | .        | 4    | 0    | .000          | 2.194           |
| a. Predictors: (Constant), SRV5, SRV4, SRV6, SRV2 |                    |          |                   |                            |                   |          |      |      |               |                 |
| b. Dependent Variable: SRV1                       |                    |          |                   |                            |                   |          |      |      |               |                 |

From the above model summary table, the predictors are company use of information system in procurement process SRV5, Frequent performance feedback to suppliers SRV4, imported raw material are always available locally with affordable SRV6, Long term relationships with

supplier SRV2 and Measuring of suppliers' performance SRV1 is outcome variable the value of R<sup>2</sup> is 1. Each model which account 100% variation in measuring of suppliers' performance.

The adjusted R Square is 1, which implies that SRV5, SRV4, SRV6, SRV2 can account for 100% of the variation in measuring of suppliers' performance.

The R2 value of 1.00 (100%) Implies the contribution of SRV2 ,SRV4 ,SRV and SRV6 in interpreting the SRV1 Supplier Performance , remaining .000% of the changes in the change can be attributed to other factors.

The significance value of 0.000 less than 0.05 indicates that the regression relationship is significant in predicting the effects SRV5, SRV4, SRV6, SRV2 of on SRV1 of the firm.

There is no other factor that can explained the variable on measuring supplier performance.

In other hand when we see in model summary Durbin-Watson test whether adjacent residual is correlated so, the value is 2.194. This indicate that negatively between adjacent residual but it is cause concern.

➤ **SPSS Output Coefficients of the regression model**

**Table 2.25: Regression model analysis in sourcing process coefficients results**

| . Coefficients <sup>a</sup> |            |                             |            |                           |   |      |              |            |         |                         |           |
|-----------------------------|------------|-----------------------------|------------|---------------------------|---|------|--------------|------------|---------|-------------------------|-----------|
| Model                       |            | Unstandardized Coefficients |            | Standardized Coefficients | T | Sig. | Correlations |            |         | Collinearity Statistics |           |
|                             |            | B                           | Std. Error |                           |   |      | Beta         | Zero-order | Partial | Part                    | Tolerance |
| 1                           | (Constant) | -2.600                      | .000       |                           | . | .000 |              |            |         |                         |           |
|                             | SRV2       | -1.800                      | .000       | -1.691                    | . | .    | .783         | -1.000     | -.342   | .041                    | 24.480    |
|                             | SRV4       | 1.000                       | .000       | .874                      | . | .000 | .269         | 1.000      | .383    | .192                    | 5.200     |
|                             | SRV6       | .600                        | .000       | .525                      | . | .000 | .774         | 1.000      | .407    | .601                    | 1.664     |
|                             | SRV5       | 2.600                       | .000       | 2.274                     | . | .001 | .740         | 1.000      | .459    | .21                     | 2.544     |

a. Dependent Variable: SRV1

The above regression coefficients out SPSS table consist of estimated b-value, collinearity Statistic Tolerance, variance inflation factor VIF. The b-value table indicate individual contribution of each predictor to the model.

the only independent variables are SRV4 with significance value of 0.00, SRV6 with significance value of 0.00 and SRV5 with significance value of 0.00 which is less than 0.05 which has a positive effect on the dependent variable SRV1 measuring suppliers' performance.

The other two SCM sourcing independent variables are insignificant to predict dependent variable SRV1 measuring suppliers' performance.

To calculate the outcome of  $R^2$  SRV1 measuring suppliers' performance

SRV1 measuring suppliers' performance =  $b_0 + b_2 \text{SRV2 Long term relationships with supplier} + b_4 \text{SRV4 Frequent performance feedback to suppliers'} + b_6 \text{SRV6 Imported raw material are always available locally with affordable} + b_5 \text{SRV5 use of information system in procurement process}$ .

$$\text{SRV}_i = b_0 + b_2 \text{SRV}_2 + b_4 \text{SRV}_4 + b_6 \text{SRV}_6 + b_5 \text{SRV}_5$$

$$\text{SRV}_1 \text{ measuring suppliers' performance} = -2.6 - 1.8 \text{SRV}_2 + 1.00 \text{SRV}_4 + 0.6 \text{SRV}_6 + 2.66 \text{SRV}_5$$

The b-values tell us about the relationship between measuring suppliers' performance and each predictor. Long term relationships with supplier has negative relationship with measuring suppliers' performance.

Frequent performance feedback to suppliers', imported raw material are always available locally with affordable, and use of information system in procurement process have positive effect on measuring suppliers' performance.

➤ **Variance inflation factor (VIF)**

Variance inflation factor (VIF) is commonly used to detect any collinearity problem. The value of VIF SRV2 =24.480, SRV4=5.200, SRV6=1.664, and SRV5=2.544 except  $b_2 \text{SRV}_2$  Long term relationships with supplier VIF value less than 10 even the mean is 8.3. This indicates that final model showed that multicollinearity was not a potential problem.

In multiple regression, tolerance is used as an indicator of multicollinearity. When we see the value of tolerance from the above table greater than 0.2 so it is safe.

The researcher could conclude that all predictor except SRV3 are important to predict measuring suppliers' performance.

### **5.15.3 Data Analysis and Model validation in making process**

➤ **SPSS out summary of model**

**Table 2.26:** Regression analysis in making process summary model

| Model Summary                                      |                    |          |                   |                            |                   |          |     |     |               |                 |
|--|--------------------|----------|-------------------|----------------------------|-------------------|----------|-----|-----|---------------|-----------------|
| Model  | R                  | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics |          |     |     |               | Durbin - Watson |
|  |                    |          |                   |                            | R Square Change   | F Change | df1 | df2 | Sig. F Change |                 |
| 1  | .956 <sup>a</sup>  | .915     | .893              | .38188                     | .915              | 42.857   | 1   | 4   | .003          |                 |
| 2  | 1.000 <sup>b</sup> | 1.000    | .                 | .                          | .085              | .        | 4   | 0   | .             | 1.594           |
| a. Predictors: (Constant), MV6                     |                    |          |                   |                            |                   |          |     |     |               |                 |
| b. Predictors: (Constant), MV6, MV4, MV5, MV2, MV3 |                    |          |                   |                            |                   |          |     |     |               |                 |
| c. Dependent Variable: MV1                         |                    |          |                   |                            |                   |          |     |     |               |                 |

When we see the above SPSS output model summary table, the independent variable are, (MKV2) Information sharing method between department to department, (MKV3) Delivery time are extremely important for the department planning, (MK4) company have coordination during production process, (MKV5) Material requirement methods are used by your departments planning, (MKV6) Internal and external customers’ needs for material or capacity and the outcome variable are (MKV1) production process and capacity. The value of  $R^2$ , is a measure of how much of the variability in the outcome is accounted for by the predictors.

The adjusted  $R^2$  gives us some idea of how well model generalizes and ideally its value to be the same, or very close to, the value of  $R^2$ . the difference for the final model is small (in fact the difference between the values is  $0.915 - 0.893 = 0.002$  less variance in the outcome 2% only.

The adjusted  $R^2$  is .893, which implies that MV6, MV4, MV5, MV2, MV3 can account for 89.3% of the variation in (MKV1) production process and capacity. The factor MV6, MV4, MV5, MV2, MV3 value have (89.3%) contribution on MKV1. There is remain 11.7% additional factor merits to measure supply chain integration performance.

The significance value of 0.003 less than 0.05 indicates that the regression relationship is significant in predicting the effects MV6, MV4, MV5, MV2, MV3 of on MV1 of the firm.

In Stein’s equation,  $R^2$  is the unadjusted value,  $n$  is the number of participants and  $k$  is the number of predictors in the model  $n = 5$  and  $k = 6$  using this equation to cross-validate a regression model.

$$R^2 = 1 - \left[ \left( \frac{n-1}{n-k-1} \right) \left( \frac{n-2}{n-k-2} \right) \left( \frac{n+1}{n} \right) \right] (1 - R^2)$$

$$R^2 = 1$$

This value is very similar to the observed value of R2 =1 indicating that the cross-validity of this model is very good.

Durbin-Watson test value is 1.594 so, adjacent residual is positively correlated so, the value therefore its cause concern.

➤ **SPSS Output Coefficients of the regression model**

**Table 2.27: Regression model analysis in making process coefficients results**

| Model |            | Coefficients <sup>a</sup>   |            |                           |       |      |                                 |             |              |            |         |                         |           |     |
|-------|------------|-----------------------------|------------|---------------------------|-------|------|---------------------------------|-------------|--------------|------------|---------|-------------------------|-----------|-----|
|       |            | Unstandardized Coefficients |            | Standardized Coefficients | T     | Sig. | 95.0% Confidence Interval for B |             | Correlations |            |         | Collinearity Statistics |           |     |
|       |            | B                           | Std. Error |                           |       |      | Beta                            | Lower Bound | Upper Bound  | Zero-order | Partial | Part                    | Tolerance | VIF |
| 1     | (Constant) | -.333                       | .412       |                           | -.808 | .464 | -1.479                          | .812        |              |            |         |                         |           |     |
|       | MV6        | 1.250                       | .191       | .956                      | 6.547 | .003 | .720                            | 1.780       | .956         | .956       | .956    | 1.000                   | 1.000     |     |
| 2     | (Constant) | -.600                       | .000       |                           | .     | .    | -.600                           | -.600       |              |            |         |                         |           |     |
|       | MV6        | .600                        | .000       | .459                      | .     | .    | .600                            | .600        | .956         | 1.000      | .186    | .164                    | 6.080     |     |
|       | MV2        | .200                        | .000       | .200                      | .     | .    | .200                            | .200        | .854         | 1.000      | .110    | .305                    | 3.280     |     |
|       | MV4        | 1.750 E-016                 | .000       | .000                      | .     | .    | .000                            | .000        | .492         | 1.000      | .000    | .088                    | 11.333    |     |
|       | MV5        | .200                        | .000       | .187                      | .     | .    | .200                            | .200        | .781         | 1.000      | .053    | .80                     | 6.480     |     |
|       | MV3        | .400                        | .000       | .258                      | .     | .    | .400                            | .400        | .947         | 1.000      | .047    | .033                    | 30.373    |     |

a. Dependent Variable: MV1

To check multicollinearity from coefficient table b-value, collinearity Statistic Tolerance, variance inflation factor VIF are important. To calculate the outcome of R<sup>2</sup> (MKV1) production process and capacity from independent variable (MKV2) Information sharing method between department to department, (MKV3) Delivery time are extremely important for the department planning, (MK4) company have coordination during production process, (MKV5) Material requirement methods are used by your departments planning, and (MKV6) Internal and external customers' needs for material or capacity.

$$MKV1_i = b_0 + b_2 MKV2 + b_3 MKV3 + b_4 MK4 + b_5 MKV5 + b_5 MKV6$$

$$MKV_i \text{ production process and capacity} = -0.600 + .600 MKV6 + 0.200 MKV2 + 1.75 MV4 + .200 MV5 + .400 MV3.$$

The b-values tell us production process and capacity each predictor has positive relationship and each predictor has effect on production capacity.

➤ **Variance inflation factor (VIF)**

The other multicollinearity is Variance inflation factor (VIF) The value of VIF in each predictor MKV2=3.280, MK4=11.333 MKV5=6.480, MKV6=6.080 except MKV3 =30.373 the VIF value is less than 10. For the final model only MKV3 was multicollinearity potential.

In making process all predictor is important to predict production process and capacity.

