SUPPLY CHAIN ANALYSIS OF HANDMADE TEXTILE MANUFACTURING INDUSTRY USING SUPPLY CHAIN OPERATIONS REFERENCE(SCOR) MODEL:

ACASE OF GAMO ZONE

MSc THESIS

BY

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HAWASSA UNIVERSITY
SCHOOL OF GRADUATE STUDIES
ADVISORS' APPROVAL SHEET

This is to certify that the thesis entitled "Supply Chain Analysis of Handmade Textile Manufacturing Industry by Using Supply Chain Reference (SCOR) Model: A Case of Gamo Zone" submitted in partial fulfillment of the requirements for the degree of masters of science in Industrial Engineering and Logistics Management has been carried out under my supervision. Therefore, I recommend that the student has fulfilled the requirements and hence hereby can submit the thesis to the department.

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EXAMINERS' APPROVAL SHEET

As a members of the Board of Examiners of the final master's degree open defense, we certify that we have read and evaluated the thesis paper prepared by Aygota Aka under the title "Supply Chain Analysis of Handmade Textile Manufacturing Industry by Using Supply Chain Operation Reference (SCOR) Model: A Case of Gamo Zone" and recommended that it should be accepted as fulfilling the thesis requirement for the degree of masters of science in Industrial Engineering and Logistics Management.

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DECLARATION

I hereby declare that this MSc thesis titled "Supply Chain Analysis of Handmade Textile Manufacturing Industry by Using Supply Chain Reference (SCOR) Model: A Case of Gamo Zone" is my original work carried under the supervision of Fasika Bete Georgise (Dr:-Ing.) and Mr. Temesgen Endale. It has not been presented as a thesis in any other university and all sources of material used for this thesis have been duly acknowledged.

AYGOTA AKA ---------- ----------

Candidate Signature Date

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

FASIKA BETE GEORGISE (DR:-ING.) ---------- ----------

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Co-Advisor Signature Date

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Aygota Aka

Abstract

Supply chain management is a process of designing, developing, optimizing, and managing the internaland external components of the supply system in a consistent manner with the overallfirm‘s objectives and strategies. In today's businessenvironment, companies are operating in supply chains to increase efficiency and truly meet the customers' demand. Because of theimportance of supply chain management to compete in the current market, there is agrowing need of supply chain operation improvement to improve its process efficiency and to meet the customers’ requirements. This study aimed to analyze supply chain operation of handmade textile manufacturing industry in Gamo Zone to improve its efficiency and satisfy customers’ needs. Surveying method of data collection using interview, questionnaire and observation was used to collect the data. Both primary and secondary data were used to identify challenges and gaps of the existing supply chain management. The study utilized Supply Chain Operations Reference (SCOR) model to analyze the existing SC operations and to identify opportunities for future improvement of the supply chain of the case industry. Based on the analysis of the existing SC operation, the main challenges identified were high cost of sourcing due to prolonged supply chain process, shortage of raw material and quality problem, low production efficiency and capacity utilization, lack of modified weaving technologies, lack of appropriate production schedule, poor order and delivery management and weak marketing system. Because of these gaps of SC operation, the overall performance of supply chain of the case industry was poor. Supply chain analysis to improve the efficiency of the case industry was performed based on analysis of existing SC challenges and mapping future improvement on SC planning, sourcing, production and delivery processes using SCOR model. This improvement on SC operation can be achieved by changing source point to local potential suppliers of raw materials, minimizing the number of non-value adding SC actors by linking weavers with suppliers and consumers, using modified production technologies, strengthening direct market linkage with final product users and establishing distribution center for weaving associations in urban areas. This improvement action will minimize cost of sourcing and production, time of delivery, and increase SC efficiency of the industry to meet customers’ demand.

Key words:*Supply chain management, handmade textile manufacturing industry, supply chain analysis, SC processes, SCOR, performance measurement.*

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List of Abbreviations

ABC Activity-Based Costing

BSC Balanced scorecard

EVAEconomic Value Analysis

HMTHandmade textile

HMTMIHandmade textile manufacturing industry

MTO Make-To-Order

MTS Make-To-Stock

SMESmall and medium scale enterprises

PMSPerformance measurement system

SC Supply chain

SCC Supply Chain Council

SCMSupply chain management

SCORSupply chain operations reference

CHAPTER ONE

INTRODUCTION

1.1. Background of the study

Supply chain management(SCM) is a process of designing, developing, optimizing, and managing the internaland external components of the supply system in a manner that is consistent with the overallfirm‘s objectives and strategies(Chen *et.al*, 2004). Currently manufacturing industries are facing different supply chain management problems. The main problems that currently these firms faceare problems of planning, sourcing, production activity, distribution and marketing that hinder their efficiency and innovative activities. To introduce some order into supply chain management and speed up achieving the goals, it is important to analyze supply chain managementperformance to improve its efficiency, to reduce costs of production, to increase efficiency of the firms and meet customer demands.Long-term competitiveness therefore depends on how well the company meets customer preferences in terms of service, cost, quality, and flexibility, by designing the supply chain, which will be more effective and efficient than the competitors(Chopra and Meindl, 2007). The process of product development, obtaining raw materials, manufacturing and assembling of finished products and delivering it to the customer is central to any company involved in filling customer orders, because a successful supply chain management is essential for a successful business and there is vast diversity of supply chain planning initiatives to achieve the goal(Chopra and Meindl, 2007).

1.2. Background of the industry

Ethiopia has a strong and long lasted tradition in producing handmade textiles and the country is undoubtedly the most important center for production of handmade clothes in Eastern Africa, and has always held this position of pre-eminence (Japan Embassy, 2008).According to CSA (2003)report, there were 221,848 weaving establishments in Ethiopia in 2002. The number of such establishments has showed significant increase over time, and in 2010 the number of such establishment were estimated to be 330,341 for the whole country. Currently, it is expected that the number of weavers as well as their establishments is greater than the previous years’corresponding to population growth and increased demand for hand woven cloths. The report also described the

textiles industry has the second highest number of establishments in the cottage and handicraft manufacturing industry representing 23% of the total number of cottage and handicraft enterprises, with almost 55% of these located in rural areas. Across the nation the textile industry employs the second highest number of people among the cottage industry which accounts for 23% of the total employment following food products and beverages. Weaving enterprises make up 73.2% of the textile industry in number of establishments, and 42.8% in total number of workers.

Manufacturingof handmade textiles in Gamo highlands in Gamo zone isprominent in Ethiopia. Weavers from Gamo highlands are known to be among the weaving pioneers of the country and held in high esteem for their superb skill and for producing exquisite textiles and garments of which the design, style, and structure varies from simple to complex(Kedir, 2016).

Currently there are so many unorganized private handlooms that operate individually and 123 legally certified associations of handmade textiles and garment producers in Gamo zone. From these 123 legally licensed associations 92 are in micro enterprise level with total capital less than 100,000 birr, 26 are small level with total capital between 100,000 and 500,000 and 5 are medium scale enterprises with total capital between 500,000 and $1.5x10^6$. These enterprises have 814 permanent memberships and additionally they employed or created a job opportunity for more than 113 people temporarily and they have a total capital of more than 8 million birr (Gamo zone, 2021).

1.3. Problem statement

Manufacturing companies have great challenge of SCM related to integration of internal functions within a company and linking them with the external operations of suppliers and supply chain members to overcome the challenge of high market competition.The supply chain integrates all the elements like flow of material, finance and information which leads to production efficiency; which in turn leads to product quality and customer satisfaction. As global competition increases, businesses should be more involved in how their suppliers and customers do business. The goal of SCM is to maximize overall SC performance by minimizing cost and to achieve a low cost and a company needs to have excellent internal and external performance (Chopra and Meindl, 2007). In handmade textile manufacturing industry due to weak supply chain management, there is a problem ofsourcing of raw materials, production process and also there exist non-satisfaction of customers (Kalyani.A, 2021). HMTMIsalso encountered many challengeof sourcing,

production efficiency, distribution and marketing in their business operation process. The challenges were serious in sourcing because the relation between suppliers and manufacturers is weak and has no consistency and resulted in supply uncertainty. Production process is inefficient because of raw material supply disruptionand also delivery and marketing process are not satisfying customers (Girum, 2016). There is high demand uncertainty of the products of HMTMIs and almost all options are with high uncertainty of demand (Hofverberg, 2010).

Handmade textile manufacturing industries need to focus on process that has an impact on improving supply chain management processes such as where materials come from, how their suppliers' products are produced, how products are transported and stored and what consumers really wants (Hitesh and Chaudhari , 2020).There were very limited researches in the SCM areas in handmade textile sector. From reviewed literatures and the knowledge of the researcher from the study area, the case industry has SC operation challenges of high cost of sourcing due to prolonged supply chain process, shortage of raw material and quality problem, low production efficiency and capacity utilization, lack of modified weaving technologies and weak marketing system. Consequently, having limitation and gap of research and application in area of SCM of the case industry, there exist many weaknesses and draw backs that have been causing high cost of SC, asset management problems and the organizations were unable to compete in the current market.

That is why the researcher is motivated in the area to contribute an effort by analyzing SC operations of HMTMIs by identifying the challenges of sourcing, production efficiency and distribution and marketing to minimize overall SC costand to satisfy customers.

1.4. Research questions

1. How the existing SC of HMTMI operates?
2. What are challenges and weaknesses of supply chain operations of HMTMI?
3. How does SCOR model fit to SC operation of HMTMI to improve its operations?

1.5. Research objectives

1.5.1. General objective

The general objective of this thesisis toanalyzesupply chain operationsusing SCOR model to improve SC operation of handmade textile manufacturing industry in Gamo zone.

1.5.2. Specific objectives

The specific objectives of the research are:

- Toassess the existing supply chain operation of HMTMIs.
- To identify the challenges and weakness of supply chain operation of HMTMI.
- Topropose the improvement opportunity for supply chain operationof the HMTMI.

1.6. Significance of the study

The significance of this study was to give an insight for handmade textile manufacturing industries SC operations and to tackle the problems related to supply chain management of HMTMIs and enable them to improve by analyzing SC operations of the industry. Thus the study is highly useful tool to indicate significant factors that hinders supply chain management processes of handmade textile manufacturing firms. The study was used to analyze the supply chain management of the HMTM firms and improves the SC efficiency of the case industry. It also increases the productivity of the firms and improvessupply chain management process and benefits the operators by improvingtheir income.This study also can provide baseline information for the concerned body and can be served as a base and supportive resource for further research for academicians.

1.7. Scope of the study

The scope of this research is to focus on theHMTMIin Gamo Zone from the supply chain view, in reducing the overall cost with efficient supply chain management. The study is delimited to assess the supply chain management processes of handmade textiles manufacturing firms and its main problems concerning supply chain activities. More emphasis was given to analyzesupply chain managementof the case industry. The study focuses on the HMTMIin Gamo zone as this activity is widely practiced in this area.

1.8. Limitation of the study

The field researches may be limited due to time and budget constraints. The research area covers specifically only Gamo zone, but there are other areas that practice handmade textile manufacturing activities that are not included due to time, budget and other factors.The research used only

handmade textile manufacturers that are included in associations of SMEs and traders of hand woven products as primary data source.

1.9. Organization of the thesis

The research paper was organized in five chapters: Chapter One contains the introduction part dealing with back ground of the study and the company, the research problem, objectives of the study, research questions, scope, significance and limitation of the study. The second chapter discusses the literature review about the subject matter. In Chapter Three the research methodologies was presented. In Chapter Four results and discussion of the study was presented and finally, Chapter Five contained the major findings, conclusions and forwarded suggestions of the study.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

The literature review of this study is composed of basic theories which provide definition and explanation about supply chain, supply chain management, supply chain analysis and examines key concepts and approaches used in the study. The study reviews supply chain management process as general and SC of HMTMIs specifically. Few papers on handmade textile SC operations have been published in the past decades. However, the researcher considered those papers that regard with SCM as a whole entity and papers that describe about SC of HMTMIs in the review. In general, there are three interconnected themes in this literature review are supply chain management, SC operations of HMTMI and analysis part of the SC. The review begins with a discussion of supply chain managementof manufacturing industry as general and continues to considersupply chain management processes of handmade textile and its challenges and finally SC operations analysis using SCOR model was reviewed.