**5.15.4 Data Analysis and Model validation in delivery process**

➤ **SPSS out summary of model**

*Table 2.28: Regression analysis in delivery process summary model*

| Model Summary                               |                   |          |                   |                            |                   |          |      |      |               |               |
|---|-------------------|----------|-------------------|----------------------------|-------------------|----------|------|------|---------------|---------------|
| Model                                       | R                 | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics |          |      |      |               | Durbin-Watson |
|   |                   |          |                   |                            | R Square Change   | F Change | df 1 | df 2 | Sig. F Change |               |
| 1   | .853 <sup>a</sup> | .727     | .659              | .61237                     | .727              | 10.667   | 1    | 4    | .031          | 2.000         |
| a. Predictors: (Constant), DRV2, DRV2, DRV3 |                   |          |                   |                            |                   |          |      |      |               |               |
| b. Dependent Variable: DRV1                 |                   |          |                   |                            |                   |          |      |      |               |               |

From the above model summary table, the predictors (independent variable) are (DRV2) we deliver products for major customer on just-in-time, (DRV3) Company always delivers orders with leads time, (DRV4) company have a single point of contact for all order inquiries, (DRV5) company have real time visibilities of order tacking, (DRV6) company consolidate orders by customers, source carriers and (DRV1) Company respond to major customers need quickly is outcome variable.

The adjusted R Square is .659, which implies that DRV2 can account for 65.9% of the variation in (DRV1) Company respond to major customers need quickly.

The remaining 34.1% of the variation in DRV1 can't be explained by DRV2, DRV2, DRV3.

When we see adjusted R2  $0.727 - 0.659 = .0068$  (6.8%) this value is very close to, the value of R2.

the final model is small difference 6.8%.

In Stein’s equation,  $R^2$  is the unadjusted value,  $n$  is the number of participants and  $k$  is the number of predictors in the model  $n = 5$  and  $k = 6$  using this equation to cross-validate a regression model.

$$R^2 = 1 - \left[ \left( \frac{n-1}{n-k-1} \right) \left( \frac{n-2}{n-k-2} \right) \left( \frac{n+1}{n} \right) \right] (1 - R^2)$$

$R^2 = 0.727$  this implies that the observed value and the outcome value are the same therefore the model is valid.

Durbin–Watson statistic test from the above tabulation the value is 2.000, which the assumption been meet perfectly.

➤ **SPSS Output Coefficients of the regression model**

**Table 2.29:** Regression model analysis in delivery process coefficients results

| Model |            | Coefficients <sup>a</sup>   |            |                           |       |      |                                 |             |              |         |      |                         |       |  |
|-------|------------|-----------------------------|------------|---------------------------|-------|------|---------------------------------|-------------|--------------|---------|------|-------------------------|-------|--|
|       |            | Unstandardized Coefficients |            | Standardized Coefficients | T     | Sig. | 95.0% Confidence Interval for B |             | Correlations |         |      | Collinearity Statistics |       |  |
|       |            | B                           | Std. Error | Beta                      |       |      | Lower Bound                     | Upper Bound | Zero - order | Partial | Part | Tolerance               | VIF   |  |
| 1     | (Constant) | .500                        | .395       |                           | 1.265 | .275 | -.597                           | 1.597       |              |         |      |                         |       |  |
|       | DR V2      | 1.000                       | .306       | .853                      | 3.266 | .031 | .150                            | 1.850       | .853         | .853    | .853 | 1.000                   | 1.000 |  |

a. Dependent Variable: DRV1

The above coefficients out SPSS table consist of b-value, collinearity Statistic Tolerance, variance inflation factor VIF. Its value indicates that whether the data multicollinearity or not. The b-value table indicate individual contribution of each predictor to the model.

Deliver products for major customer on just-in-time are positive effect on (DRV1) Company respond to major customers need quickly.

➤ **Variance inflation factor (VIF)**

When we see the variance inflation factor (VIF) from the above coefficient the value of deliver products for major customer on just-in-time DRV2 is 1, therefore the final model showed that multicollinearity was not a potential problem .

In other hand tolerance value from the regression coefficient table indicate that its value is greater 0.2 therefore it is safe.

The researcher conclude that DRV2 deliver products for major customer on just-in-time have more important to predictor whether the company respond to major customers need quickly.

**5.15.5 Data Analysis and Model validation in returning process**

➤ **SPSS out summary of model**

*Table 2.30: Regression analysis in return process summary model*

| <b>Model Summary</b>                                   |                    |          |                   |                            |                   |          |     |     |               |               |
|--|--------------------|----------|-------------------|----------------------------|-------------------|----------|-----|-----|---------------|---------------|
| Model  | R                  | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics |          |     |     |               | Durbin-Watson |
|  |                    |          |                   |                            | R Square Change   | F Change | df1 | df2 | Sig. F Change |               |
| 1  | 1.000 <sup>a</sup> | 1.000    | 1.000             | .00000                     | 1.000             | .        | 1   | 3   | .000          | 2             |
| a. Predictors: (Constant), RV5                         |                    |          |                   |                            |                   |          |     |     |               |               |
| b. Not computed because there is no residual variance. |                    |          |                   |                            |                   |          |     |     |               |               |
| c. Dependent Variable: RV1                             |                    |          |                   |                            |                   |          |     |     |               |               |

When we see the above SPSS output model summary table, the independent variable is (RV2) company have documentation describing our product return, (RV3) company allocate resource for our product return during planning, (RV4) company have accurate forecasts of our product return, (RV5) product return process is easy for our major customer to follow and the outcome variable is (RV1) company have a set of specifications to verify the quality of returned.

The value of R2, is a measure of how much of the variability in the outcome is accounted for by the predictors.

The adjusted R Square is 1, which implies that can account for 100% of the variation in RV1.

The adjusted R2 gives us some idea of how well model generalizes and ideally its value to be the same, or very close to, the value of R2.

The difference for the final model is small (in fact the difference between the values is 1.000 – 1.000 = 0.00 this, value indicate there is no variance in the outcome.

In Stein’s equation, R2 is the unadjusted value, n is the number of participants and k is the number of predictors in the model n =5 and k =5 using this equation to cross-validate a regression model.

$$R^2 = 1 - \left[ \left( \frac{n-1}{n-k-1} \right) \left( \frac{n-2}{n-k-2} \right) \left( \frac{n+1}{n} \right) \right] (1 - R^2)$$

$$R^2 = 1$$

This value is very similar to the observed value of R2 =1 indicating that the cross-validity of this model is very good.

Durbin–Watson statistic test from the above tabulation the value is 2.000, which the assumption been meet perfectly.

➤ **SPSS Output Coefficients of the regression model**

**Table 2.31:** Regression model analysis in returning process coefficients results

| Coefficients <sup>a</sup> |            |                             |            |                           |   |      |                                 |             |              |         |       |                         |       |
|---------------------------|------------|-----------------------------|------------|---------------------------|---|------|---------------------------------|-------------|--------------|---------|-------|-------------------------|-------|
| Model                     |            | Unstandardized Coefficients |            | Standardized Coefficients | T | Sig. | 95.0% Confidence Interval for B |             | Correlations |         |       | Collinearity Statistics |       |
|                           |            | B                           | Std. Error | Beta                      |   |      | Lower Bound                     | Upper Bound | Zero - order | Partial | Part  | Tolerance               | VIF   |
| 1                         | (Constant) | .000                        | .000       |                           | . | .000 | .000                            | .000        |              |         |       |                         |       |
|                           | RV5        | 1.000                       | .000       | 1.000                     | . | .000 | 1.000                           | 1.000       | 1.000        | 1.000   | 1.000 | 1.000                   | 1.000 |

a. Dependent Variable: RV1

In the above multiple regression, the first part of the table shows that estimated b-values and these values indicate the individual contribution of each predictor to the model.

The values of b tell us about the relationship between production planning activities and each predictor.

The above  $b$  value is positive this tell as predictor and outcome have positive relationship the, whereas a negative coefficient represents a negative relationship.

$$PLV_i = b_0 + b_5 RV5$$

(RV1) product return process is easy for major customer to follow =1+1(RV5) company have a set of specifications to verify the quality of returned.

The value of  $R^2$ (RV1) product return process is easy for major customer to follow=1, Similarly the value of  $R^2$  (RV5) =1

Predictors (RV5) company have a set of specifications to verify the quality of returned have positive relationships  $b$ -values in Product return.

In generally the model implies that, company use a set of specifications to verify the quality of returned have positive effect on product return process in the company.

➤ **Variance inflation factor (VIF)**

to cross validate the model we can check variance inflation factor (VIF) from the above coefficient the value of deliver products for major customer on just-in-time DRV2 is 1, therefore the final model showed that multicollinearity was not a potential problem

In other hand tolerance value from the regression coefficient table indicate that its value is greater 0.2 therefore it is safe.

## 5.16 Data Analysis with SCI Performance Attributives

### 5.16.1 Data Analysis with Regression model in SCI performance attributives

*Table 2.32: Regression analysis in SCI performance attributives summary model*

| Model Summary |                   |          |                   |                            |               |
|---------------|-------------------|----------|-------------------|----------------------------|---------------|
| Model         | R                 | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1             | .783 <sup>a</sup> | .879     | .891              | 1.22474                    | 1.667         |

a. Predictors: (Constant), Cost, Quality, Reliability Responsiveness,

b. Dependent Variable: SCI performance attributives

These results which implies that, SCI performance attributives explains the 89.1% of the variance in Cost, Quality, Reliability Responsiveness.

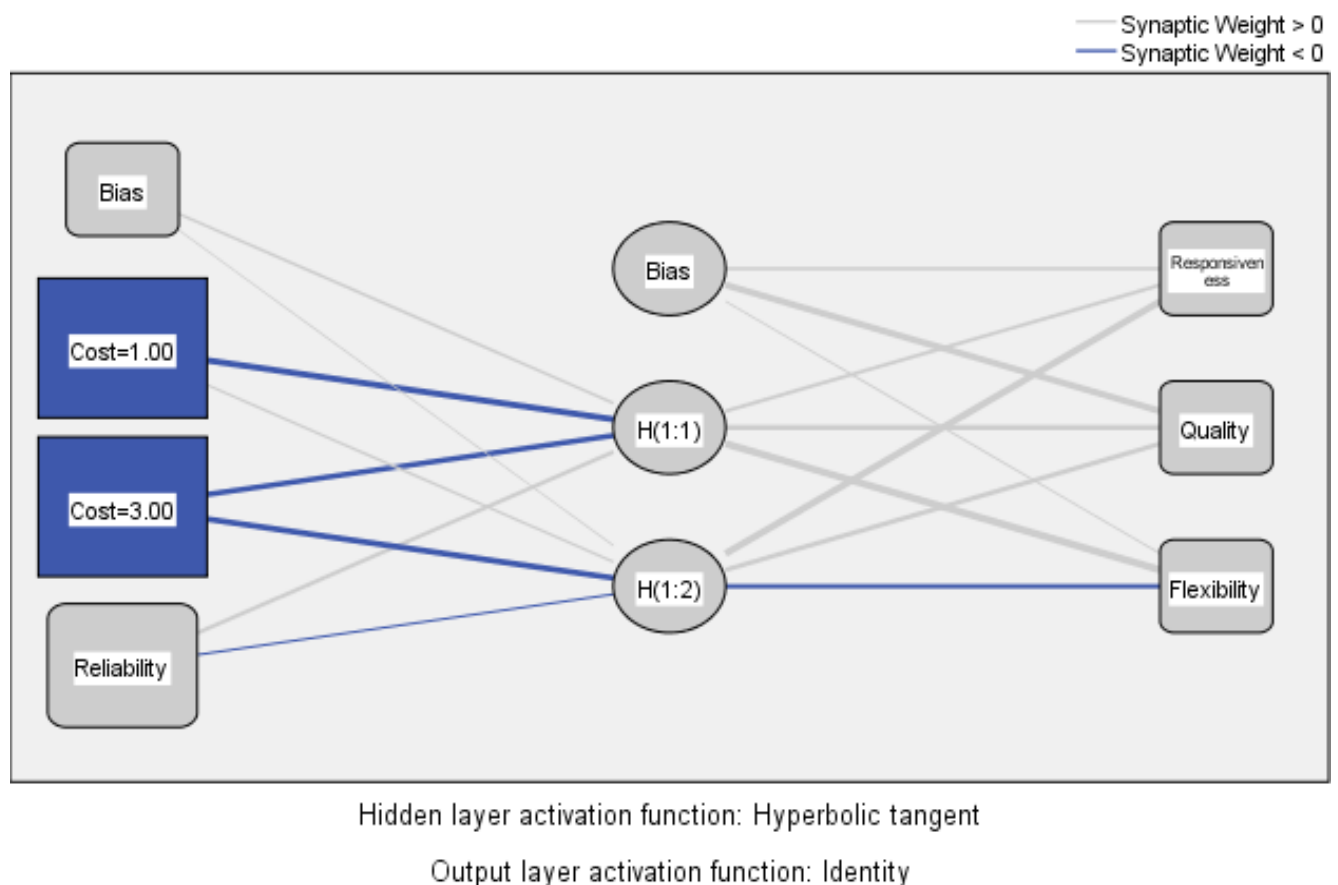
This means that the remaining 10.9% of the variation in Supply chain Performance attributives cannot be explained by those dimensions of Cost, Quality, Reliability Responsiveness.

The R2 value of .879(89.9%) Implies relative contribution of Cost, Quality, Reliability Responsiveness in interpreting the SCI Performance of the company, the remaining 12.1% of the changes in the change can be attributed to other factors. Hence suggesting that other variables which were not considered in this research may also be associated with SCI performance attributives.

Finally, the results indicate that SCI performance attributives likes Cost, Quality, Reliability Responsiveness together, explain the 89.1% of variance in SCIP.

According to Durbin-Watson Test  $\leq 2$  is positive correlation the results of Durbin-Watson test value is 1.667 adjacent residual is positively correlated therefore, its value cause concern.

**5.16.2 Data analysis with neural network algorithms in SCI performance attributives**



**Figure 5.11:** Data analysis with artificial neural network algorithms in SCI performance attributives

Neural networks algorithms model used to predict which SCI performance attributives relatively more importance to measure the level SCIP of the current situation.

From the above neural networks algorithms model result indicate that Responsiveness, Quality, Reliability relatively most importance to predict the current SCIP in the company.

### **5.17 Summary of Major Findings**

According to the data analysis in, summary of the findings presented as follows.

- ❖ The majority responses on the three block supplier integration, intra company integration, and customer integration average means scores were (supplier integration = 2.72), (intra company integration = 2.75), and (customer integration = 2.189) signifies agreement by the respondent this show that supply chain integration was very rarely practice in HMMBI.
- ❖ The respondents reply on Supply chain integration performance imply that majority of respondents agreed to the fact that supply chain integration performance is vary infant. Generally, the overall level of supply chain integration was very poor condition in the companies.
- ❖ The correlation result shows that there is significantly strong correlation between supply chain integration and its factor meticais. In addition, identifying the proper supply chain integration factors metrics have good contribution on supply chain integration performance.
- ❖ The finding from result of correlation test between supplier integration, intra company integration, customer integration, and its metrics factors show that with correlation coefficient of ( $\rho=0.915^{**}$ )  $P=0.001$  have strong and positive correlation and the relationship is statistically significant.
- ❖ The correlation results supply chain integration with SCOR model measure at planning, sourcing, making, delivery, and returning shows that there is significantly positive strong correlation between supply chain integration at (planning, sourcing, making, delivery, and returning) and its Performance.
- ❖ Regression analysis confirm that 0.00% of variability of supply chain integration performance explained by each factors metrics at (planning, sourcing, making, delivery, and returning).
- ❖ In general, to improve the SCIP the researcher has identified each metrics factor at (planning, sourcing, making, delivery, and returning) with SCOR model and the validation has been done by deep examining survey literature and cross checking different test on regression analysis

(Durbin-Watson test, R square value test, adjusted R square value test, tolerance test, variance inflation factor test, b-value test, and multicollinearity test.

- ❖ Finally, the final regression model indicates the minimum difference 0% and maximum variance is only 6.8% the cross-validity of this model is very good.

## **5.18 Existing Supply Chain Integration Performance**

### **The existing supply chain integration performance system HMMBI**

- According to respondents' response 74% of respondents believed that the company are poorly engaged to supply chain integration and the awareness, share technical information with their supplier also not well good.
- Mostly the companies are not considering indicators include information sharing related to demand, sales, production schedules, delivery schedules and performance metrics.
- The existing communication tools of the companies are not advanced, they use only direct visit and telephone. Still now companies have weak collaboration, communication, trust, relation commitment & coordination with local and international suppliers.
- The flow of goods, information, and money from supplier to the companies were not a smooth interplay between and among the different partners.
- With regard to product delivery time to the customers 95% the respondents said that customers always complaints with delivery lead times.
- According to the respondents 80% said that the company doesn't recognized their customers because they have no criteria to select their potential customers.
- In the company's mostly there is no incorporating feedback, listening, and facilitating between employees and top management. The companies have not a systematic way to measure constantly customer satisfaction and technical information.
- In the company's domination of top management decision making and power are always on the hand of military group. According to the respondents lack of management commitment, political situation, racisms are the root cause of poor production performance.
- In general, the supply chain integration performance of the companies was very poor condition.

## **Chapter Six**

### **Proposed SCI Performance Improvement Model**

#### **6.1 Development of Supply Chain Integration Performance Improvement Model**

The objective of this research is to measure supply chain integration performance of Ethiopian metal manufacturing and machine building industries and to recommend the best model that will enhance the supply chain integration performance.

Supply chain (SC) integration is considered one of the major factors in improving performance. Based upon some concerns regarding the constructs, measurements and items used, this paper analyses case study-based research with respect to the relationship between SC integration and measuring its performance.

In this section, a proposed framework model has been presented for identifying the implications and the factor affecting of supply chain integration in performance measurement. This model is based on the review of literature on different influential factor in supply chain integration and performance measurement system. Critically reviewing the literature helped to identify the major SCI factors, barriers and critical success factors for the application of SCI in performance measurement.

##### **6.1.1 Overview of the Model**

The supply chain operations reference (SCOR) model was built by the Supply Chain Council (SCC) as a tool to diagnose the business process activities in supply chain. This method is used to investigate the relationship between suppliers, customers and manufacture. So, this method is not suitable for use in simple business process (H. Taghizadeh and E. Hafezi, 2012). Based on research in Hibert manufacturing and machine building industry, SCOR models can measuring and improve the supply chain integration that includes business activity process, metrics, best practices and information technology. However, improving supply chain integration the system in measuring performance needed some suitable metrics indicators in representing the real SCI system. The (SCOR) model inherent processes can be divided into three level, the first level is process definition, next process types, and process category. In addition, the metal manufacturing and machine building process definition is consist based on of the stages that have standardized on Plan, Make, Source, Deliver and Return ,which consider the information and physical flows (T. E. Erkan and U. Bac, 2011). The SCOR model integrates

the concepts of Process activity, process measurement. Adopting the SCOR model is helpful for managers to standardize the description of supply chain, which is useful to form a unified understanding.

The SCOR model advocates hundreds of performance metrics used in conjunction with five performance attributes: responsiveness, flexibility, Reliability cost, and asset metrics.

### **6.1.2 Correlation Analysis Results in each process with SCOR Model**

Identifying the proper supply chain integration factors metrics(key indicators) have good contribution on supply chain integration performance. The correlation results of the SCOR in each activities shows the selected metrics factor has strong and positive relationship each process activities .the relationship has statistically significant.

The metrics factors in each process have positive effect on supply chain integration performance.