2.2. Supply chain management

2.2.1. Supply Chain

A supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request and characterized by the flow of goods, services, money, and information both within and among business entities including suppliers, manufacturers, and customers. It also includes all types of organizations engaged in transportation, warehousing, information processing, and materials handling (Chopra and Meindl, 2007). Sourcing, procurement, production scheduling, manufacturing, order processing, inventory management, warehousing, and finally customer service are the functions performed throughout the supply chain(Chopra and Meindl, 2007). A typical supply chain commonly involves a network of tiered suppliers producing raw materials, parts, components, subassemblies, assemblies and final products together with business process and customers (Mentzer *et al*., 2001). An effective supply chain may be defined as the art of bringing the right amount of the right product to the right place at the right time while minimizing related costs within and between all parties (Saad, 2002). Supply chain can alsobe described as allinter-

linked resources and activities needed to create and deliver products and services to customers(Chopra and Meindl, 2007).

2.2.2. Supply chain management

Supply chain management (SCM) is the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities (Chopra and Meindl, 2007). Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers (Council of SCM Professionals, 2008). It is a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses, and stores, so that merchandise is produced and distributed at the right quantities, to the right locations, and at the right time, in order to minimize system wide costs while satisfying service level requirements and it has shifted the emphasis from internal structure to external linkages and processes, and is dependent on the interaction between the organization and its external environment, with strong feedback linkages and collective learning (Chen et.al, 2004).

2.3. Supply chain management and its challenges of HMTMI

There is a strong relation between supply chain management practices and production performance in handloom industry and that supply chain management practices have high significance to production performance of handloom industry,but according to the analysis carried out, most of the weavers were focusing more on production activity rather than SCM practices to improve their performance (Kalyani, 2021).

SCM process involved in handmade textile sector is haphazard, i.e. it lacks adequate mechanism of sourcing, production planning, distributing and marketing and it has numerous problems in terms of technology, working capital, raw materials supply, production planning, pre-loom process, marketing, competition, and related problems(Kalyani and Samala, 2017).

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Handmade textile sector plays a significant role to the economy of developing countries. However, the pressing issue is the inadequate supply chain management process. As a result, firms and

individual weavers find it difficult in procuring the raw materials as well as in the process of production and finally selling those in the market. In addition, this sector is having issues in terms of obsolete technology, low productivity, availing working capital, and poor marketing links. Therefore, supply chain management practices needs to be adopted by the firms. Moreover, the players involved in this sector needs to rationalize costs at each stage of supply chain. Coordination between industry and relevant trade bodies also required to ensure a sound supply chain process in place(Kalyani and Samala, 2017).

The access to raw material such as cotton and yarn has become a great challenge of handloom production activities since it was a rural and semi-rural production activity and weavers have to go far to get these raw materials. Moreover, textile and clothing industries have one of the longest and extremely fragmented supply chains, with existence of many intermediaries between the producer and the final consumer(Bedi, 2009). Each intermediary not only leads to lengthening of lead times, but also adds to costs. By the time the product reaches the final consumer,price of it increases manifold (Bedi, 2009).

Fabric production is the major stage of the handmade textile supply chain mainly consists of weaving and knitting process as well as the non-woven process. Most of the fabric production part is unorganized and not planned on demand bases and consists of small weavers and knitters including the handlooms based on the household business, traditional looms and hand knitting.HMTMIs have suffered from low productivity and inefficiency and its competitiveness gets compromised severely because of its longest and extremely fragmented supply chain, with existence of many intermediaries between the producer and the final consumer (Chandra, 2006).

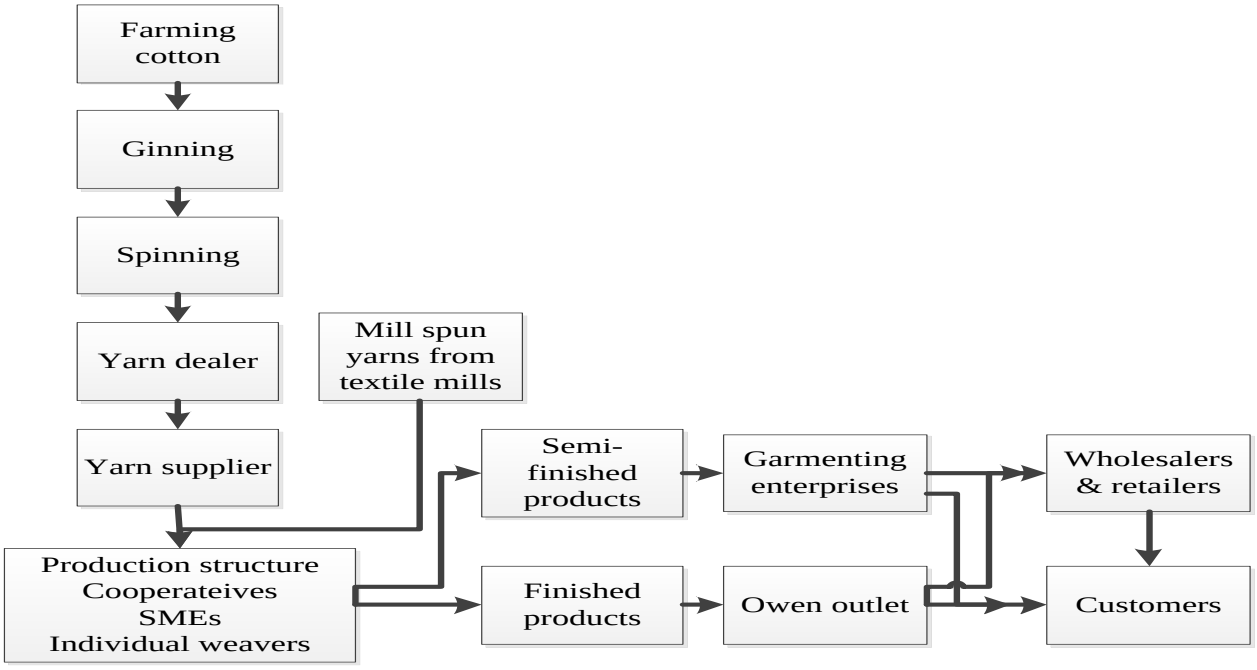


Figure 2-1:Supply chain of handmade textile (Kalyani, 2021)

2.4. Handmade textiles supply chain in Ethiopia

Weaving process starts with purchasing of raw materials that the weavers use to produce woven fabric. They use three kinds of raw materials to produce woven fabric: dir, a factory produced warp, mag a weft which was spun by women mostly in the house and tilet, factory produced colored threads used for decorative borders. These raw materials come from different sources and their supply system was not organized. Mainly weavers produce different kinds of cloth: ‘Kemis’, ‘netela’, ‘gabi’, ‘buluko’, scarf and others. In addition to products for clothing purpose they also produce curtains, cape and other products for different services. When the woven fabric is produced, the weaver hasdifferentoptions to sell the product to market, but almost all options are with high uncertainty of market demand (Hofverberg, 2010).

The knowledge of weaving and the production process of weavers are influenced by different factors like lack of raw materials, training, shortages of capital and market. Granting advances or credit facilities and technical training are necessary to promote the knowledge and to improve the quality and the quantity of the production. Weavers utilize traditional instruments of production and largely depend on manual labor. Economic development of weavers highly depends upon provision of proper marketing arrangements. As weaving knowledge is underutilized and unexploited

indigenous knowledge, it is possible to expect industrial development and socio-cultural transformation by organizing and coordinating weavers' activities(Girum, 2016).

The major products of handmade textile manufacturing sector in Ethiopia are either semi-finished or finished fabric. Semi-finished fabrics are usually channeled to the domestic garment making enterprises for further processing to produce garments like kemis, coat and others, whereas finished products are divided into traditional clothing categories like Netella, Gabi, Kuta, Scarf and Cape which are sold mainly in the domestic market and to Ethiopians living abroad, and home furnishing textiles like curtain which are destined to the international market. The marketing system of the handmade textile products is not structured and full of uncertainties(Abdella *et al.*, 2008).

The manufacturing process of handmade textiles in Ethiopiais not simply a particular way of making cloth but is inextricably bound up with structure, values, history and identity of the community in which it practiced.Hand-woven cotton garments also called *shemma* were traditionally worn by different religion followers of Ethiopia. Today the hand-woven cotton garments are found nearly everywhere in all part of the country and are not only used for garments but also for household products like blankets, cushion covers and table covers. Traditional weaving has various socio-cultural, economic and religious significance and values. Even though, costumes that participant wear in ritual activity, religious, political and in different cultural event are provided by local weavers, its production process is costly due to weak linkage between producers and suppliers and customers (Temesgen, 2018).

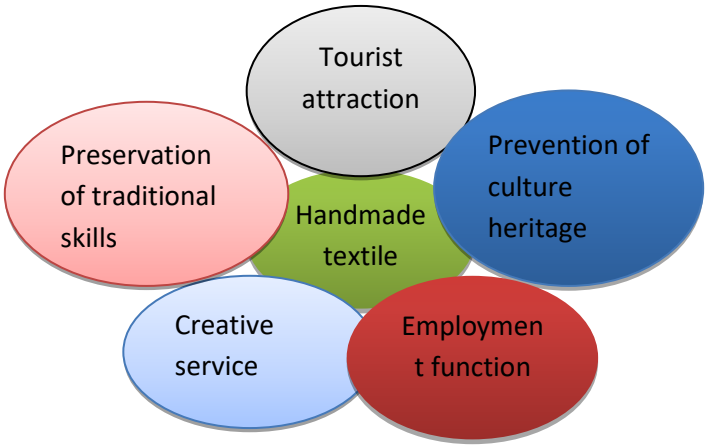


Figure 2-2:the role of handmade textiles(Temesgen, 2018)

2.5. Supply chain analysis using SCOR model

Analyzing the existing SCM system is critical to the success of the supply chain. The particular challenge that faces during analysisis the successful design, selection and implementation of such evaluation system with its business processes.The SC analysis models have been compared on the basis of evaluation criteria's like ability to compare similar SCs, ease of identifying weak part of SC, presence of structured methodology for alignment of strategic and operational metrics and goals to identify business improvement opportunities, capability of the model to serve as standardized supply chain process reference framework and multi-level process performance metrics.Moreover industry and competitive benchmark data sources, macro-level approach for identification of improvement opportunities, work and information flow analysis, IT capabilities to optimize the supply chain and other criteria's are used to compare supply chain models to select more appropriate SC analyzing model(SCC, 2010).

There are different supply chain performance analysis models that are used to evaluate supply chain performancelike ABC (Activity-Based Costing), BSC (Balanced Scorecard),EVA (Economic Value Analysis) and SCOR(Supply Chain Operations Reference) model and SCOR and BSC are the most famous models of them that are extensively applied by researchers(Ouyang, 2012).

2.5.1.Supply Chain Operations Reference (SCOR) Model

The SCOR model is a supply chain analyzing modelintroduced in 1996 and includes five basic processes including plan, source, make, deliver, return and process enablers. SCOR model has been used in many case studies starting with enhancing business competitiveness such as ready-made garments for small and medium size enterprises. As SCC (2010) the SCOR model provides a systemic approach for identifying, evaluating and monitoring SC performance. The model provides not only an opportunity to see how the firm is doing but also a common framework of reference and language across SC. By selecting the right analysis model, the organization can check its position to know where it is and where it is going, confirm priorities; since by measuring it can identify how far it is from its goals; communicate its position according to two perspectives, inter-organizationally communicates in order to thank individuals and teams and externally organization communicates in order to deal with legal requirements or market needs (Ouyang, 2012).

Also, it represents thousands of performance metrics characteristics in reliability, responsiveness, flexibility, cost, and asset attributes. These attributes are characteristics of the supply chain that permits it to be analyzed and evaluated against other supply chains with competing strategies. It provides a consistent supply chain management framework, including business process, performance evaluation, and the best practice. It can help all participants of a supply chain, including manufacturers, first tier and second-tier suppliers, downstream retailers/distributors/logistics service providers and customers, to improve the efficiency of supply chain management thereafter by communicating effectively via the reference model (Hwang et al., 2008). The SCOR is a cross-industry, standard supply chain model that forms analytical tools for the supply chain on the basis of process, performance evaluation and best practice (Hwang et al., 2008). SCOR provides a standard description of supply chain processes, performance metrics, best practice and enabling technologies. It offers a comprehensive methodology to improve supply chain operations (Georgise et al., 2012). This process reference model designed to facilitate communication among supply chain members. One of the applications of the SCOR model is to aid the understanding of a particular supply chain by means of mapping it in business process terms using SCOR model terminology (Wang et al., 2010). This process reference model is also integrated with the well-known concepts of the business process reengineering, benchmarking and best practice(Wang et al., 2010).