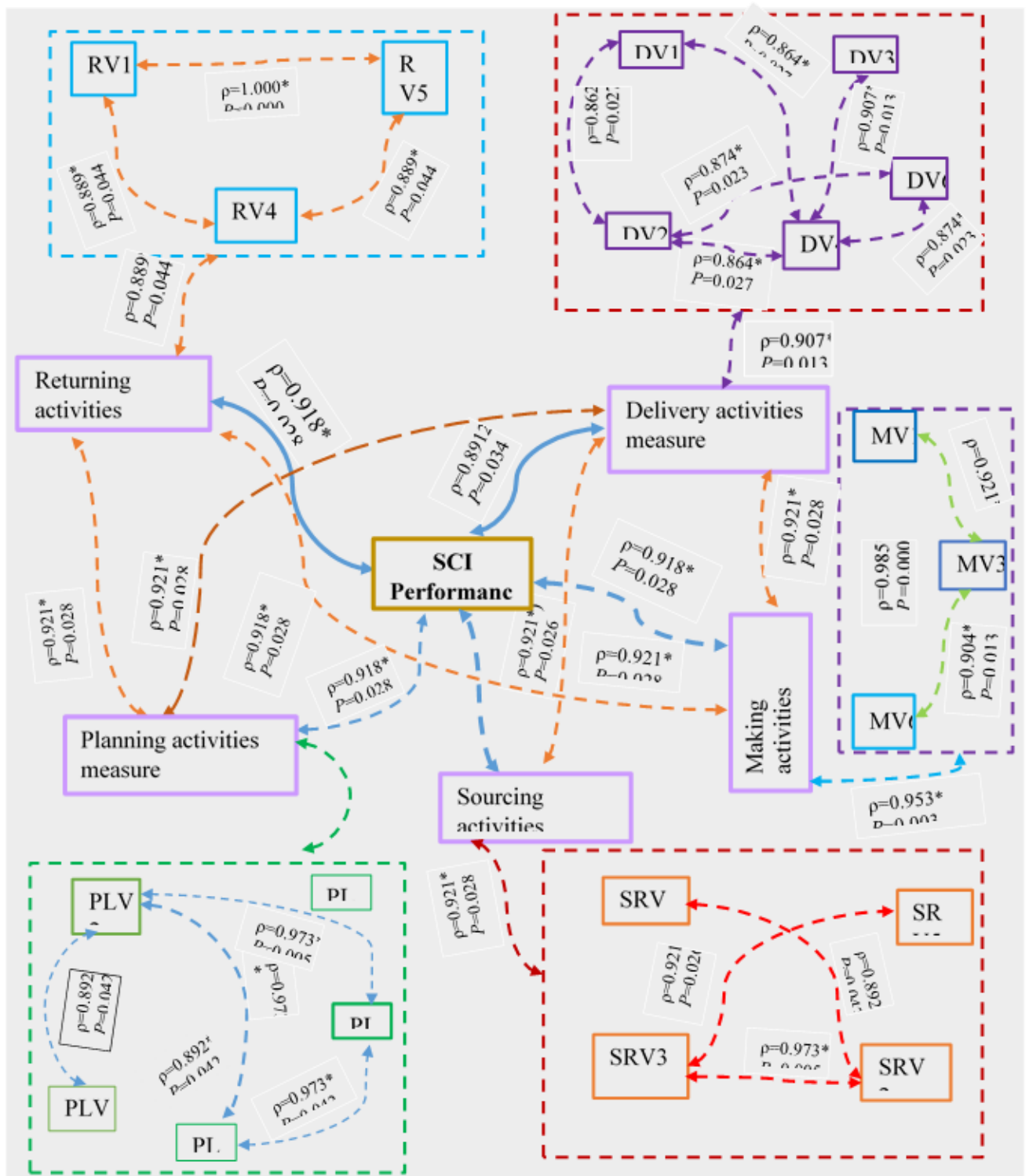
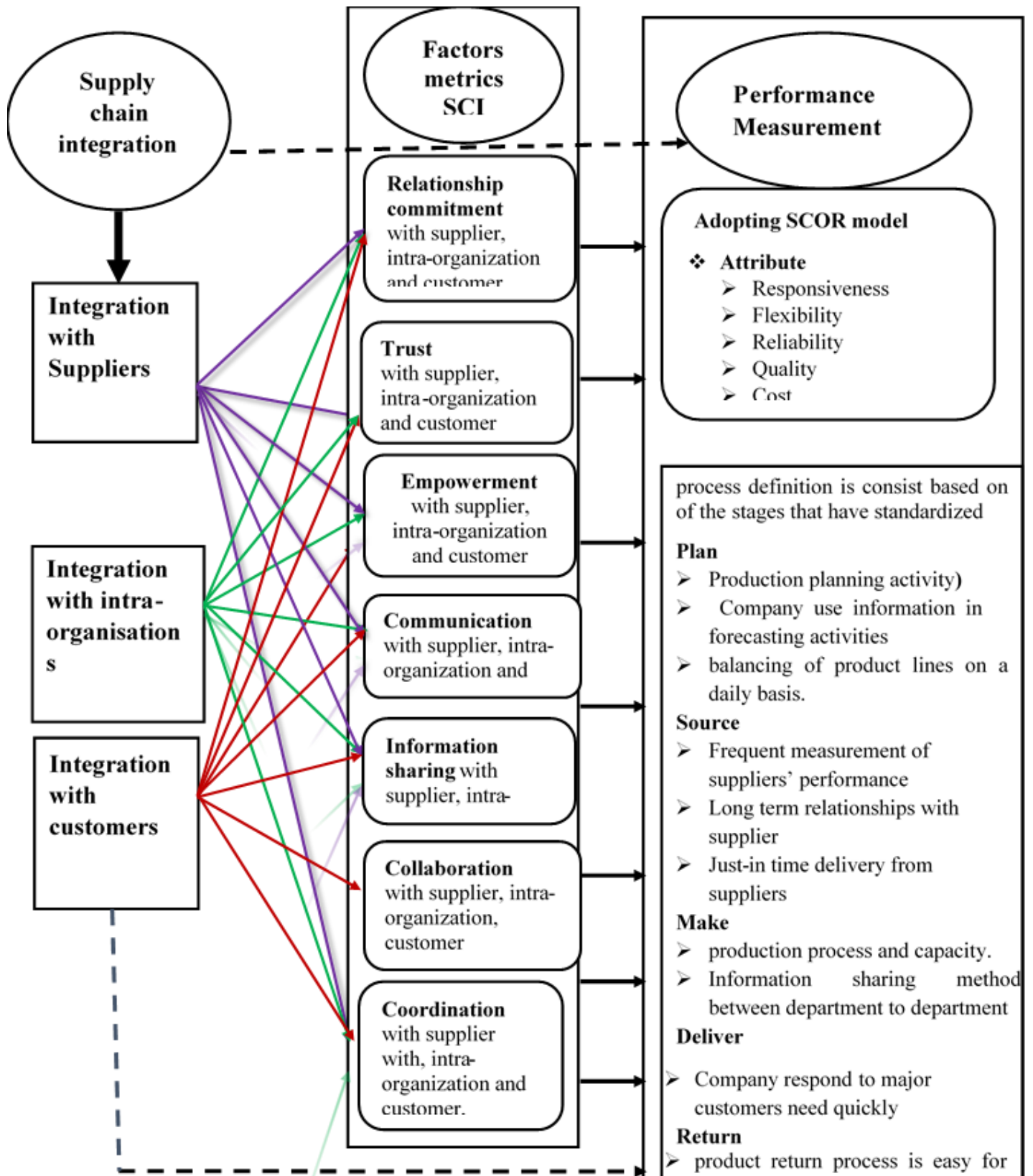


Figure 6.1: Supply chain integration performance correlation results in each proposed SCOR model process perspective.



**Figure 6.2:** *Proposed Model of Supply chain integration performance measurement of metal manufacturing and machine building industries*

### **1. Supplier /customer Integration**

#### **➤ Supplier/customer relationship commitment**

Relationships help to develop collaborative behaviors which are interpreted into various forms, including communication, information integration. Information integration cannot be achieved without relationship between supply chain partners.

Long term relationship between different suppliers and organization increase mutual benefits.

Relationship produces vital benefits for all supply chain partners as it improves firm performance and increase the relationship satisfaction.

Relationship commitment built confidence of the partners and improves commitment that reduces risk of opportunistic behavior in the effectiveness of the future exchange relationship and on the side bets, switching costs and scarcity of alternatives.

Close relationships between companies and suppliers increase mutual ongoing benefit. Supplier relationship commitment help to companies had long-term planning arrangements with their suppliers.

Managing the relationship between company and suppliers closely create long relationships duration with its suppliers that were built based on mutual understanding and produce high information visibility. Long term relationship is relatively increase levels of mutual understanding and commitment.

Relationships commitment exchange partner believing that an ongoing relationship with another is so important as to warrant maximum efforts at maintaining it and commitment is central to all of the relational exchanges between the firm and its various partners.

#### **➤ Trust**

Trust has significant importance and to become one of the top priorities to hold up the relationship among different supply chain partners. Trust lower transaction costs and create good relationship between partners this results positive outcomes for the firm. Partnership with high trust will increase willingness and communication to take risks. Different companies in high-trust relationships with their suppliers not afraid to share all information and believe in the content of the information received.

In addition, companies with high trust relationships are more inclined to take risks and enhance good relationship.

➤ **Empowerment**

Power influences in information sharing, process coordination, relationship commitment and trust. Companies and supplier had empowered or mediated power they gained significant mutual benefits. Furthermore, one side power is difficult for parties to integrate in the supply chain. Empowerment increase confidence by avoiding one party hold authority over another. Different bases of power will affect inter-firm relationships in significant yet contrasting ways. Empowerment between focal companies and their suppliers appeared to produce higher information visibility.

➤ **Communication**

Communication with the suppliers on, production schedule sharing production plan and production capacity by emerging instant online communication tools such as telegram, Facebook and Viber were importance for facilitating information sharing rather than direct contact, email and phone. In this global world online communication, was the main choose of supplier and customer. Creating awareness between supply chain partner the other value adding activities.

Phone, fax and email known communication tools even so, the introduction of instant online communication tools that can further be readily used in Smart Phones provide additional option for communication tools that enabling information sharing with suppliers and customers.

The metal industries must identify the communication level of information participant, information sharing, and information quality of this information (cross check its reliability and timeliness), and how this information is used and translated into the partner's business processes.

➤ **Collaboration**

Collaboration between companies and participating in supply chain setups are increase efficiency and decrease costs.

According to literature collaboration among different partners in the supply chain has several positive effects and it have value advantage, cost advantage, or both of them.

Collaboration increase supply chain efficiency, and also it makes trade partners more flexible in addressing shifts in consumer demand. It has advantage that companies enter to collaboration

to improve total system responsiveness and to reduce cost. In the long term, most significant benefits of collaboration are lowered inventory risk costs, improve customer responsiveness increase flexibility for changing market conditions, and finally improve customer service and satisfaction.

The factors that mostly managers should not underestimate the energy and time required to create and sustain a strategic collaboration. Building partners chain collaborations and managing the partners' relationships is time-intensive.

Generally, companies collaborate with different partners have improve delivery schedules, access to supplier's new and reduce internal procurement procedures costs, reduce internal sales procedures and Secure buyer for product.

➤ **Coordination**

Forming network of producers, externally with suppliers sourcing activities, delivery , to facilitate the integration of the supply chain system in the metal industries. The researcher focus the term coordination in the case companies and customer side rather than supplier side. According to the respondents response coordination system between department to department , machinist to machinist and different formal that control each work activities in each factories section are not well coordinated to share resource( like tools cutter and caliper etc.) , information, about the input material by which machine it can do it because the designer and the machinist not communicated due to lack of coordination.

In any companies system, the smooth functioning of entities is the outcome of well-coordinated entities.

Coordination of activity links relates to SC partners' willingness to make investments in mutual tangible and intangible assets. It includes activities, sourcing and systems, risk reward sharing and delivery, information sharing with key actors (e.g. inventory plans, capacity, demand forecasts, production schedule and performance).

Generally coordination have multiple benefits accruing from effective Supply chain coordination such as , reduction of lead times, improved customer service increased sales, revenue enhancements ,increased flexibility to cope with high demand uncertainty ,low manufacturing costs , efficient product developments efforts, and increased customer retention.

## **6.2 Proposed SCIPM (SCOR) Model for Ethiopian Metal and Machine Building Industries**

### **Planning process**

Planning activities in Ethiopian manufacturing and machine building industries are very low because of lack of proper information to forecasting, manually data collection system, use of computer in planning not well adopted, no formal forecasting system, lack of sale visibility. The existing planning system are mostly done without considering customer need and capacity. This has also its own impact on customer satisfaction. Metal manufacturing and machine building industries they are not cross functional companies planning each department due to lack a coordinated planning process between procurement marketing.

In Ethiopian metal manufacturing forecasting done simply by prediction of total volume growth some amount percentage across all department without any analysis.

Generally to meet customer need and to enhance the performance of metal manufacturing and machine industries we must consider the following .

- Identifying production capacity
- balancing of product lines on a daily basis.
- Using information in forecasting activities
- use guide line for forecasting
- frequently contacts retailers to get information about sale information and market demand.

### **Sourcing process**

Mostly Ethiopian metal manufacturing and machine building industries procure raw materials from the foreign suppliers by using open tender procedure. the procurement procedures are determined by the central bank of Ethiopia bidding procedure due to foreign –currency needs. The average lead time from the supplier to the companies is 2 up to 5 months this is a very long lead. In addition to that choose list price is the main procedure to source raw material from suppliers. currently main challenge lack of currency, distant foreign markets, complex customer procedure, price fluctuation.

When we see the case company HMMBI relationship with their suppliers is traditional mostly but sometimes they have been seeing as a partner but there is no chance to collaborate.

Most of metal manufacturing companies are not consider that the indicators of information integration include information sharing related to demand, sales, production schedules, delivery schedules and performance metrics.

The main factors accounting for the failure in securing partnership between parties during outsourcing process are poor communication, lack of top-management support, lack of trust, lack of Currency, price fluctuation, sample and imported are misaligned, and late delivery time.

Generally the researcher considered the following point to validate the model.