2.5.2SCOR Model Business Processes

The processes in SCOR have been identified as unique processes a supply chain requires to execute in order to support its primary objective to fulfill customer orders. For each unique process, SCOR only has one representation.Thus the process type execute have the three variants of these processes.The model is based on six different management processes. The processes Source, Make and Deliver of the company, together with those of clients and suppliers, form a supply chain planned as a whole by the different actors in the process plan. SCOR is based on hierarchical modeling and it analyzes a company's supply chain operation in three levels. The first level represents the core management processes and the metrics and measures corresponding to the management processes. The three types of processes are represented in level two of the model. The plan process types are represented as sP2, sP3. sP4,sP5 and sP6 for plan source, plan make, plan

deliver, plan return and plan enablers. The basic source, makes, deliver and return have variants like make to stock, make to order and engineer to order(SCOR v 12.0).

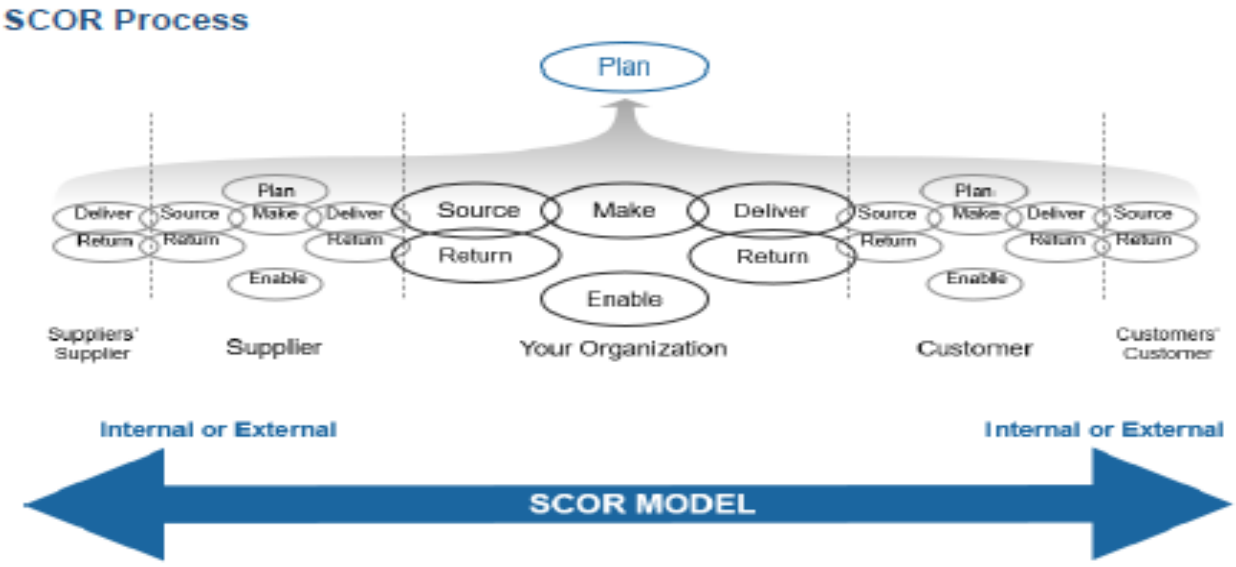


Figure 2-3: SCOR model business process(SCOR v 12.0).

2.5.2.1.SCOR Level 1 (Top Level) Processes

SCOR level-1 is made up of five core processes and is considered a strategic level. At this level, companies use SCOR model to establish basic strategic objectives regarding their operations areas. Level 1 defines the scope and content for the Supply Chain Operations Reference-model. Basis of competition of performance targets are set in this level of the supply chain.

Plan processis the process that balance aggregate demand and supply to develop a course of action which best meet the established business rules. To plan the acquisition of prime matters in Source, Make and Deliver, it is necessary to be conscious of the demand's variability along the whole chain to avoid the unwanted effect. For this it is necessary to establish narrow relations with suppliers and clients to plan production in agreement to the demand of the final product (SCOR v 12.0).

Source process is process that procures goods and services to meet planned or actual demand. The prime matters are an essential part to assure the quality of the final products. That's why quality standards must be established by the suppliers, to satisfy the final clients. However, the chain must recognize that uncontrollable events will affect the product procured. A vendor may have a contract, to clearly identify standards and be a certified supplier, but factors completely outside of

the vendor's ability to control, could result in a product delivered that doesn't match established parameters (SCOR v 12.0).

Make process is a process that transforms goods to a finished state to meet planned or actual demand. In this process it is necessary to take into account all the activities of the transformation process from the raw material to the final product, as well as the flows of material and information of the productive process. When programming the activities of production process, it is necessary to have in mind that production is done according to request.

Delivery process is a process that provides finished goods and services to meet planned or actual demand, typically including order management, transportation management and distribution management. To deliver the products, the volume that the client needs will be assured avoiding excessive deliveries, unnecessary costs of transport, etc. The clients' portfolio will be defined. In this process it is managed from the questions and requirements of the clients up to the shipments of the product and the selection of logistic companies (SCOR v 12.0).

Return processis associated with returning or receiving returned products for any reason. These processes extend into post-delivery customer support. To do a good returns management and returns of raw material can be an important source of competitive advantages. It is necessary to assume that, in spite of the good practices to deliver a quality product, there can always be motives for which our products, or our prime matters, will be returned by the clients or to our suppliers respectively. Because of this, it is proposed to offer to the client an efficient service of management of returns, which allows to answer in time to this type of situations, minimizing a potential deterioration in the relation with the clients, and also to manage the process of returns with suppliers in case of receiving defective, expired or excessive inputs (supply chain council, SCC)

Enable processes describe the activities associated with the management of the supply chain and include management of business rules, performance management, data management, resource management, facilities management, contract management, supply chain network management, managing regulatory compliance, risk management, and supply chain procurement (SCOR v 12.0).

2.5.2.2.SCOR Level 2 process

This is level of Configuration or process categories by which companies configure their supply chain. A company's supply chain can be "configured-to-order" at Level 2 from core process

categories. The process categories are defined by the relationship between a SCOR process and a process type. Each product or product type may have its own supply-chain.

The type of process planning consists of periodically aligning the necessary resources to get the requirements of demand: in this one the demand, internal or for exportation, is agreed with the necessary supply for the production. The type execution is unleashed by the current or planned demand; here the state of the materials is changed, and implies the transformation of the product, programming and sequencing the production. The type enable corresponds to processes that prepares, support or handle information or relations on which depend the processes of planning and execution (SCOR v 12.0).

2.5.2.3. SCOR Level 3 Process

This level is the lowest level in the scope of the SCOR model in which processes decompose in to operational components. Implementation levels that are below level 3 in which we decomposes process elements into tasks and further activities in classical hierarchical manner, are not in the scope of the SCOR model. Level 3 allows businesses to define in detail the processes identified, as well as performance metrics and best practice for each activity. Performance levels and practices are defined for these process elements. Benchmarks and the required attributes for the enabling software are also noted at this level. At level 3, inputs, outputs, and basic logic flow of process elements are captured.

2.6. SCOR model metrics in each level

Measuring how well the supply chain performs is as essential as understanding how it operates and measurements must link to business objectives, repeatable, provide insights into how to manage the supply chain more effectively and support conflicting targets (Balanced Score Cards). SCOR defines five generic performance attributes and three levels of measures that the analysts can use. Diagram below depicts where could measure a supply chain process. In the case of **m0** measures, we are measuring the performance of the organization, as a whole and attributing it to the overall effectiveness of the supply chain. In the case of **m1** measures, we are measuring the performance of the supply chain as a whole. (SCOR refers to m0 measures as internal facing measures and to m1 as customer facing measures.), and**m2** measures check on the performance of one of the Level 2

processes, while **m3** measures check on the performance of specific sub-processes within a Level 2 process.

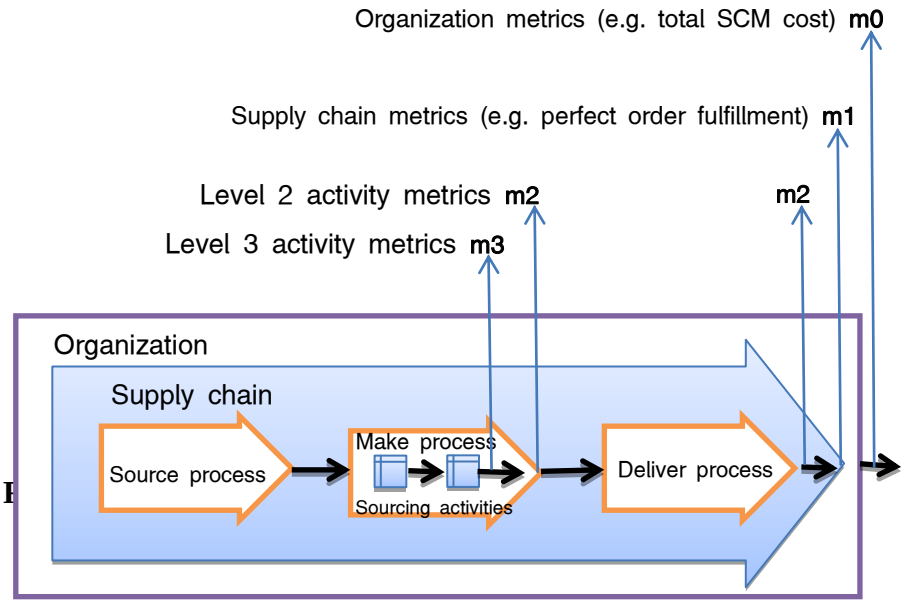


Figure 2-4 Supply chain performance measurements(SCOR v 12.0).

The following table shows how SCOR defines the five performance attributes and the Level 1 measures. Some industries rely on some of these measures and not on others, or give the measures a different name to emphasize what the measure focuses within the specific industry. Thus, once the SCOR team has scoped the 'As-Is' supply chain, it can begin to review historical data and determine which measures they can use to define their specific supply chain. SCOR relies on variations and refinements of the measures shown in diagram above to measure sub-processes or activities. The SCOR team will probably be satisfied with the Level 1 measures. If a team decided it wanted to studysS1 process in more detail, however, it could look in the SCOR manual and find the Table 2.1, which specifies the measures that SCC companies have found most useful in analyzing the source stocked products process.

SCOR level-1 metricsforprocesses like plan, source, make and deliver are similar metrics of measurements likeperfect order fulfillment which is percentage of orders meeting delivery performance with complete and accurate documentation and no delivery damage and components include all items and quantities on-time using the customer's definition of on-time, and documentation. Percentage of orders delivered in full is percentage of orders which all of the items

are received by customer in the quantities committed and the number of orders that are received by the customer in the quantities committed divided by the total orders. Return on working capitalwhich is a measurement which assesses the magnitude of investment relative to a company's working capital position versus the revenue generated from a supply chain. Delivery performance to Customer commit date is the percentage of orders that are fulfilled on the customer's originally committed date. Upside SC adaptability, downside SC adaptability, cash-to-cash cycle time and total SCM costs are other metrics used to measure level-1 processes (SCOR v 12.0).

Table 2-1: Performance attributes of SCOR model (SCC, 2010)

	Performance attributes	Performance attribute definition	Level 1 strategic metrics
Customer facing attributes	SC delivery reliability	The performance of the supply chain in delivering the correct product, to correct place, at correct time, in correct condition and packaging, in the correct quantity with correct documentation, to the correct customer.	Delivery performance
			Fill rates
			Perfect order fulfillment
	Supply chain responsiveness	The velocity at which the supply provides product to the customer.	Order fulfillment lead time.
Internal facing attributes	Supply chain flexibility	The agility of the SC in responding to marketplace changes to gain or maintain competitive advantage.	Supply chain response time.
			Production flexibility.
	Supply chain costs	The costs associated to operating the supply chain.	Cost of goods sold
			Total SCM cost
			Value added productivity
			Warranty/ return processing costs
	Supply chain asset management efficiency	The effectiveness of the organization in managing assets to support demand satisfaction. This includes the management of all assets.	Cash –to-cash cycle time
			Inventory days of supply
			Asset turns.