- Frequent measurement of suppliers' performance
- Long term relationships with supplier
- Just-in time delivery from suppliers
- Frequent performance feedback to suppliers'
- Use of information system in procurement process
- Checking imported raw material are always available locally with affordable

### **Making process**

The case companies (HMMBI) produce a product according to the customers specifications with make to order strategy. HMMBI currently not satisfying their customers with help of available raw material and quick delivery time.

planning procedures related to material capacity and the outcome are not aligned .the existing production process and procedures are not meet with customer requirement.

Metal manufacturing and machine building industries in Ethiopia are highly fragmented dependent on foreign technology and production activities also labour intensive. The main key indicator in production process HMMBI are lack of top management commitment ,low educational and experience of employee, high uncertainty in suppliers , some production machine are not functional, spare part are produced locally by small work shop , production schedule are not practice well , high work in progress, lack of waste reduction and delivery lead time very high.

The enablers to facilitate Examining existing metal manufacturing and machine building industries to enhancing production activities in a case companies proper production planning ,production process, production capacity, sharing Information between department to department, planning delivery time, coordination during production process ,planning material requirement ,create flexible workforce, Production simplification, Preventive maintenance, waste reduction overproduction. Enablers to facilitate linkage suppliers, customer and intra organization partnerships are very important . HMMBI information collection system internally was manual. The companies must consider the communication tools like smart phone rather than paper using.

## **Delivery process**

HMMBI have local and international suppliers. Most of the suppliers are from Indian, china, Dubai etc. Since local suppliers are very infant. The company doesn't have long term agreement with any of the international suppliers. The companies procure raw materials from the suppliers always by using open tender procedure. The average lead time from the supplier to the companies is 2 up to 5 months this is a very long lead. In addition to procurement the raw material companies mostly select by giving bill they choose the list price at the time they ask sample to check the quality

Delivery process need to configure with planning process to ensure appropriate mechanisms of product deliver to the customer

Delivery process according case companies situation have two important function ,to source raw material from suppliers and to fulfill customer request order.

The delivery process is order handling at the supplier and all the activities that are related to delivery.

HMMBI have local and international suppliers. Most of the suppliers are from Indian, china, Dubai etc. Since local suppliers are very infant. The company doesn't have long term agreement with any of the international suppliers. The companies procure raw materials from the suppliers always by using open tender procedure. The average lead time from the supplier to the companies is 2 up to 5 months this is a very long lead.

Nowadays product delivery time and customer service are one criteria for companies competitiveness. But HMMBI does not have customer order processing and delivery aim to provide the requested with a short lead time. Generally the delivery process in a case companies at low level of performance.

The companies have to measure the current delivery process performance must consider delivery process performance indicators with SCOR model.

- Respond to major customers quickly
- Deliver products for major customer on just-in-time
- Delivers orders without leads time and Real time visibilities of order tacking
- consolidate orders by customers, source carriers
- use modern communication tools

### **Return process**

Return process has two importance the first one is during sourcing of raw material from suppliers if the ordered product miss match with specification) and secondly sometimes customer complaint (when the ordered size, material, quality, clearance, surface finish are not ) companies are not handling system return process.

Delivery process maybe easy for local supplier because of the companies can contact physically price negotiation but for external supplier their cost implication to return even once deliver a product no physical return. Most of a time local customer need to return the product was due to quality related problem the causes of poor quality products in the companies is employees lack of skill, lack of experience, employee turnover (leave) due to less salary paid. The other factor were system of the organization such as policies, rules and procedures are the primary obstacle to improve quality in the company .Generally the researcher consider the following points to adopt the SCOR model in return process.

- product return process is easy for major customer to follow
- documentation describing product return
- allocate resource for product return during planning
- accurate forecasts for product return
- set specifications to verify the quality of returned

## **6.3 Existing Versus Proposed Supply Chain Integration Performance Measurement and Improvement Approach**

*Table 6.1 Existing versus proposed supply chain integration performance measurement and Improvement approach*

| Existing supply chain integration Performance  | Proposed supply chain integration performance Improvement Approach based on SCOR model  |
|--|---|
| <ul style="list-style-type: none"> <li> <b>Planning activities</b><br/>                     Planning activities in HMMBI are very low due to lack of proper information to forecasting, manually data collection system.<br/>                     There is no formal forecasting system, lack of sale visibility. The existing planning system are mostly done without considering customer need and capacity. Lack of communication, coordination, top management commitment to plan.                 </li> <li> <b>Sourcing activities</b> </li> </ul>   | <ul style="list-style-type: none"> <li> <b>Planning activities</b><br/>                     To meet customer requirement and to enhance the performance of Hibert manufacturing and machine industries the proposed SCOR model that provide the improvement approach for HMMBI to identifying production capacity, balancing of product lines on a daily basis, using information in forecasting activities, and frequently contacts retailers to get information about sale information and market demand.                 </li> <li> <b>Sourcing activities</b> </li> </ul> |
| <p>The company relationship with their suppliers is traditional mostly but sometimes they have been seeing as a partner but there is no chance to collaborate. The existing system SCI was high lead time to procure raw material.</p> <p>The main factors accounting for the failure in securing partnership between parties during outsourcing process are poor communication, lack of top-management support, lack of trust, lack of Currency, price fluctuation, sample and imported are misaligned, and late delivery time</p> <ul style="list-style-type: none"> <li> <b>Making activities</b> </li> </ul> | <p>The model gives emphasis companies to have strong and positive relationship with different suppliers to deliver quality product with minimum lead time the SCOR consider Frequent measurement of suppliers' performance, create long term relationships with supplier, Frequent performance feedback to suppliers, and use of information system in procurement process.</p> <ul style="list-style-type: none"> <li> <b>Making activities</b> </li> </ul>  |
| <p>The existing production process and procedures doesn't not meet customer requirement. Planning procedures related to material capacity and the outcome are not aligned. The main obstacle are high uncertainty suppliers, some production machine is not functional, production schedule is not practiced well, high work in progress, lack of waste reduction and delivery lead time very high.</p> <ul style="list-style-type: none"> <li> <b>Delivering activity</b> </li> </ul>   | <p>To improve production capacity, the SCOR model examine production planning, production process, production, sharing information between department to department, planning delivery time, coordination during production process, planning material requirement, create flexible workforce, Production simplification, Preventive maintenance, and waste reduction overproduction</p> <ul style="list-style-type: none"> <li> <b>Delivering activity</b> </li> </ul>   |
| <p>The average lead time from the supplier to companies is 2 up to 5 months this is a very long lead. A company doesn't consider product delivery time and customer service as one criteria for competitiveness.</p> <ul style="list-style-type: none"> <li> <b>Returning process</b> </li> </ul>  | <p>The SCOR model in delivery process indicators, respond to major customers quickly, real time visibilities of order tacking ,consolidate orders by customers, source carriers ,and use modern communication tools</p> <ul style="list-style-type: none"> <li> <b>Returning process</b> </li> </ul>  |
| <p>In the company there is no organized well returning process. During sourcing of raw material form supplier miss match with specification this cause cost implication to return even once deliver a product no physical return.<br/>There is no returning process when customer compliant about defective product.</p>   | <p>The SCOR model improving approach in returning process, set specifications to verify the quality of returned product and measure return process is easy for major customer to follow.</p>  |

## **Chapter Seven**

### **Conclusion and Recommendation**

#### **7.1 Conclusion**

In modern highly competitive markets, Identifying the factors and measuring its supply chain integration performance did provide greater insight. Integration is the most important key indicators for the success of supply chain.

Ethiopian metal manufacturing industry, is characterized by very low level of supply chain integration, poor export capacity, poor production capacity, and poor performance.

Generally, the aim of this research study is to measure and improve approach to supply chain integration performance and finally to propose supply chain integration performance measurement and improvement approach model to HMMBI.

To accomplish the above objective, the research conducted a literature survey review with regard to Supply Chain integration, (supplier, intra company, and customer),factor metrics of SCI. data was collected thought primary and secondary source. Based on the data an analysis is made ,the supply chain integration performance has been measured by using eight SCI metrics factors. In general the supply chain integrations in hibret manufacturing and machine building industry was very low.

The findings of the research show that the problems of low SCI performance in Hibert manufacturing and machine building industry, the main factors accounting for the failure in securing partnership between parties during outsourcing process are poor communication, lack of top-management support, lack of trust with their business partners, lack of a total quality management program of the provider company and inadequate upfront planning. The level of coordination, cooperation, information sharing system, are very infant.

In the analysis has strong positive relationship correlation between in each perspective ( planning, sourcing , making, delivering ,and returning) were identified.

In general, to improve the SCIP the researcher identified each metric factors at (planning, sourcing, making, delivery, and returning) with SCOR model and the validation has been done by examining survey literature and cross checking different test on regression analysis Durbin-Watson test, R square value test, adjusted R square value test, tolerance test, variance inflation factor test, b-value test, and multicollinearity test.

The proposed factor metrics measure 90.8% of supply chain integration performance. This implies there is additional factor metrics to measure supply chain integration performance. The regression analysis model indicate the remain mean variance value 9.1% therefore, the overall regression model fit the data so, the model is valid.

Finally, the researcher proposed SCIP Measurement and Improvement Approach model for HMMBI based on SCOR model.

## **7.2 Recommendation**

Based on the major findings of the study the following recommendations are forwarded to the Ethiopian metal manufacturing and machine building industry. Though give special attention to solve the rooted problems identified in the company such as supply chain integration problem, factor affecting SCIP, planning related problems, sourcing related problems, making related problems, delivering related problems, returning related problems, domination of top management decision making, and Quality related problems, which affects the supply chain integration performance of metal manufacturing and machine building industry.

To measure and improve supply chain integration performance of the Ethiopian metal manufacturing and machine building industries, the first thing is identifying which factor affecting supply chain integration performance and measure each factors in what extent affecting SCI. Next create awareness about the advantage (benefit) of supply chain integration performance measurement and improvement. The company should have supply chain integration at planning, sourcing, making, delivering and returning process internally and externally such as (department to department, each machine section to the other machine section, machinist with machinist, manager with each work shop head and company with potential supplier) to improve supply chain integration performance.

To be company competitive in the global market should be accomplish by focusing to the requirement of customer. To improve potential supplier and customer relation the supply chain integration of Ethiopian metal and manufacturing machine building industries each integration must be managed and their supply chain integration performance must be measured.

At the end application of the proposed SCOR model is highly recommended to solve the company problems and To improve supply chain integration performance of Ethiopians metal manufacturing and machine building industries.

### **7.3 Future Research Directions**

This research study introduces a SCOR model by identifying metrics factor to Measure and Improve Ethiopian metal manufacturing and machine building industry. Already stated the model, how to Measure and Improve supply chain integration performance. The results of this research study provide several opportunities for future work.

1. To measure and improve supply chain integration performance the researcher was identified the metrics factor but it need more factors identify to give additional emphasis.
2. Use other criteria and test the SCOR to improve supply chain integration performance.
3. Testing the model, in the other companies in footwear, food, textile, and beverage, etc.