SCOR level-2 source process metrics – process performance measurement metrics for source process in this level are order fulfillment cycle time which is the time needed to fulfill order, source

cycle time, current source volume, cost to source, cost to receive product, return on working capital, inventory days of supply - raw material (SCOR v 12.0).

SCOR level-2 make process SC metrics -SCOR level-2 metrics for make process are order fulfillment cycle time (RS.1.1), make cycle time (RS.2.2) which is the average time associated with make processes, current make volume (AG.3.38), cost to make (CO.2.3), cash-to-cash cycle time (AM.1.1) and others (SCOR v 12.0).

SCOR level-2 deliver process - SCOR metrics for deliver process are perfect order fulfillment (RL.1.1) is the percentage of orders meeting delivery performance with complete and accurate documentation and no delivery damage and components include all items and quantities on-time using the customer's definition of on-time, and documentation, order fulfillment cycle time (RS.1.1), deliver cycle time (RS.2.3) which is the average time associated with deliver processes, downside deliver adaptability (AG.2.8), current delivery volume (AG.3.32), order management cost (CO.3.14) and others (SCOR v 12.0).

Level-3 SCOR metrics of source process are source cycle time which is the average time associated with source processes,percentage of schedules changed within supplier's lead time, average days per schedule change, schedule product deliveries cycle time, percentage orders processed complete, receiving product cycle time, verify product cycle time, percentage product transferred on-time to demand requirement, inventory days of supply(SCOR v 12.0).

Level-3 metrics for make process are schedule achievement (RL.3.49)which is the percentage of time that a manufacturer achieves its production schedule and can be calculated basedon the number of scheduled end-items or total volume for a specific period. Schedule production activities cycle time (RS.3.123), capacity utilization (AM.3.9),fill rate (RL.3.36), produce and test cycle time (RS.3.101), cost to make (CO.2.3) and direct material cost(CO.3.11)(SCOR v 12.0).

Level-3 deliver metrics are receive product from make cycle time (RS.3.108), delivery item accuracywhich is percentage of orders in which all items ordered are the items actually provided, and no extra items are provided(RL.3.33), delivery quantity accuracy (RL.3.35) is the percentage of orders in which allquantities received by the customer match the order quantitieswithin mutually agreed tolerances, cost to verify product (CO.3.10), order management costs(CO.3.14), cost to deliver (CO.3.14), % of orders delivered in full (RL.2.1), delivery performance to customer commit

date (RL.2.2), reserve inventory & determine delivery date cycle time (RS.3.115), receive, configure, enter & validate order cycle time (RS.3.111).

2.7. SCOR model best practices

A practice is a unique way to configure a process or a set of processes. The uniqueness can be related to the automation of the process, a technology applied in the process, special skills applied to the process, a unique sequence for performing the process, or a unique method for distributing and connecting processes between organizations. All practices have links to one or more processes, one or more metrics and where available one or more skills. SCOR recognizes several different types of practices exist within any organization as Emerging practices, Best practices and Standard practices. These practice categories go by other names as well. What's important to understand is that different practices have different performance expectations. The classification of a practice will vary by industry. For some industries, a practice may be standard, whereas the same practice may be considered an emerging or best practice in another industry. The SCOR classification of practices has been established based on input from practitioners and experts from a diverse range of industries. All practices in SCOR have been classified to simplify finding a practice. A SCOR practice may be business process analysis/improvement, planning and forecasting, customer support, product lifecycle management, distribution management, production execution, information/data management, purchasing/procurement, inventory management, material handling, new product introduction, sustainable supply chain, transportation, order or warehousing management (SCOR v.12.0).

Best practices are 'current', 'structured' and 'repeatable' practices that have had a proven and positive impact on supply chain performance: current: not emerging, not outmoded, structured: feature a clearly stated goal, scope, process, and procedure, proven: demonstrated in a working environment, and linked to key metrics and repeatable: proven in multiple organizations and industries. SCOR best practices have been chosen by SCOR practitioners in diverse industries. It is understood that not all best practices will yield the same results for all industries or supply chains. It may be risk management strategies, item rationalization, supply network planning, supply chain optimization (SCO), inventory optimization, transportation optimization, lean planning, manufacturing reliability improvement, freight carrier delivery performance evaluation and others (SCOR v.12.0).

2.8. Knowledge gaps in the existing literature

Textile and clothing industries have one of the longest and extremely fragmented supply chains, with existence of many intermediaries between the producer and the final consumer. Each intermediary not only leads to lengthening of lead times, but also adds to costs. By the time the product reaches the final consumer, price of it increases manifold (Bedi, 2009). Though handmade textile sector plays a significant role to the economy of developing countries, it is under the pressure of inefficient supply chain management process and weaving enterprises find it difficult in procuring the raw materials as well as in the process of production and finally selling those products in the market due to poor marketing links(Kalyani, 2017) and also marketing system of the weaving enterprises was not structured and full of uncertainties and challenged by competition (Abdella *et al.,* 2008).Traditional weaving has various socio-cultural, economic and religious significance and values. Even though, costumes that participant wear in ritual activity, religious, political and in different cultural event are provided by local weavers, its production process is costly due to weak linkage between producers and suppliers and customers (Temesgen, 2018). Weavers utilize traditional instruments of production and largely depend on manual labor. Economic development of weavers highly depends upon provision of proper marketing arrangements (Girum, 2016). Weaving process starts with purchasing of raw materials that the weavers use to produce woven fabric. These raw materials come from different sources and their supply system was not organized and the product marketing system is also with high uncertainty of market demand (Hofverberg, 2010).Many researchers conducted study to assess the SCM problems of HMTMI and the gaps observed are shown in the following table:

Table 2-2: Summary of literature gaps

Author(s)	Year	Title	Major findings	Study gaps unaddressed
Kalyani.A	2021	Examining the relationship between SCM practices and production performance in handloom industry	Identified that SCM has significant relation with production performance of hand looms	SCM area with weaknesses were not identified
Hitesh and Chaudhari	2020	SCM practices of weaving industry in India	Medium level weaving enterprises were giving emphasis only for production volume increment	Impact of relation with suppliers and customers on performance was not addressed
A.G. Temesgen.	2018	The art of hand weaving textiles and crafting on socio-cultural values in ethiopian	The challenge of production process and the value of hand woven product was well addressed	Challenges related to delivery and marketing was not addressed in this case
Kalyani and Samala	2017	Impact of SCM practices on product quality in indian handloom industry	SCM practice has great impact on product quality	Challenges of SCM in each process of source, make and deliver was not addressed
Girum, E.	2016	Indigenous knowledge among dorze community: the case of weaving	Addressed well the weaving process as indigenous knowledge and identified the challenges of production processes in HMTMI	Didn't address other processes like sourcing and marketing problems and the improvement opportunities.
Hofverberg, H.	2010	Dorze Weaving in Ethiopia	Addressed the production process problems and challenges	No improvement opportunity was identified for other challenges
Bedi, J. S.	2009	Assessing the prospects for India's textilesector	Addressed SC the challenges and gaps of the textile sector	Did not addressed the SC of gaps in each process

In general, there are gaps of both problem identification and identifying improvement opportunity to improve the SC operation of HMTMI.

Therefore, this research work tried to analyze SC operation of handmade textile manufacturing industry to improve its SC efficiency, cost and time of delivery to satisfy customers.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

This chapter discusses the research methodology of the study. It describes about the study area, the research design, research approach, data collection method and analysis strategies employed to answer the research questions. The research design or process followed in this study consisted of the following steps. 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. Threeresearch questions were generated from the research problems. The literature was thoroughly checked to determine whether those questions had been answered. The research aim was 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 meet the research objective, literature was further studied to analyze the SCM of HMTMIs in Gamo zone.

3.2. Description of the study area

Gamo Zone is located in Southern Nations, Nationalities, and Peoples' Regional State of Ethiopia. The Zone has 14 woreda districts and 5 towns administrates. Gamo zone is bordered on the south by the Derashe special woreda, on the southwest by South Omo and Gofa zone, on the north by Dawro and Wolayita, on the northeast by the Lake Abaya which separates it from the Oromia Region, and on the southeast by the Amaro special woreda and its administrative center is Arba Minch. Gamo zone is known by its prominent handmade textile manufacturing in Ethiopia. Gamo highland area is an area enclosing 12 woreda districts fully or partially from Gamo zone based on their altitude. Weavers from Gamo Highlands are known to be among the weaving pioneers of the country and held in high esteem for their superb skill and for producing exquisite textiles and garments of which the design, style, and structure varies from simple to complex. Especially handmade textile manufacturing of Dorze ethnic group of Gamo zone is traditionally taught from one generation to another. HMTM sector creates a job opportunity for many people and generates a great economic income in Gamo highland areas and in the country as a whole. Handloom weaving

was established to meet household need and demand for clothing, and then gradually grew to be an additional source of income as an off-farm activity in the area (Kedir, 2016).

3.3. **Research design**

The research design can be thought as the logic or master plan of a research that throws light on how the study will be conducted. It shows how all of the major parts of the research are done. Depending on the purpose of the research, research design can be classified in to several categories. As described by (Kothari, 2ndEd), research design can be categorized as descriptive, exploratory and causal and effects. This study employed a cause and effect research design because the causes and effects of SC operation performance was identified by this research by using qualitative and quantitative approach.

There are different forms of handmade textile manufacturing organizations like individual weavers and knitters, associations and PLCs in the study area. This research considered SME weaving associations and their customers in Gamo Zone to analyze the supply chain operations of case industry. The study utilized qualitative and quantitative design by conducting interview, questionnaire and observation to give answer for the research questions. Keeping in mind the educational background of the respondents and nature of the topic selected for study, the study used close-ended questionnaire translated in appropriate language, semi-structured interview and observation method. SCOR model was used to analyze the existing SC operation, identify the gap and improvement opportunity, because SCOR model is a universal model with balanced approach having suitability for all types of business facilitating SCM analysis for internal and external process improvement of business operations. Interview and observation techniques have become more suitable to analyze SC by using SCOR model and questionnaire method was used to measure SC performance of the case industry.Considering the industry's supply chain operations improvement as a goal, which was realized through identifying processes, identifying existing SCM gaps and providing plans for change on processes, the researcher conducted detail observation and interview using 31 SME weaving associations found in the study area and used questionnaire by using 75 respondents of weaving associations and their customers of licensed traders. The data that was collected through interview and observation helped the researcher to identify the existing SCM

status and its gaps and the data obtained by questionnaire was used to measure SC performance to identify the relevant main processes and sub processes.