## 5.7 References

- Supply-Chain,Council. (2010) Supply-Chain Operations Reference-model, SCOR Version 10.0 Overview, *Supply-Chain Council Inc., Pittsburgh.*
- A, G. (2001). Performance measures and metrics in a supply chain environment. *International Journal of Operations & Production Management, Vol. 2, , No 1.*
- Alie Wube, D. (2017). the Roles of TQM and JIT for Basic Metal Industries Global Competitiveness. *OMICS Internationals Volume 6, 1-4.*
- Alie, W. D. (2016). Study Supply Chain Integration to basic Metal Industry. *Global Journal of Researches in Engineering, 1-3.*
- Amlan Bora, S. C. (2004). Developing key performance indicators for performance controlling of a supply chain,” Proceedings of the Fifth Asia Pacific Industrial Engineering and Management Systems Conference. *Proceedings of the Fifth Asia Pacific Industrial Engineering and Management Systems Conference.*
- Arshinder K, K. A. (2008). Rocket science retailing is almost here: are you ready? . *International journal Production Economics 115(2).*
- Bagchi et al. (2002). Integration of information technology and organisations in a supply Chain. *The International Journal of Logistics Management, pp 4-23.*
- Ballou, R. H. (2004). *Business logistics/Supply chain management : planning, organizing, and controlling the Supply chain (5 ed.)*. Upper Saddle River, N.J.: Pearson Prentice Hall.
- Basnet, C. and Wisner, J. . (2012), Nurturing Internal Supply Chain Integration. *Operations and Supply Chain Management, 5(1).*
- Bavarsad, K. G. (2015). Evaluating effect of supply chain Information system strategy on supply performance. *Indian Journal of Fundamental and Applied Life Sciences.*
- Beamon, B. M. (1999). Measuring supply chain performance. *International Journal of Operations & Production Management 19(3)*, pp. 1-12.
- Benton, M. M. (1999). *POWER INFLUENCES IN THE SUPPLY CHAIN*. Columbus: Fisher College of Business The Ohio State University.
- Bititci, U. (1994). Measuring your way to profit. *International Journal Management Decision 32(6): , pp16–24.*
- Bourne, M. N. (2003). Why Some Performance Measurement Initiatives Fail: Lessons From the Change Management Literature. *Journal of Business Performance Management, Volume 5.*
- Brewer et al. (2000). Using the balanced scorecard to measuresupply chain performance. *Journal of Business Logistics. Vol. 21 (1).*
- Brown, J. D. (2002). *The Cronbach alpha reliability estimate*. Manoa: University of Hawai'i .
- Bryman, A. B. (2011). *,Business research methods*, Oxford: Oxford University Press.

- Chan et al. (2006). A review of performance measurement systems for supply chain management. *International Journal of Business Performance Management*,.
- Chan, F. (2003a). Performance Measurement in a Supply Chain. *International Journal of Advanced Manufacturing Technology* 21(7).
- Chopra, S. a. (2010). internal supply chain integration . *Supply chain management, 4th, Englewood Cliffs, NJ: Prentice-Hall*.
- Christopher M. (1998). Logistics and Supply Chain Management: Strategies for Reducing Costs and Improving Services (2nd ed.). *international Journal of Logistics: Research and Applications, Vol. 2*.
- Cigdem Ataseven, A. N. (2017). Assessment of Supply Chain Integration and Performance Relationships: A Meta-Analytic Investigation of the Literature. *Intern. Journal of Production Economics*.
- Cousins, P. a. (2006). The implications of socialisation and integration in supply chain management. *Journal of Operations Management*, 24(5).
- Coyle, J. B. (2003). *Management of Business Logistics - A Supply Chain Perspective (7 ed.)*. Mason.
- Damien, P. (2005). Supply chain management integration and implementation: a literature review. *An International Journal of Supply Chain Management*.
- Das, A. N. (2006). Supplier integration – finding an optimal configuration. *Journal of Operations Management*, 24(5), pp1-12.
- Eltantawy et al. (2009). A strategic skill based model of supplierintegration and its effect on supply management performance. *Industrial Marketing Management*, 38(8).
- Fabbe et al. (2007). Supply chain integration improves performance: the Emperor’s new suit? *International Journal of Physical Distribution & Logistics Management, Vol. 37*.
- Fabbe-Costes, N. a. ( 2008 ). Supply chain integration and performance: a review of the evidence. *The International Journal of Logistics Management*, 19(2).
- Fasika, B. G. (2013). Assessing the Existing Performance Measures & Measurement Systems in Developing Countries: An Ethiopian Study. *Global Journal of Researches in Engineering*, 1-13.
- Fasika, B. G. (2014). Integrating Developing Country Manufacturing Industries into GlobalSupply Chain. *Journal of Industrial Engineering and Management*.
- Flynn et al. (2009). The impact of supply chain integration on performance: A contingency and configuration approach. *Journal of Operations Management*.
- Flynn et al. (2010). The impact of supply chain integration on performanc :A contingency and configuration approach. *Journal of Operations Management*, 28(1).
- Fraenkel, F. J. (2002). *How to design and evaluate research in education 4th edition*. New York: McGraw-Hill.

- Frohlich et al. (2001). Arcs of integration: an international study of supply chain strategies. *Journal of Operations Management*, 19(2).
- Frohlich, M. T. (2002). E-integration in the supply chain: Barriers and performance",. *Decision Sciences*, Vol.
- Ganapathy, B. &. (1997). A hierarchical system of performance measures for concurrent engineering,5(2).
- Ghalayini AM & Noble JS. (1996). The changing basis of performance measurement. *International Journal of Operations and Production Management* 16(8).
- Ghalayini AM, N. J. (1997). An integrated dynamic performance measurement system for improving manufacturing competitiveness. *International Journal of Production Economics* 48(3).
- Gimenez, C. and Ventura, E. (2005). Logistics-production, logistics-marketing and external integration – their impact on performance. *International Journal of Operations & Production Management*, 25(1).
- Gimenez, C. v. (2012). Supply chain integration and performance: The moderating effect of supply complexity. *International Journal of Operations & Production Management*, 32(5)
- Gomes, C. Y. (2004). An examination of manufacturing organizations performance evaluation: analysis, implications and a framework for future research. *Journal of Operations & Production Management, Emerald Group*, 24(5).
- Goodman L.E., D. P. (2001). The determinants of commitment in the distributor-manufacturer relationship, *Industrial Marketing Managemen*.
- Gunasekaran A, P. C. (2001). Performance measures and metrics in a supply chain environment. *International Journal of Operations & Production Management* 21(1/2), pp 1–17.
- Gunasekaran et al. (2004). A framework for supply chain performance measurement. *International Journal of Production Economics*, 87 (3).
- Gunasekaran, A. (2007). Performance measures and metrics in logistics and supply chain management: A review of recent literature (1995–2004) for research and applications. *International Journal of Production Research* 45(12).
- Gunasekaran, A. and Ngai. (2004). Information systems in supply chain integration and management. *European Journal of Operational Research*, 159(2).
- H. Taghizadeh and E. Hafezi. (2012). The investigation of supply chain's reliability measure: a case study. *J. Ind. Eng. Int.*, vol. 8.
- Harland, C. M. (1996). Supply Chain Management: Relationships, Chains and Networks. *British Journal of management*, vol 7.
- Hausman, W. (2004). The Practice of Supply Chain Supply chain performance metrics Management: Where Theory and Application Converge.

- Hefu Liu, W. K. (2013). Effects of Supply Chain Integration and Market Orientation on Firm Performance: Evidence from China. *International Journal of Operations & Production Management*.
- Helene, G. (2006). *Supply chain optimization in the forest industry*. Sweden: Linköping Studies in Science and Technology Dissertations No. 1105.
- Hervani AA, Helms MM & Sarkis J. (2005). Performance measurement for green supply chain management. *Benchmarking* 12(4).
- Hogarth, D. G. (2003). Are co-operation and trust being confused with power? An analysis of food retailing in Australia and the UK. *International Journal of Retail & Distribution Management*.
- Holmberg, S. (2000). A systems perspective on supply chain measurements. *International Journal of Physical Distribution & Logistics Management*, 30(10), 847.
- Hull, B. (2002). A Structure for supply-chain information flows and its application to the Alaskan crude oil supply chain. *Logistics Information Management* 15(1).
- Huo, B. (1999). Power, Relationship Commitment and Supply Chain. Hong Kong: The Chinese University of Hong Kong, Shatin, N.T.
- Hussain A.H Awad, M. O. (2010). Supply Chain Integration: Definition and Challenges. *Proceeding of international multi conference of engineers and computer scientist 2010 Vol I, IMCES 2010, March 17-19 Hong- Kong*.
- Ipek Koçoglua, S. Z. (2004). The effect of supply chain integration on information sharing: Enhancing the supply chain performance. *7th International Strategic Management Conference*.
- Ittner CD, L. D. (2003). Performance implications of strategic performance measurement in financial services firms. *Accounting, Organizations and Society* 28(7–8).
- J., G. (2006. ). *Living supply chains. How to mobilize the enterprise around delivering what your customer want*. Prentice Hall.
- Jespersen & Skjott, -L. B. (2005). Supply chain management: in theory and practice, Copenhagen Business School Press, Herndon, VA. *International Journal of Logistics Management*.
- Johnston, D. A. (2004). Effects of supplier trust on performance of cooperative supplier relationships. *Management*, 22(1), *Journal of Operations*.
- Joreskog K., S. D. (1993.). Structural Equation Modelling with the SIMPLIS Command Language. *Hillsdale, NJ, Lawrence Erlbaum Associates*.
- Jorgensen, D. (1989). *Participant Observation: A Methodology for Human Studies*. London : Sage Publication.
- Kaplan & Norton. (1996). Using the balanced score card as a strategic management system, *Harvard Business Review*.

- Kaplan and Norton. (1992). The balanced scorecard - Measures that drive performance. *Harvard Business Review*. Jan/Feb Vol. 70 (1)
- Kaplan, R. S. (1996). *The Balanced Scorecard*. . Boston: Harvard Business School Press,.
- Keebler, J. a. (2000). Keeping score: measuring the business value of logistics in the supply chain. , Council of Logistics Management.
- King, N. ( 1994). *The Qualitative Research Interview and Qualitative Methods in Organizational Research: A Practical Guide*. London, Sage Publication.
- Kleindorfer P R and Saad GH. (2005). Managing disruptions risks in supply chains, *Production Operation Management*.
- Kothari, C. (2006). *Research Methodology: Methods and Techniques ,7th Edition*, India, New, Delh.
- Koufteros, X. R. (2010). Organisational integration for product development: the effects on glitches, on-time execution of engineering change orders, and market success, *Decision Sciences*, 41(1).
- Kwon, I. a. (2005). “Trust, commitment and relationships in supply chain management: a path analysis”, *Supply Chain Management: . International Journal*, 10(1), , pp26-33.
- Lambert DM & Pohlen, T. (2001). Supply chain metrics. *The International Journal of Logistics Management* 12(1):, 1–19.
- Lambert, D et al. (2001). Supply chain metrics. *International Journal of Logistics Management*, 12(1).
- Lambert, D. M. (2001). Supply chain metrics. *International Journal of Logistics Management*, 12(1).
- Lee, H. ( 2000). Creating value through supply chain integration, *Supply Chain Management Review*, 4(4).
- Lee, H. C. (2002). Aligning supply chain strategies with product uncertainties. *California management review* (44)3.
- Lee, J. K. (2003). *Operations Management: Strategy and Analysis. six ed. New Delhi: Prentice-Hall of India P. Lt.*
- Legard, R. K.-D. (2003). *Qualitative Research Practice: A Guide for Social Science Students and Researcher*. London: Sage Publication.
- Lynch, R. & Cross, K. (1991). *Measure Up-The Essential Guide to Measuring Business*. London: Mandarin.
- Mark A, J. (2003). The effect of internal communication and employee satisfaction on supply chain integration. *International Journal of Production Economics*.
- Marshall, C. and Rossman, G. (2006). *Designing Qualitative Research. 4th ed*. London: Sage Publication.

- Mason-Jones, R. a. (1998). Time compression in the supply chain: information management is the vital ingredient. *Logistics Information Management*, Vol. 11, No. 2.
- Mathieu J.E., Z. D. ( 1990). Antecedents, Correlates, and Consequences of Organizational Commitment. *psychological Bulletin*.
- Mathuramaytha, C. (2011). Supply Chain Collaboration – What’s an outcome?: A Theoretical Model. *International Conference on Financial Management and Economics IPEDR vol.11*.
- May, T. ( 2001). *Social Research: Issues, Methods, and Process. 3rd ed.* Buckingham and Philadelphia: Open University Press.
- Mayer, R. D. (1995). An integrative model of organization trust. *Academy of Management Review*, , Vol. 20 No,3.
- McAllister, D. ( 1995). Affect and cognition-based trust as foundations for interpersonal cooperation in organizations. *Academy of Management Review* 38.
- Melnik SA, S. D. (2004). Metrics and performance measurement in operations management: dealing with the metrics maze. *Journal of Operations Management* 22(3).
- Michaela, S. (2012). Review and Comparison of Performance Measurement Systems. *Journal of Organizational Management Studies*.
- Miles, M.B. and Humberman,A.M. (1994). *Qualitative data Analysis: An Expanded Sourcebook*. Thousand Oaks: Sage Publication.
- Moore, K. R. (1998). Trust and relationship commitment in logistics alliances: a buyer perspective. . *Journal of Supply Chain Management*, 34(1).
- Morgan R.M, H. S. (1994). The commitment-trust theory of relationshipmarketing. *Journal of Marketing* .
- Mowday R.T.et.al. (1982.). *Organisational Linkages, thePsy chology of Commitment, Absenteeism and Turnover*. New York: Academic Press.
- Muzeyin, M. ( 2014). Enhancing the competitiveness of Ethiopian steel manufacturing industries . *Addis Ababa Institute of Technology*.
- Myers, R. (1990). Classical and Modern Regression with Applications. Duxbury Press, Boston, MA. *Journal of Information Systems and Technology Management* Vol. 5.
- Nahapiet, J. &. (1998). Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review*, Vol. 23No.2.
- Narasimhan et al. (2008). An empirical investigation of supply chainstrategy typologies and relationships to performance. *International Journal of Production Research*, 46(18), 1-20.
- Narasimhan, R. K. (2002). Effect of supply chain integration on the relationship between diversification and performance: Evidence from Japanese and Korean firms. *Journal of Operations Management*, 20(3).

- Nazila Kaveh, n. (2009). How Collaborative Logistics Management Increases Supply Chain Efficiency. *compulsory part in the Master of Science thesis Major in Industrial Management – Logistics*.
- Neely A, G. M. (1995). Performance measurement system design: A literature review and research agenda. *International Journal of Operations & Production Management* 15(4).
- Neely et al. (2001). The Performance Prism in Practice. *Measuring Business Excellence, Vol 5 , Issue 2*.
- Neely et al. (2005). Performance measurement system design: A literature review and research agenda. *International Journal of Operations & Production Management*.
- Neely, A. J. (2000). Performance measurement system design: developing and testing a process-based approach. *International Journal of Operations Production Management, Vol. . International Journal of Operations Production Management, Vol. 20 No. 10 , pp. 1119-1145*.
- Olsen, E. e. (2007). Performance measurement system and relationships with performance results. *International Journal of Productivity and Performance Management, 56(7)*.
- Pagell, M. (2004). Understanding the factors that enable and inhibit the integration of operations, purchasing and logistics. *Journal of Operations Management, 22(5)*.
- Power, D. (2005). Supply chain management integration and implementation: a literature review”, *Supply Chain Management: An International Journal, 10(4), , pp52-63*.
- Prajogo D. (2012). Supply chain integration and performance: The effects of long-term relationships, information technology and sharing, and logistics integration. *International Journal of Production Economics, 135(1),, pp1-12*.
- Prajogo, D. (2009). The effect of supply chain information integration and logistics integration on firm performance. *ANZAM*.
- Q. Su, Y. S. (2008). The impact of supply chain relationship quality on cooperative strategy,. *Journal of Purchasing and Supply Management 14 (4)*.
- Ragatz, G. H. ( 1997). Success factors for integrating suppliers into new product development. *Journal of Product Innovation Management, 14(3)*.
- Rai et al. (2006). Firm performance impacts of digitally enabled supply chain integration capabilities. *MIS Quarterly, Vol.30*.
- Ramaa, A. R. (2009). A Review of Literature on Performance Measurement of Supply Chain Network. *2nd International Conference on Emerging Trends in Engineering and Technology*.
- Robson, C. (1993). *Real World Research*. . Oxford: Blackwel.
- Rolstands, A. (1995). Performance Measurement: A Business Process Benchmarking Approach. *Chapman and Hall, New York, USA*.
- Sarantakos, S. ( 2001). *Social Research. 2nd ed*. Basingstoke: Palgrave.

- Schoenherr, T. and Swink, M. (2012). Revisiting the arcs of integration: Cross-validations and extensions. *Journal of Operations Management*, 30(1-2).
- Seuring, S. M. (2005). Conducting a Literature Review - The Example of Sustainability in Supply Chains, in: . In *Research Methodologies in Supply Chain Management*. Heidelberg: Physica-Verlag HD.
- Shapiro, J. F. (2001). *Modeling the Supply Chain*. Pacific Grove: Duxbury.
- Sillanpää, I. (2010). *Supply chain performance measurement in the manufacturing industry. A single case study research to develop a supply chain performance measurement framework*. University of Oulu. : Acta Univ. Oul. C 374, 2.
- Silverman, D. (2005). *Doing Qualitative Research: A Practical Hand Book*. ed. London: Sage Publication.
- Silverman, D. A. (2000). *Doing Qualitative Research. Practical Hand Book*. London: Sage Publication.
- Simchi-Levi D, K. ( 2008). *Designing and Managing the Supply Chain: concepts, strategies, and case studies*. Boston. McGraw-Hill/Irwin.
- Sink et al. (1989). Planning and Measurement in Your Organization of the Future,. *Industrial Engineering and Management Press, Nocross, GA*.
- Spekman, R. E. (1998). An Empirical Investigation Into Supply Chain Management: A perspective on partnerships. *International Journal*, 3(2).
- Stadtler, H. (2005). Supply Chain Management and Advanced Planning-Basics, overview and challenges, . *European Journal of Operations Research*, Vol. 163, Issue 3.
- Stake, R. (1995). *The Art of Case Study Research*. London : Sage Publication.
- Stank, T. K. (2001). Performance Benefits of Supply Chain Logistical Integration, . *Transportation Journal*, 41(2/3).
- Stevens, G. (1989). Integrating the Supply Chain. *International Journal of Physical Distribution & Materials Management*, Vol. 19, No. 3.
- Stevens, J. (1992). Applied Multivariate statistics for the social sciences. *Journal of Information Systems and Technology Management* Vol. 5, No. 1, 2008.
- Stewart, G. (1995). *Supply chain performance benchmarking study reveals keys to supply chain excellence*.
- Stock, G. G. (2000). Enterprise logistics and supply chain structure: the role of fit. *Journal of Operations Management*, 18(5).
- T. E. Erkan and U. Bac. (2011). Supply chain performance measurement : a case study about applicability of SCOR model in a manufacturing industry firm. *Int. J. Bus. Manag. Stud.*, vol. 3, no. 1.
- Talavera, M. G. (2013). Exploring the Relationship of Supply Chain Collaboration and Trust. *Bangko Sentral ng Pilipinas and UP Professorial Chair paper to be presented on May 24*.

- Tan, K. K. (1999). Supply Chain Management, Supplier Performance. *Internal Journal of Purchasing and Materials Management*, 34(2).
- Tangen, T. (2004). Performance measurement: from philosophy to practice. *International Journal of Productivity and Performance Management*, Vol. 53.
- Taticchi et al. (2010). Performance measurement and management: a literature review and a research agenda. *Measuring Business Excellence*, Vol. 14.
- Taticchi, P. T. (2010). "Performance measurement and management: a literature review and a research agenda". *Measuring Business Excellence*, Vol. 14, No. 1, pp. 2.
- Theeranuphattana A, & Tang JCS. (2008). A conceptual model of performance measurement for supply chains: Alternate considerations. *Journal of Manufacturing Technology Management*.
- Togar et al. (2002). The knowledge of coordination for supply chain integration. *Business Process Management Journal*, Vol. 8 .
- Tonchia, S. & Quagini. (2010). *Performance measurement: linking balanced scorecard to business intelligence*. Heidelberg [Germany] Springer.: New York:.
- Trent, R.J, and Monczka, R.M. (1998). Purchasing and supply management: trends and changes throughout the 1990s. *International Journal of Purchasing and Materials Management*, Fall.
- Turkulainen, V. a. (2012). Cross-functional integration and performance: what are the real benefits?. *International Journal of Operations & Production Management*.
- Vickery, S. J. (2003). The effects of an integrative supply chain strategy on customer service and financial performance: an analysis of direct versus indirect relationships. *Journal of Operations Management*.
- Williams et al. (2013). Leveraging supply chain visibility for responsiveness: The moderating role of internal integration. *Journal of Operations Management*.
- Williamson et al. (2004). Information System Development within Supply Chain Management. *International Journal of Operations & Production Management*, Vol. 24, Issue 5.
- World, B. (2013). *Reducing Supply Chain Barriers Could Increase Global GDP Up To 6 Times More Than Removing All Import Tariffs Report*. Switzerland.
- Wu, F. Y. (2006). The impact of information technology on supply chain capabilities and firm performance: A resources-based view. *Industrial Marketing Management*, Vol. 35.
- Xu, L. (2006). Supply Chain Coordination and Cooperation Mechanisms: An Attribute-Based Approach. *The Journal of Supply Chain Management*, pp 1-3.
- Yin, R. (1994). *Case Study Research Design and Methods*. 2nd ed. London: Sage Publication.

Zahra Lotfi, S. S. (2013). The Relationships between Supply Chain Integration and Product quality . *The 4th International Conference on Electrical Engineering and Informatics (ICEEI 2013)*, pp8-9.

## **Annex 1. Survey questionnaire**

**ADDIS ABABA UNIVERSITY  
INSTITUTE OF TECHNOLOGY  
SCHOOL OF MECHANICAL AND INDUSTRIAL ENGINEERING  
(Industrial Engineering Stream)**

**Thesis Title: Measuring supply chain integration performance**

Dear Participants;

This questionnaire is developed for an academic effort planned for the collection of data to conduct a thesis paper on the title “**Measuring supply chain integration performance**”, in order to fulfill the University’s (Addis Ababa University) requirement set for awarding of a Master’s Degree in Industrial Engineering. The information obtained from this questionnaire will be kept confidential and will not be used for any other purposes. Hence, I am kindly asking respondents to give your candid information.

Thank you for your cooperation!