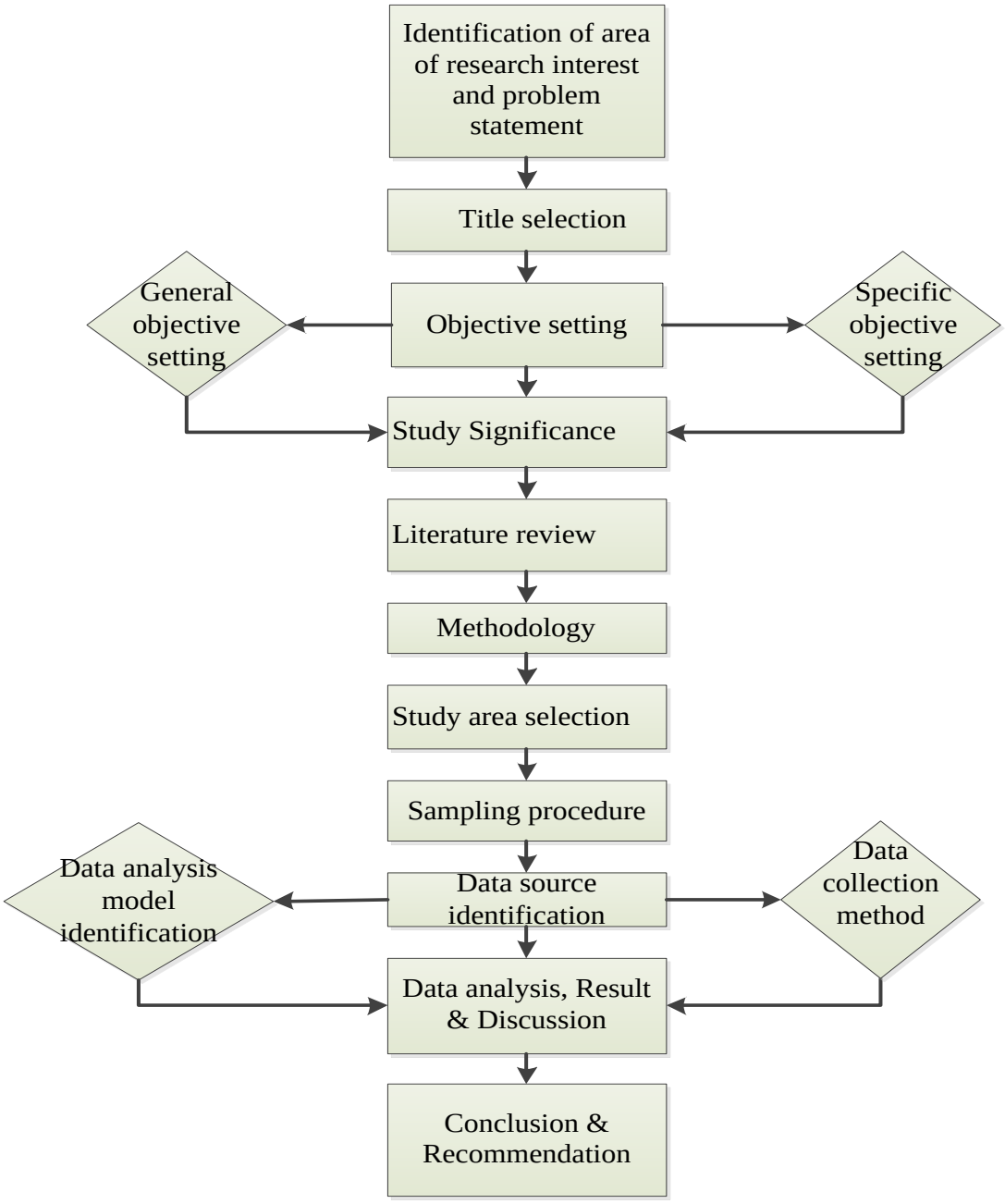


Figure 3-1Research Design process

3.4. Research Approach

Research approach can be categorized as a quantitative, qualitative and mixed approach. Qualitative research approach is used to formulate knowledge based on some existing historical and social views to establish particular pattern. Quantitative research approach is a research approach used by researcher based on the measurement of quantity or amount to gain knowledge by using observation and measurement to check the pre-established theories by implementing survey technique and experiment. The mixed method approach on the other hand, is a research approach used by researcher to seek knowledge by combining both quantitative and qualitative research approaches (Kothari, 2ndEd). Supply chain operation analysis and improvement in supply chain operation of the case industryis the main goal of the research, which could be realized through identifying processes, process gaps and existing opportunities and providing plans for change. This research approach used a mixedapproachusing qualitative and quantitative data to study the supply chain management of handmade textile manufacturing industry. SCOR model was used to analyze supply chain management processes.

3.5. Data Sources

Data was collected from primary and secondary sources. The respondent categories for primary source were SME weaving associations and their customers found in Gamo Zone because these association groups have better information about the SC of the case industry than micro level associations and individual weavers. The researcher used semi-structured interview method with discussion, questionnaire and observations to collect data from handloom weaving associations and their customers. These techniquesprovided insight in the handmade textile industry that helped the researcher to give emphasis on the most important issues when analyzing SC of the case industry to improve efficiency and customer satisfaction. Detailed interview and observation with prepared observation checklist were held on 31 weavers associations 26 from small scale enterprise level and 5 from medium weavers associations to get detailed information about the case industry SC operation. In addition to interview and observation, questionnaire method using respondents of 31 SME weaving associations and 44 licensed traders of hand woven products found in the study area. In addition to primary sources of data, the researcher utilized secondary data through reviewing literatures from different sources like journals, documented materials, publication and different

reportsto get supply chain management of handmade textile manufacturing industries related information.Also basic supply chain theories that can help to analyze and improve SCM of the case industry were reviewed.

3.6. Sample Design

The study used a population group of SME handloom weaving associations and their customers that are licensed traders in the study area. The study utilized stratified sampling method to select the samples from different population groups. There are 31 SME weaving associations in the area and each association has 5 to 25 members and 44 licensed traders. Small and medium scale weaving associations and licensed traders were selected purposively, because they can have more information about the SC of HMTMI than micro level enterprises and individual weavers. For interview and questionnaire method due to constraints such as time and budget, it was not possible to collect data from the entire population of all association members. Therefore, strata sampling procedure was used because the samples were drawn twice from different populations. Primarily association from association population was sampled purposively and each operator or weavers of association members were drawn randomly. A single sample for each method was drawn randomly from each population member associations and traders were used for questionnaire method. As previously mentioned the researcher used interview, questionnaire and observation method of data collection to get qualitative and quantitative data that gives detail information about the SCM operations of the case industry. AllSME associations were used for observation method to visualize the SC operations of the case industry.

3.7. Sampling procedures and sample size

A sample is a subset of population that represents the whole population. The source population for this study was SME handloom weaving associations and their customer tradersin Gamo zone. This study used stratified sampling method to selected samples from different population groups like weaving associations, woven product traders and members from associations. There are 92 micro levels, 26 small and 5 medium scale totally 123 weaving associations in study area 31 SME associations that are participating in HMTM by hand weaving and local garmenting. From these associations 26 small level and 5 medium levels weaving associations weaving associations were purposively selected, because these groups of associations have more information about the SC

operation of the case industry than micro level enterprises. For interview method of data collection from association members' one sample was randomly drawn by taking the name list of the members from the association. That means 31 samples from 31 associations were taken for interview purpose. After the name of the association member was selected, researcher takes him to appropriate area to ask interview questions. For questionnaire 75 respondents were selected from two population groups SME associations licensed traders of hand woven products. From SME associations 31 respondents that can read and write were selected purposively excluding the member that was selected for interview and 44 licensed traders was selected purposively. After the samples were selected for questionnaire method short orientation about the aim of the questionnaire and how to fill and return was given for each respondent. For observation all associations were used, because observation does not need the participation of each member to give information.

3.8. Data Collection Instruments

Among the several methods of data collection techniques interview, questionnaire and observation methods were selected for this study. These are commonly used method of collecting information for research work. Interviews are classified according to the degree of flexibility into two categories: Unstructured interviews and structured interviews.In this study structured interview was used.

Observation is a way of collecting data through observing. Observation data collection method is classified as a participatory study, because the researcher has to immerse him/herself in the setting where his/her respondents are, while taking notes and/or recording.Observation as a data collection method can be structured or unstructured. In this study structured or systematic observation, data collection is conducted using specific variables and according to a pre-defined schedule. Observation data collection method has an advantage of direct access to research phenomena, high levels of flexibility in terms of application and generating a permanent record of phenomena to be referred to later.

Questionnaire method used in this study was close ended that were prepared by the researcher in appropriate language and translated to Amharic to be suitable for respondents and distributed to respondents.

3.8.1. Interview method

This technique is important method to collect data that give a chance for respondents to express their ideas by their own words. For this study, researcher used semi-structured interview techniques keeping in mind that the educational background of the respondents and nature of the topic selected that some questions need explanations to the respondents. The researcher used 31 SME weaving associations found in the study area for interview question. Respondentsfrom association members were selected randomly from the population of the members. The researcher used semi-structured interview approach based on research questions and SCOR model processes. The information obtained through interview questions includes current SC processes of HMTMIs. The main aim of interview is to get detail information from their experience and knowledge on HMTMI to identify the existing SC status, challenges and gaps of SC operations for the industry. The interview questions addressed the existing SC processes including SC planning, sourcing, production, delivery and return process. Researcher collected information like the main challenges of SCM of HMTMIs related to SC planning, raw material sourcing, production and delivery processes from interview questions. Information obtained from interview question also includes the way the raw material is sourced from suppliers and relation between manufacturers and suppliers and SC performance based on delivery reliability, responsiveness, flexibility, and cost and asset management. Process of sourcing, production and delivery on each level of SCOR model was identified and addressed in existing SC operation. This method was used to identify the challenges that hinder the capacity utilization, production efficiency and product distribution that in turn hinders the customer satisfaction and competition in the current marketof the industry.

3.8.2. Observation method

Observation conducted on handmade textile manufacturing industries in Gamo zone to know the practical problems faced for flow of material and information, efficiency and time utilization, their attitude towards commitment and involvement for their tasks.It is used to collect the data based on short checklist that helps the researcher to get important information by visiting the processes and activities of handmade textile manufacturing enterprises. Scheduled observation was administered so as to collect in-depth information and data that needs insight of the researcher himself to have detailed information about the supply chain of HMTMIs starting from suppliers to end customers. The SC processes of 31 handloom weaving associations 26 from small enterprise and five from

medium size enterprise were observed based on the prepared checklist. Observation of SC operations starting from raw material receiving, storing, preparing it for weaving, weaving process and delivery and distribution process of associations were conducted. The flow of material from raw cotton supplier through spinning, winding process and process of preparation of warp yarn like sizing, warping, knotting to loom and weaving processes were observed and the weak links of SC of the case industry were identified. In sourcing process raw material ordering, scheduling product receipt process, receiving product and verifying process and process of transferring product to weaving process were observed. In production process flow, capacity utilization, productivity of traditional and modified loomswas addressed by observation method of data collection. Also material issuing and quality controlling mechanism of the enterprises was observed.The information obtained from observation method helped the researcher to visualize the delivery process of products to customers and order management systems and inventory management process. Observation also helped to identify flow of materials, information and finance in the selected weaving enterprises in the study area and to identify the existing SCM process status of the case industry and its gaps. This observation also provided the researcher with information about the SC areas that need future improvement to improve the SC of handmade textiles based on the existing SCM status.

3.8.3. Questionnaire method

Questionnaire is the appropriate instrument to collect data from relatively large sample size. It was used as additional primary tool for collecting quantitative data from weavers and customers of weaving associations. The questionnaire contained many close-ended items based on SCOR model performance attributes like reliability, responsiveness, flexibility, cost and asset management system that was prepared in English language and translated to Amharic considering educational background of the respondents. This method is used to measure supply chain performance of the case industry taking reliability, responsiveness and flexibility from customer facing attributes and cost and asset management from internal facing attributes. Five-point Likert's scale was applied in the construction of questionnaires to show the level of agreement: 1= strongly disagree (SD), 2= disagree (D), 3= neither agree nor disagree (ND, 4= agree (A) and 5= strongly agree (SA) to have uniform response and for performance level 1.00-1.80 = very poor performance, 1.80-2.60 = poor, 2.60-3.40 = moderate, 3.40-4.20 = good and 4.20-5.00 very good performance as shown in the

following Table 3.1. The study result also interpreted on the basis of Likert's five-point scale response criterion (Al-sayaad, *et al*., 2006).

Table 3-1: Likert's five-point scale response criterion (Al-sayaad, *et al*., 2006)

No	Mean range	Response option for agreement	Response option for performance
1	1.00-1.80	Strongly disagree	Very poor
2	1.80-2.60	Disagree	Poor
3	2.60-3.40	Neither agree nor disagree	Moderate
4	3.40-4.20	Agree	Good
5	4.20-5.00	Strongly agree	Very good

3.9. Methods of data analyses and interpretation

Data analysis depends on both the objectives of the study and the nature of the variables in the data collected. In this study the data was analyzed in qualitative and quantitative approach because the data collected was qualitative and quantitative data that was obtained by interview, questionnaire andobservationmethods.

SCOR model was used to analyze the data obtained through interview, questionnaire and observation and different soft wares like micro soft excel for data analysis, micro soft Visio and EdrawMax to draw diagrams during data analysis were used. The data collected through interview method was used to identify the SC operationchallenges and gaps that hinder the SC operation efficiency, to evaluate the SC process in each level of SCOR using different metrics.

The data collected by observation methodswas used to identify the flow of material and information and to map the existing supply chain of the case industry in standard SCOR terms. The data obtained through questionnaire were used to measure the SC performance of HMTMI using measures like supply chain reliability, responsiveness, flexibility, cost and asset management. Existing SC analysis of the case industry using SCOR model helped in identifying the areas where the industry was performing well and where it needed to tighten. The data that was collected to determine SCM problems includedthe supply chain processes like plan, source, make, deliver and

return process perspective variables and SC performance based on the reliability, responsiveness, flexibility, cost and asset management. After the problems were identified from collected data, the way of tackling each problem were proposed by using improvement opportunities based on SCOR model best practices. The SCOR model uses different charts and maps to analyze each supply chain like business Scope diagram that specifies the scope of a project or organization, the geographic map which shows the material flows on the surface of a geographic map, thread diagram to show the same material flow diagram for level 2 processes and to know the complexity or redundancy of high - level processes and process flow diagram or process models which deals with the analysis of workflows, materials, and information on level 3 of SCOR model.

It was realized through mapping to identify processes, identify existing SC challenges and opportunities for improvement and providing plans for change based on SCORprocesses. For each of the relevant criteria of the SCOR model, detailed discussions were held with the respondents and detail observation of the SC flow by the researcher was carried out. The current SC processwas mapped to identify the gap and improvement opportunities of the case company and "To-Be" analysis also done by using SCOR model and then mapping the improvement of SC performed by using improvement opportunities identified.

Supply chain performance was measured based on the questionnaire result by statistical analysis such as frequency, mean, range and standard deviation to support the qualitative data analysis. The general situation of variables on basis of SCOR model processes such as plan, source, make, deliver and return and performance activities like reliability, responsiveness, flexibility, cost and asset management performance were used for descriptive statistics analysis in this study. Data test was carried out to determine the significant differences with the given confidence level of 95%.

3.10. Ethical consideration

Ethical issues in research works are likely to emerge on both when considering the collection of data and in the researcher - participant relationship and there are four requirements (Bersoff, 2003) that researchers have to be aware of:

- The information requirement: The participants should be informed about their partaking in the project and what it will be used for.

- The consent requirement: The participants in the survey have the right to determine their involvement.
- The confidentiality requirement: Details about people in the survey should be given confidentiality and personal data should be stored in such a way that no-one is able to take advantage of it.
- The "use" requirement: Data collected on individuals must only be used for research purposes.

Due to these four requirements all the research participants included in this study were appropriately informed about the purpose of the research and their willingness and consent was secured before the commencement of asking questions. Regarding the right to privacy of the respondents, the study maintained the confidentiality of the identity of each participant. In all cases, names were kept confidential thus collective names like 'respondents' was used. Respondents have been assured that no meaningful damage inflicted on them due to their participation in this particular study by boldly explaining to them the apparent purpose of the study (which is actually for academic purpose) and ensuring the confidentiality of their identity and whole part of the information they provided for the purpose of undertaking this study.

CHAPTER FOUR

DATA ANALYSIS RESULT AND DISCUSSION

4.1. Introduction

This chapter deals with data analysis result and discussion based on collected data by interview questions,observationand questionnaire method. The primary focus of this study was to analyze the supply chain operationof HMTMIs by identifying SC operation gaps and to identify improvement opportunity. Therefore, to assess the supply chain management challengesof the handmade textile industries, emphasis was put to understand the existing supply chain processes and its challenges in each level of decision-making.Therefore, the proposed methodology involves the analysis of all supply chain processes based on SCOR model structure. This model is used to identify the existing SCM challenges and improvement opportunities to SC operation of the case industry. Thus, based on the responses obtained from the respondents, data analysis was made to analyze supply chain using SCOR by reducing the complexity of the SCM of the case industry.

4.2. Respondents' profile

As mentioned in the preceding part of this study, the population of the study was SME handloom weaving associations in Gamo Zone and their customers of licensed traders. The data that was important to analyze the SC operations of handmade textiles manufacturing industries was mainly the data collected through interview, observation and questionnaire method. There are 123 SME associations that are participating in HMTM by hand weaving and local garmenting and 44 licensed hand woven product traders in the study area. From 123 associations of weaving,92 are micro level, 26 are small level and 5 are medium level enterprise. For this study, 31 small and medium level associations were purposively selected because these groups of associations have better information than micro-level weaving enterprises. Interview was conducted with one of the members of the association that was randomly selected from the list of members. Two population groups were used for questionnaire method. These were SME weaving associations and their customers that are legally licensed traders of hand woven products. Totally 75 respondents were selected as mentioned above 31 from associations and 44 from traders. Considering genderfor interview all are males because most of the time weavers are males in the study area that women participate in weaving

preparatory work. For questionnaire 76% (33) was male and 24% (11) was female. Considering age (65.6 %) were aged between 26 to 45 years and majority with educational qualification below secondary school (51.4%) and secondary school complete (28.6%) and diploma and first degree holders together only 20% of the total.All the respondents have with weaving and trading experience of more than 10 years.

4.3. Characteristics of the HMTMIs

Handmade textile manufacturing industry in the study area is characterized by shortage of working capital, lack of infrastructure, lack of skill and technology to manage business processes(Girum, 2016).

Working capital shortage is the maincharacteristic problem of HMTMI. It faces a problem of sourcing of qualityraw materials at required time and amount is mainly caused by shortage of working capital. Most of the enterprises are suffering from financial shortage to properly run their business and sufficient working capital is mandatory to maintain smooth flow of production and to use full capacity of the producers. The scarcity of working capital highly upsets production process of the case company. Because of the shortage of capital, weaving enterprise and individuals are purchasing the raw materials in small amount that increases the cost of sourcing by increasing transportation costs. Most of the time, weavers acquire their working capital from their own and sometimes they acquire their initial capital from their relatives(Girum, 2016).

Lack of infrastructure affects their production process thus most of the weavers are performing the weaving/ production without electric light that means they produce only on day time and also there is a problem of road access for many weavers in Ethiopia. Road access also hinders raw material sourcing process and the marketability of the woven products and there is also lack of skill to manage business processbecause handloom weaving is taught from generation to generation with only the skill of weaving that skill of managing the production process remains limited to perform activities like purchasing raw material, pattern making, technical skill of producing the required design by weaving and other business development activities. It also prevents them from climbing a level to value added or complex weaving industry like other developing countries which is also important for revenue. There is no labor skilling institution in the country in the level of weaving by handlooms(Girum, 2016).

4.4. Handmade textile Supply chain stockholders

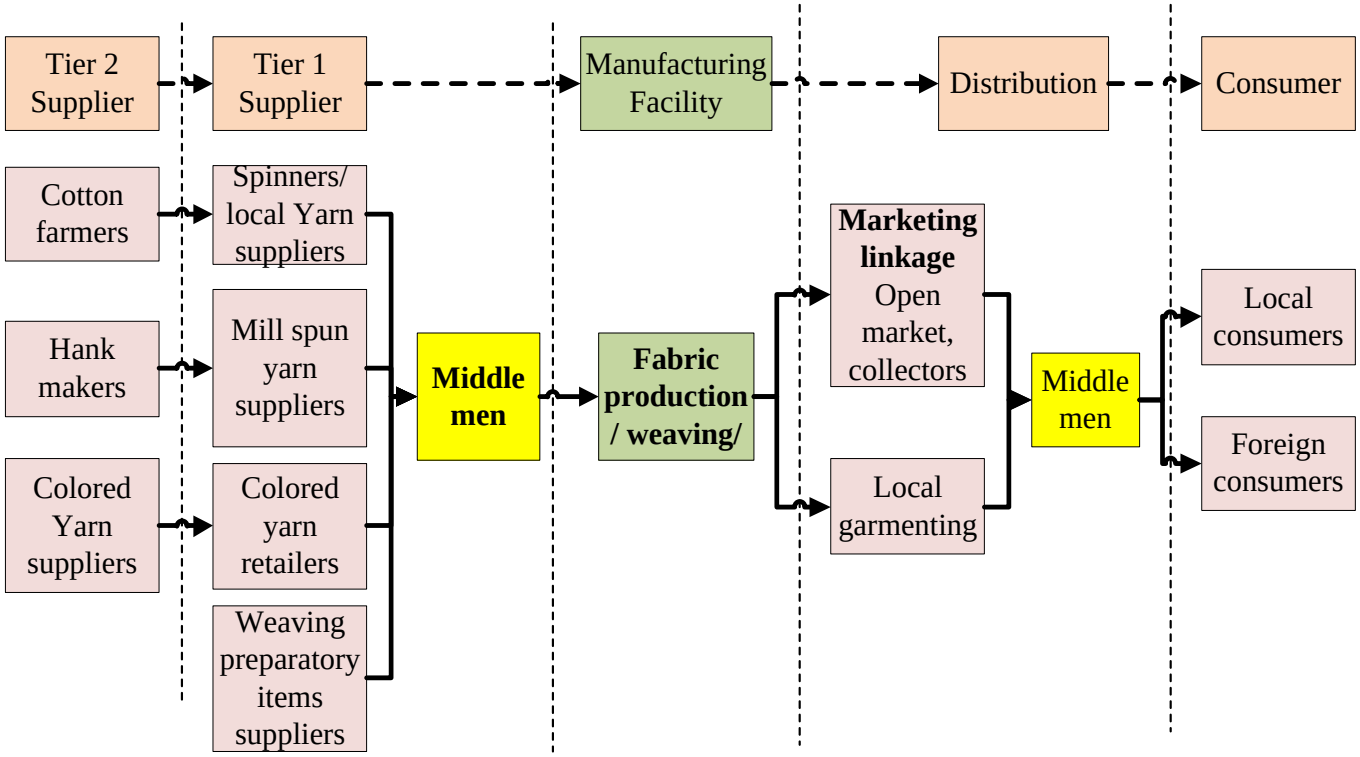


Figure 4-1:Handmade textile supply chain (Survey 2022 by observation)

Cotton farmers: these are responsible for cultivating, harvesting, and delivering raw cotton to ginners and spinners. There are individual farmers that own land in small size and cultivate cotton for local market and also there are large cotton farm investors that supply cotton to large textile factories in low land part of Gamo zone. Individual farmers are main suppliers of raw cotton for HMTM firms in the area.

Local spinners: theybuy raw cotton from farmers from local market and gin/separate cotton seed from fiber and spin it to hand spun yarn. This is mostly performed by women in the study area. They may spun by buying raw cotton from market to sale the product to market or the ginned cotton is supplied by the yarn demander with special orders and payment per kilo grams of ginned cotton.

Hank makers: they buy yarn in the form of cone from spinning mills, mostly from Addis Ababa and Adama and change it to hank form using small machines or manually to make it ready for warping for weavers. There are two enterprises in Arba Minch town that changes cone form in to

hank form by purchasing cones of yarn from Addis Ababa or Adama spinning mills. They sale their product in the form of hank yarn to retailing shops or weavers.

Raw material retailing shops: most of the retailing shops buy raw materials like grey or colored hank of yarn and sewing threads from wholesalers and retail it for weaving enterprises around the area. Majority of retailing shops are found in urban area like Arba Minch and Chencha towns.

Weaving preparatory item suppliers: these are suppliers of weaving preparatory items like weft winding instruments, sizing chemicals andspares of looms and others. Some of these are produced by the suppliers and others are factory products.

Weaving/ fabric production process: this includes preparatory work and weaving. Weaving preparatory work includes sizing of warp yarn or 'dir', warping process, winding the weft yarn or 'mag' and decorative colored yarn on a handmade bobbin winder or spinning wheels called 'diwera mekina' mostly done by women or children. After preparing warp and weft yarn for weaving, the next is passing the warp threads through each harness and tooth of memcha or the comb which is the main part of loom and weaving started. The products produced by weaving may be finished product like netela, gabi, buluko, scarf or semi-finished products like fabric produced to make kemis, coat or other home furnishing textiles. If the product is finished product it is channeled to open market, local collectors or directly to customers. If the product is semi-finished product, it goes to local garment factories to make final product.

Local garment enterprises: produces finished products from semi-finished woven products and sale to retailing shops in the area or to their customers.

Local product collectors:these are licensed traders of hand woven products and they collect the woven product from weaving enterprises around rural areas by lower price and sale it to wholesalers, retailers or directly to consumers. These are the major demanders of woven products in rural areas accounting for more than 50% of the product marketing in the rural area.

Retailers: these are modern traders with legal license of trade and buy woven products from weavers, garment enterprises, local collectors or wholesalers and sale the product to local consumers or foreigners by gaining some profit from retailing the product in their shops or open markets.

Middlemen (brokers): these are non-value adding actors that involve to gain higher profit than suppliers and producers by increasing the price of raw materials and the final product of the case company.

Consumers:these are final users of HMTMI products and they may buy product from weavers, open markets, collectors or retailing shops based on the accessibility of the product based on their demand.