**NB:**

- It is not necessary to write your name
- Try to address all the question given below
- For the closed ended questions use (√) mark for your choice in the given box

Sincerely,

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Addis Ababa institute of Technology

**I. Preliminary Information**

Part I Respondent profile

|   |  |
|---|--|
| <i>Qualification</i> (Below diploma, College diploma, BA/BSc, MA/MSc & Above) |  |
| <i>Experience (Service year)</i>  |  |

**Section I: supplier customer integration Perspectives**

Please rate on the scale 1 to 5 to the level of importance, with (1= Strongly disagree; 2= Disagree; 3= Neutral; 4= Agree; 5= Strongly agree) and make it 'X' mark in the corresponding table box

| <b>A. Information on supplier Integration</b>  | <b>Strongly agree</b> | <b>Agree</b> | <b>Neutral</b> | <b>Disagree</b> | <b>Strongly disagree</b> |
|--|-----------------------|--------------|----------------|-----------------|--------------------------|
| (SV1). You have effective trust , communications with your suppliers                                     |                       |              |                |                 |                          |
| (SV2). You have effective relationship commitment with your suppliers.                                   |                       |              |                |                 |                          |
| (SV3). You and your supplier have transparent information about each other's inventory status.           |                       |              |                |                 |                          |
| (SV4). You suppliers provide each other with each other's production plan                                |                       |              |                |                 |                          |
| (SV5). You and your suppliers are aware of each other medium-term and long-term policies and strategies. |                       |              |                |                 |                          |
| (SV6). You and your suppliers share technical information with each other if required.                   |                       |              |                |                 |                          |
| (SV7).You have long-term relationships with your suppliers.  |                       |              |                |                 |                          |
| (SV8). You reward your suppliers based on their performance  |                       |              |                |                 |                          |
| (SV9). During procurement your supplier have quick ordering system                                       |                       |              |                |                 |                          |
| (SV10.) your company and your supplier have good trust and relationship commitment                       |                       |              |                |                 |                          |
| (SV11). level of coordination and cooperation your company with your supplier are good                   |                       |              |                |                 |                          |
| <b>B. Information on Customer Integration</b>  |                       |              |                |                 |                          |

|  |  |  |  |  |  |
|--|--|--|--|--|--|
| (CV1). You have effective trust, communication with your customers                                       |  |  |  |  |  |
| (CV2). You and your customers have transparent information about each other's inventory status.          |  |  |  |  |  |
| (CV3). You have effective coordination with your customers.  |  |  |  |  |  |
| (CV4). You collaborate with your customer's development program(s).                                      |  |  |  |  |  |
| (CV5). You and your customers are aware of each other's medium-term and long-term policy and strategies. |  |  |  |  |  |
| (CV6). You and your customers share technical information with each other if required.                   |  |  |  |  |  |
| (CV7). You have long-term relationships with your customers  |  |  |  |  |  |
| (CV8). Your company have a systematic way to constantly measure customer satisfaction                    |  |  |  |  |  |
| (CV9). your company take feedback from your customers  |  |  |  |  |  |
| (CV10). your company have coordination with your customer  |  |  |  |  |  |
| (CV11). your company have trust and relationship commitment with your customer                           |  |  |  |  |  |
| (CV12). your company have customer complain with your product quality                                    |  |  |  |  |  |

**Section II: Intra company Perspectives**

In HMMBI production department in what extent implemented the following term. Please rate them according to the level of their practice in your own company.

5=Very High 4 = High.... 3= Medium.....2= Low, .....1= Not applicable

| <b>C. Production process</b>        | <b>Very High</b> | <b>High</b> | <b>medium</b> | <b>Low</b> | <b>Never</b> |
|-------------------------------------|------------------|-------------|---------------|------------|--------------|
| (POR1) Flexible workforce.          |                  |             |               |            |              |
| (POR2) Work in progress             |                  |             |               |            |              |
| (POR3) Production simplification.   |                  |             |               |            |              |
| (POR4) Preventive maintenance.      |                  |             |               |            |              |
| (POR5) Statistical process control. |                  |             |               |            |              |
| (POR6) Continuous improvement.      |                  |             |               |            |              |
| (POR7) Smoothed line production.    |                  |             |               |            |              |

|  |  |  |  |  |  |
|--|--|--|--|--|--|
| (POR8) Work team quality control.  |  |  |  |  |  |
| (POR9) Waste reduction from product defects  |  |  |  |  |  |
| (POR10) Time spent waiting   |  |  |  |  |  |
| (POR11) Productions lead time and set-up time  |  |  |  |  |  |
| (POR12) waste reduction in processing time.  |  |  |  |  |  |
| (POR13) Waste reduction overproduction.  |  |  |  |  |  |
| <b>D. Quality perspective</b>  |  |  |  |  |  |
| (QV1) Your customer (s) is satisfied with the quality of your company product                    |  |  |  |  |  |
| (QV2) Understanding customers' expectations concerning your products                             |  |  |  |  |  |
| (QV3) Existence of favorable system for customers to express their feeling about your products   |  |  |  |  |  |
| (QV4)Your products are differentiated from competitors“ because of their quality                 |  |  |  |  |  |
| (QV5) Degree of identification of customer requirement   |  |  |  |  |  |
| (QV6) Extent of handling customer complaints quickly and positively                              |  |  |  |  |  |
| (QV7) ), Degree of identification of customer requirement  |  |  |  |  |  |
| (QV8) Quality awareness in the company   |  |  |  |  |  |
| (QV9) Customers' satisfaction with the quality your products                                     |  |  |  |  |  |
| (QV10) Quality improvement techniques  |  |  |  |  |  |
| (QV11) Degree of communication about product quality with its customers)                         |  |  |  |  |  |
| (QV12 )Understanding customers' expectations concerning your products)                           |  |  |  |  |  |
| (QV13) Existence of favorable system for customers to express their feeling about your products) |  |  |  |  |  |

**Part 2. Supply chain Performance measurement department**

**Section I Performance measurement and performance metrics: current practice and future plan for performance**

A. What type of performance measurement system (PMS) does your company use evaluate its internal operations, its supplier and customers?

- Balanced score card (BSC)
- SCOR model
- Logistics scoreboard
- Activity based costing
- Other
- No performance measurement system used for performance evaluation

**Section II Please indicate to what extent the following SCI practices with respect the SCOR model five supply chain processes (Plan, Source, Make, Deliver& Return)**

Please rate them according to the level of their practice in your own company.

5=extensively .....4 = well .... 3= Poor.....2= Not applicable, .....1= Never

| <b>Section A. Planning process</b>   | <b>Never</b> | <b>Not applicable</b> | <b>Poor</b> | <b>well</b> | <b>extensively</b> |
|--|--------------|-----------------------|-------------|-------------|--------------------|
| (PLV1) Production planning activity  |              |                       |             |             |                    |
| (PLV2) The balancing of product lines on a daily basis.                                  |              |                       |             |             |                    |
| (PLV3) Company use information in forecasting activities                                 |              |                       |             |             |                    |
| (PLV4) company use guide line for forecasting  |              |                       |             |             |                    |
| (PLV5) Your company frequently contacts retailers to get information about market demand |              |                       |             |             |                    |
| <b>Section B. sourcing process</b>   |              |                       |             |             |                    |
| (SRV1) Frequent measurement of suppliers' performance                                    |              |                       |             |             |                    |
| (SRV2) Long term relationships with supplier   |              |                       |             |             |                    |
| (SRV3) Just-in time delivery from suppliers  |              |                       |             |             |                    |
| (SRV4) Frequent performance feedback to suppliers'                                       |              |                       |             |             |                    |
| (SRV5) The company use of information system in procurement process                      |              |                       |             |             |                    |
| (SRV6) Imported raw material are always available locally with affordable                |              |                       |             |             |                    |
| <b>Section C. Make process</b>   |              |                       |             |             |                    |

|  |  |  |  |  |  |
|--|--|--|--|--|--|
| (MKV1) production process and capacity.                                      |  |  |  |  |  |
| (MKV2) Information sharing method between department to department           |  |  |  |  |  |
| (MKV3) Delivery time are extremely important for the department planning.    |  |  |  |  |  |
| (MK4) company have coordination during production process                    |  |  |  |  |  |
| (MKV5) Material requirement methods are used by your departments planning.   |  |  |  |  |  |
| (MKV6) Internal and external customers' needs for material or capacity met   |  |  |  |  |  |
| <b>Section D. Delivering process</b>   |  |  |  |  |  |
| (DRV1) Company respond to major customers need quickly                       |  |  |  |  |  |
| (DRV2) we deliver products for major customer on just-in-time                |  |  |  |  |  |
| (DRV3) Company always delivers orders with leads time                        |  |  |  |  |  |
| (DRV4) company have a single point of contact for all order inquiries        |  |  |  |  |  |
| (DRV5) company have real time visibilities of order tacking                  |  |  |  |  |  |
| (DRV6) company consolidate orders by customers, source carriers              |  |  |  |  |  |
| <b>Section E. Returning process</b>  |  |  |  |  |  |
| (RV1) product return process is easy for our major customer to follow        |  |  |  |  |  |
| (RV2) company have documentation describing our product return               |  |  |  |  |  |
| (RV3) company allocate resource for our product return during planning       |  |  |  |  |  |
| (RV4) company have accurate forecasts of our product return                  |  |  |  |  |  |
| (RV5) company have a set of specifications to verify the quality of returned |  |  |  |  |  |

**Part II. Interview part**  
**Section A. Supplier perspective**

- 1.1 Who are your suppliers (locally, internationally)?
- 1.2 How do select your supplier?
- 1.3 What are your raw material?
- 1.4 how many raw material suppliers do you have?
- 1.5 where your supplier located (locally, internationally)?
- 1.6 How do you place an order? Per week, month, 2 month 3month, yearly, if you have other method specify?
- 1.7 How do you communicate to place an order?
  - With telephone
  - By visiting
  - Fax
  - Internet
  - If have others methods pleases specify
- 1.8 How do you collaborate with your suppliers?

What are the obstacle in your supplier department?

- 1.9 What are the procedures used to evaluate potential suppliers (from used and main criteria)?
  - Experience of suppliers
  - Reputation
  - Cost
  - Quality
- 2.0 how would you describe your relationships with your suppliers (e.g. traditional, partnership, collaborative)?
- 3.0 Company have trust with supplier/customers

### **Section B. customer perspective**

- 1.1 Who are your customer (locally, internationally)?
- 1.2 What are your product?
- 1.3 How do select your customer?
- 1.4 how many customers do you have?
- 1.5 where your customers located (locally, internationally)?
- 1.6 How do you communicate to place an order for your customer?
  - With telephone
  - By visiting
  - Fax

- Internet
- If have others methods please specify

1.7 How do you collaborate with your customer?

1.8 What are the obstacle in your customers?

1.9 In what extent your company have cooperation, trust, information sharing system?

### **Section C. Intra company perspective**

1. What are the production process in your company?
2. How to improve the quality of product in your company?
3. How to reduce the waste during production?
4. What are the cause of defective product?
5. What are the obstacle during production process?
6. Customers satisfying with your company product?

### **Section d . Interview performance Measurement SCI related on planning**

1.How is the production planning and control activities carried out?

- Forecasting requirements
- What is sequence of forecasting process?
- Do you have guide lines for forecasting?
- What are the tools used to forecast needs?

1.2. What methods used to perform forecast sale for you company?

- Qualitative (historical study market)
- Quantitative (mathematical methods, models)

### **Section E Challenges and barrier which of the following does your company view as barriers in implementing performance measurement system?**

- Lack of skilled staff and professional knowledge
- Information and communication technologies
- Time constraints
- Lack of Coordination and cooperation
- Lack of direct customer contact
- Physical infrastructure
- Readiness of business partners
- Others, please specify