4.5. Raw materials and product flow map of the study area

Cotton is one of the primary raw materials required in the handmade textile manufacturing industry and produced by individual farmers and larger investment farms in the low land areas of Gamo zone. Even though there is a potential for cotton production in low land areas of Gamo zone, individual cotton farmers are abandoning the production of cotton substituting by other cash crops. Raw cotton produced in low land areas was sold in markets like Shelle and Chano to spinners and the hand spun yarn was sold to association at high land areas. Other raw materials like warp and colored thread and sizing chemicals come to Arba Minch from Addis Ababa or Adama and associations buy it from Arba Minch or Chencha towns. The products produced by weaving association were either sold around the site or come to larger towns through intermediaries.

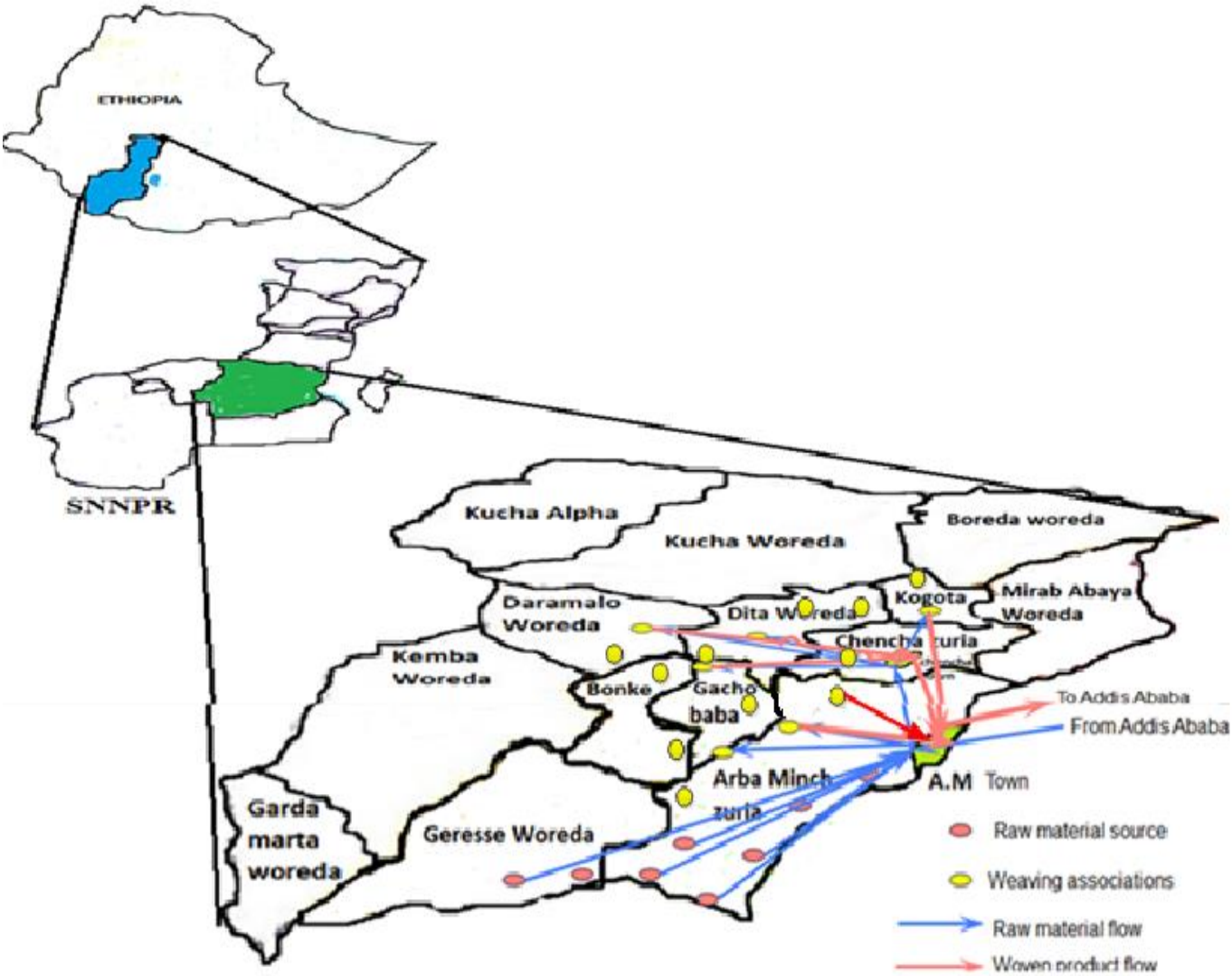


Figure 4-2:Raw material and product flow map of study area (own survey by observation)

4.6. Interview result

The information obtained through interview questions identified many SC challenges of the case company. From 31 respondents 11 respondents identified problems related to sourcing process as the first challenge, 13 identified delivery and marketing related problems as primary and the remaining 7 identified production efficiency and planning as first problem of SC of the case company. Under each process there were many challenges identified as SC gap by interview respondents as shown in the following table and the respondents also ranked each problem based on their effect to the supply chain efficiency and the data obtained was analyzed by using micro soft excel software.

Table 4-1: SC problems identified by interview method

processes	Plan	Sourcing problems	Make problems	Deliver problems	Return
Problems identified by interview	Lack SC plan	Shortage of raw materials	Low capacity utilization	Weak market linkage	Lack of return practice in the industry
	weak plan of sourcing	Quality problem of raw materials	Lack of production schedule	Lack of own distribution center	
	weak plan of make	Increasing cost of raw materials	Production disruption due to stock out	Poor order management	
	Weak plan for deliver	Prolonged mechanism of raw material supply	Low product variability	Low demand for products	
		Weak link b/n suppliers and weavers	Lack of quality controlling system	Lack of product promotion	
		Shortage of working capital	Skill gap to design pattern	High market competition	
		Knowledge gaps to source raw materials	Low productivity of traditional looms	Long chain of product delivery	
		Lack of quality checking means for raw materials	Time management problem	High price of final product	

4.6.1. Plan process analysis

According to the interview respondents response, there issupply chain planning gaps in HMT manufacturing associations including lack of plan in SC level, weakplan for sourcing, production and delivery processes except only 5 enterprises from 31 interviewed have written plan to produce what type of product at what time based on past demand history. The gap in planning of sourcing is that when, where, what type and what amount of raw material should be purchased were not planned properly. Weaving process of associations is not planned based on product demand and seasonality based on demand forecast. According to interview respondents response, there is no recorded past history about sourcing processin the case industry. In HMTMI there is product demand seasonality and needs forecast accuracy (RL.3.37) and seasonal planning includingplanmake based on seasonal demands that arise due to seasonal occasions like Meskel,

Timket and cultural festivities and other celebrations by which people demand the products of this HMT like netela, habesha kemis, t-shirts, scarfs and etc. But there is no appropriate plan to respond to this seasonal demand of the products. According to the information from interview respondents, sometimes there is a shortage of some products like dunguza scarf and capes in some occasions, but there may be some products like gabi and netela waiting for demand for a week or more. Planning delivery process includes the process of sourcing and delivering the product to the final customer. Weaving associations planning process for product delivery has gaps to satisfy customers, because they have no regular delivery plan based on past history and future forecast to satisfy customers.

4.6.2. Supply chain challenges in sourcing process

Sourcing process: according to the interview respondents responsesourcing is the second most affecting SC problem in the industry next to product delivery and marketing problem. There were many challenges identified and ranked to prioritize based on the weakness through interview method as major sourcing problems that hinder the SC efficiency and hold back the competitiveness of the industry in the current market.

Shortage of raw material:according to interview respondents, this is the main challenge what the sector faces today.Because the shortage of raw materials cause production disruption inhandmade textile manufacturing enterprises that leads to longer lead times and high cost of production as a major impediment in their operation.Most of raw cotton was supplied from individual farmers and currently these farmers were abandoning cotton farming and shifting to other cash crops in the area. Due to this there is shortage of raw cotton to purchase because associations were not purchasing raw cotton from larger suppliers like cotton farm investments in the area.The reason behind this is associations purchase volume is small and thereis purchasing orders consolidation problem (AG.3.42) to minimize cost of sourcing and transportation and to purchase from larger suppliers of raw materials. Because of this, there is high cost of sourcing and the SC process takes long time. This problem was identified as first problem of sourcing by 67.7% of the interview respondents. According to the interview respondents' response most of the time suppliers' raw materials like warp yarn and colored threads delivery schedule was not reliable. When there is raw material shortage in the area, they give priority for their permanent customers and they can't get the raw material what they wanted. Mostly decorative colored yarns have high shortage and the weavers return back empty hand for many times due to lack of this product.

Increasing cost of sourcing raw materials:according to the interview respondents' response, the ever-increasing cost of raw materials is a major concern among the weavers. Raw material mainly the price of the cotton and yarns is highly increasing and is a great threat for traditional weaving sector and because of this 61.3% of the respondents identified this problem as second most affecting and 16.12% as first challenge of SC of HMTMIs. According to the interview respondents the major source of cotton for handmade textile manufacturers are local cotton farmers and currently their number is decreased significantly. According to their response large cotton farms around Arba Minch zuria district are not voluntary to sale for local spinners or weaving associations in small volume because their product is delivered to central market or for larger modern textile factories in large volume only. Since these weaver associations are small purchasers, they have no capital to purchase in large volume as large firms can do and integrating their demand is must to increase the volume of purchase order.

Raw material quality problem: according to interview respondents, lack of quality raw material forced handmade textile firms to use raw material of inferior quality (might be grade B and C) with highest cost. According to interview respondents response, this is because quality raw material (grade-A) is either exported or goes to large domestic textile mills. This also raises a major issue in the final quality of the product produced for local market or for export. According to the interview respondents in HMT manufacturing process quality of fiber, yarn and other raw materials is very essential to minimize production time, loss of product quality and cost of production. According to the interview respondents' response the main quality problem of raw materials in handmade textile manufacturing process is the strength of the yarn. This problem is critical because it reduces the quality of the final product, increases production time, cost and creates depression on the weavers. According to their response, high frequency of yarn breakage results in more time to knot each thread to continue weaving.Because of this some associations are purchasing the raw materials like ginned cotton with quality from Addis Ababa and Adama by incurring high cost of transport.Because of this 54.8% of the respondents identified as the third basic problem and 16% and 25.8% of them ranked as first and second problem respectively.

So to get quality raw material, the sourcing process of handmade textile manufacturing enterprises should be improved and quality checking (sS.2.3) for warp and weft yarns should be practiced. According to interview respondents response the quality problem of hand spun cotton yarn

suppliers is caused by not only by raw cotton quality problem but also it may be caused due to hand spinners cotton handling system and storage problems, so it needs careful handling and storage.

Prolonged SC process of raw materials supply

Semi processed inputs required for the production of hand woven products like warp and warp yarn and Colored threads/tilet passes through different stages until it reaches weavers.This is because ginners and spinners buy raw cotton from traders or farmers of cotton and produce hand spun weft yarn to sell it for weavers. Spinning mills also buy raw cotton from cotton supplier traders and gin and spin to produce warp yarn in the form of cones. Hank makers buy the cone yarn and change it to hank form and they sell to boilers for strengthening and whitening then they sell to wholesalers. The wholesalers sell the warp yarn to retailers. This process takes longer time until warp yarn reaches weavers. In addition to this, profit margin made, loading unloading costs and boiling for strengthening and whitening costs are added on yarn until it reaches weavers. This challenge is identified as fourth highly affecting challenge SC by 54.8% of the interview respondents.According to the interview respondents, due to this prolonged chain of supplydelivery time of the products was being changed most of the time (RL.3.27) and it can be shortened by avoiding non-value adding actors and the price of raw material and time of delivery will be minimized. In the case of supply of colored threads, producers sell to wholesalers; wholesalers sell to retailers; and retailers sell to weavers and follow the same long process. In case of hand spun yarn supply, raw cotton traders collect the cotton from farmers and they sale to ginners; ginners sell to spinners and spinners to weavers. Marginal profit and other costs are added on until it reaches weavers and the final price when the raw material reaches to weavers highly increased.

Lack of integration between suppliers and weavers:according to the interview respondents' response, associations have no such strong and long lasted relation with raw material suppliers except the relation with hand spun yarn suppliers. Mostly they change their suppliers in short time when they see some faults in their products and this problem was identified as fifth challenge of sourcing process by 51.6% of the respondents of interview question. According to the interview informants there is no strong collaboration and integration with suppliers that is developed to enable continuous raw material supply from reliable suppliers to utilize full capacity thus percentage of product transferred on-time to demand requirement (RL.3.25) were below 75%. So it is important to communicate and integrate with yarn suppliers in Arba Minch to deliver the

required raw material up to Chencha town as Chencha is serving as center for the area associations. Therefore the study result and theory implied that handmade textile manufacturers should develop collaboration and integration with reliable suppliers to enable continuous raw material supply.

4.6.3. Supply chain challenges in make or production process

Low capacity utilization of handlooms

The main problem in production process of weavers was their low production capacity utilization to compete in the current market and this problem was identified as first challenge of production process by 61.3% of the interview respondents. According to interview respondents weaving associations were not using their full capacity due to raw material supply problem, weak production scheduling and lack of modified technologies like modified looms, weft winding machines and others to improve its productivity. According to interview informants a weaver can weave 1m plain fabric per hour which is 1m wide even by using traditional looms when they use their maximum potential. That means a weaver can produce more than 10m fabric per day using optimum capacity. But currently according to interview informants most association members' average production rate is less than six meters per day that is below 60% of achievable capacity. Due to thislow production capacity utilization, order fill rate, and delivery lead time are not achieved and due to weak production schedule (RL.3.49) there were highcustomers' complaint. There is also production disruption due to inventory stock out due to raw material shortage and inventory management problems. There is also weaver's time management problem due to poor management of working time that makes the weavers to waste their time on other issues that don't contribute to their productivity and profitability.

Weak production scheduling process:there is problem of weak of production schedule that resulted in wastage of time and other resources and this problem was ranked as first challenge by 29% and as second challenge of production process by 58% of the total respondents. Except only 6 enterprises that have trying to prepare their production schedule to indicate what type of product at what time be produced, the rest have informal or unwritten production schedule. Most of HMTMI products are seasonal products but most of the enterprises have no plan following product seasonality. Even when there is high demand of products following some holy days and festivals, there exists shortage of product for that demand. For instance 'netella' and 'habesha kemis' have

high demand when religious holy days like ‘Timket’ and ‘Meskel’ ceremony are coming and ‘buluko’ and ‘gabi’ are demanded in highland areas when summer cold season is coming. This condition is not supported by production plans and schedules because they produce usual products at any time mostly netela and gabi. Because of this, there is low achievement of production schedule (RL.3.49) and production capacity. Even though they produce quality products, they are not benefited from their effort because they are not following the production seasons properly.

Production disruption due to poor inventory management: the other SC challenge of production process in weaving enterprises is poor inventory management that resulted in production disruption and 16%,19% and 58% of the respondent ranked this problem as first, second andthird challenge of production process. Because of the weak linkage with raw material suppliers, most of the weavers purchase the amount what they can pay at the time and change it to woven fabric and sale it then purchase another raw material. This is because weaving associations purchase raw materials in small volume to weave few pieces of fabrics and when the inventory gets stock out, the production process is interrupted until the product produced is sold and raw material purchased and there is high schedule change rate due to this problem (RS.3.10). This problem can be solved by managing inventory appropriately to support continuity of production. Raw material sourcing should be continuous by selling the product produced in short period rather than waiting up to complete stock out and production disruption. Inventory management system should be improved by providing training to the associations.

Low product variability: most of the traditional weavers are engaged in producing common hand woven products that are not fundamental wears like “Kemis, Netela, and Gabi”, etc. that makes them get immediate income. It is possible to weave different products by using hand looms like fabrics to make shirts and other fashion wears, home furnishing fabrics like table cloth, bed sheets, pillowcase and others to widen the market of the products. This is because most of them depend on the weaving product that could be sold by the end of the week and used for purchasing basic needs their family. Due to this, most of the weavers engaged in producing any kind of hand woven products from which they can earn income rather than focusing on specialization. This gap was identified as fourth problem by 51% of the total respondents.

Lack of quality controlmanagement system:there is no quality control system for traditional weaving products. Weavers produce hand woven products and buyers determine both the quality and the price. There is no institution that provides support to the weavers in organizing and

following up technically support for quality control of their products. Lack of hand woven cloths quality standardization is the problem of weaving enterprises. Because of lack of standard weavers are simply checking their product with the given order of the customer for MTO products and deliver it simply to market for MTS products and its quality level is determined only by buyers to fix the price that they want to pay. This challenge of weaving enterprises was ranked as third, fourth and fifth problem by 22.6%, 29% and 48.4% of the total respondents respectively.

4.6.4. SC challenges in product delivery and marketing process

According to interview respondents response product delivery and marketing of HMTMI was ranked as the first problem of the industry and there are many challenges that make delivery and marketing of the product difficult. This process has many challenges that hinder the productivity of the industry and marketability of the product in the study area. These are:

Poor and insufficient market linkage:the market linkage between producers and final customers was weak and this upsets the industry from growing and weavers earning more revenue. This problem was considered as first problem of product delivery and marketing process by 80.6% of the total respondents.There is no direct market linkage that connects weaving associations with end users. According to interview report for instance the price of ‘Kemis’ with a ‘Netela’ was reported to be from Birr 700.00 to 1000.00 for buying from weavers while for selling to final customer, it was reported to be from Birr 1700.00 to 3000.00 This was on average Birr 850.00 for buying from a weaver and Birr 2350 for selling to a final user/consumer. In fact, the licensed trader puts in additional cost for garmenting and finishing and selling the product. The gross profit made on buying and selling of a ‘Kemis’ with ‘Netela’ is about Birr 1500.00 birr. This shows that weavers are not earning revenue based on their effort because of lack of direct market access to sell their products to final consumer. Most of the woven product markets are located in large cities like Arba Minch and Addis Ababa which are not simply accessible for weavers. Associations are bringing their products to market around their working area and sell to collectors in pieces rather than cooperating and consolidating products to have economies of scale in transportation and other costs. Due to weak communication and market linkage with the final customers, most of the customers buy the traditional cloths either from local collectors, retailers, or whole sellers where the producers do not earn the premium price out of their products and collectors get great profit than

manufacturers. They also facelack of communication skill to improve the marketability of their product and there was product delivery delay (RL.1.1).

Poor order management:according to interview respondents' response order management of the weaving associations is poor because their order receiving, entering and managing system has no ready format and not using appropriate document and this problem was ranked second stage by 71% of the total interview respondents. There is unreliable delivery time commitment that sometimes weavers are giving unwanted promise of short lead time to deliver the product knowing that it is not achievable time of delivery. The other problem that contributes to delivery date failure of the enterprises is that they have no recorded information about how long it takes to deliver the product to the customer starting from the time of receiving that specific product order. There was no delivery lead time record and how often it was delivered on the committed date of delivery and how often it was not achieved due to different reasons. According to the interview respondents, because of this problem, the percentage of order delivered in full (RL.2.1) was below 75% of the total order delivered.

Lack of own distribution center: one of the challenges of the supply chain delivery process of associations is that the weaving associations have no their own distribution centers or display shops that their products can be stored or displayed. Because of this they were selling their MTS products on open market for collectors by the price fixed by collectors. Unfortunately if the product carried to open market was not sold, they carry it back to their working site by expending double transportation cost. Because of this challenge, this problem was ranked third stage by 58% of the total interview respondents. According to the respondents response, sometimes they sale the product by lose not to carry back home and to get money that was needed at that time. The main problem here is lack of own distribution center, market premises or shed for producers associations in urban centers or even near their working site. Because, of lack selling place, some of the association were displaying their products on road side on the way from Arba Minch to Chencha around Dorze town laying bamboo tree horizontally without any shed above their product. If they havetheir own distribution center, they can produce in larger volume based on market demand and excess products can be stocked up to the demand is created on other time.

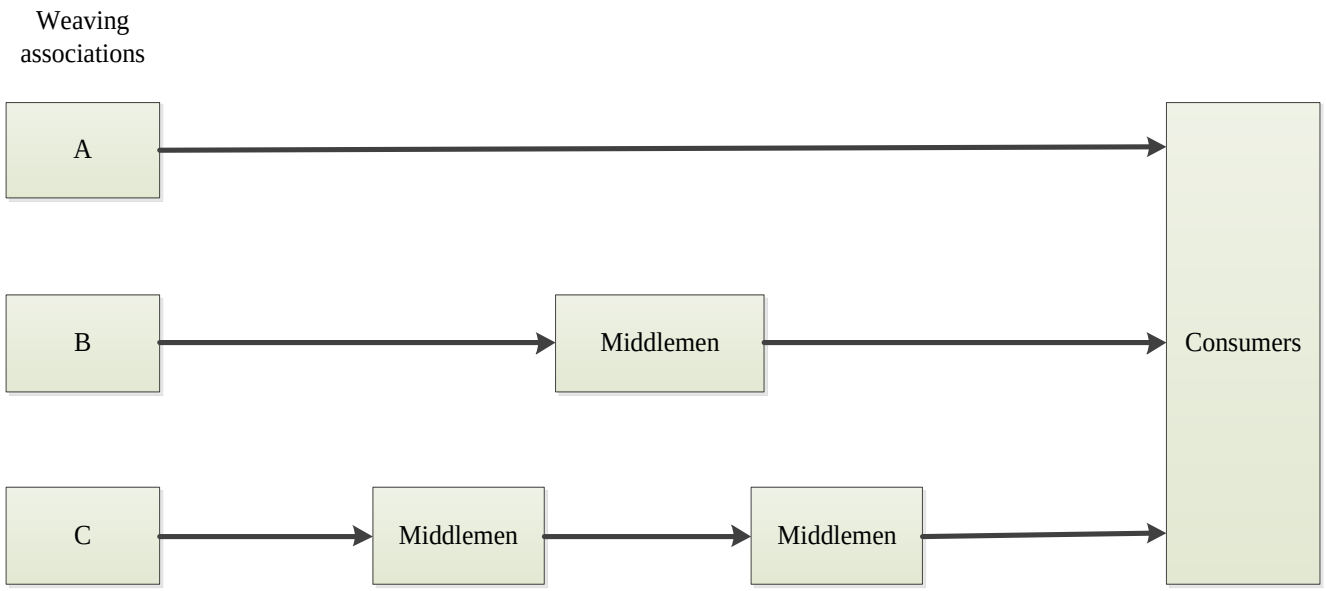


Figure 4-3HMT product distribution network

Channel A: by this distribution channel products that are produced based on customer orders or when they produce to sale their product directly to customers on open market found in the area are sold. According to interview respondents the weavers associations in rural area weave for four or five days continuously and take their products to the open market near their working area and sale it one by one on the open market to end customers. According to interview respondents response, the amount of product sold through this channel is estimated only 50% of the total products produced. If the product is not sold on that market, they carry it back home and the working capital will be tied up for a week or more time. Mostly demanders of their product from urban areas do not come to their working site to buy a single product for their needs. This channel has an advantage for weavers that they earn more from the sold product and for the customers that they buy the product by lower price. As interview respondents' report for instance kemis and netela is sold by this channel by 700-1000 birr which is sold by 1700-3000 birr by channel 'C' at urban areas. This is due to the absence of middlemen that assumes large profit for themselves to buy the product from weavers with low price and to sale it with high price.

Channel B:middlemen in this channel from small towns of the study area address associations to collect their products. They buy the woven product from weavers and sale it on the open market in the small towns. They collect the woven product from weavers from open market or from their

production site to sale it by gaining larger profit from it on the same market place or on another market day on another larger town. Based on the information gained from respondents the amount of the product sold by this way is estimated about 25% of the total product produced. These retailers address all areas where weavers associations perform their work. These middlemen may also sale the product to whole sellers that have shops in larger towns by gaining some profit.

Channel C: In this channel number of middlemen increase and exist in large towns like Arba Minch or Addis Ababa. Middlemen collect the fabric for wholesalers or retailers with shops in the urban area and for garment making enterprises in the urban area or sale to another middleman in the other town. Mostly this traders address only area with transport access to transport their product to urban area. These buyers only buy the quality products for urban shops. The products sold to final customer through this channel with many middlemen were sold with high price, because of two or more intermediaries in between the producer and final consumer and this increases the final price of woven products.

Lack of product promotion and advertisement system: The weavers in the study area have the problem of getting market at both domestic and foreign levels and this discouraged their productivity.Weaving associations lack promotional and advertisement activities and most of them have no direct communication with the customers or end users to sale their products except only 3 enterprises that have their own website to advertise their products on local and foreign markets. There is no direct communication with final customers and there are many intermediaries in product marketing system of handmade textiles that increases the final price of products without any value addition and this problem was ranked as fourth challenge in delivery and marketing process by 55% of the total respondents. The other problem in product marketing of HMTMIs is global textile markets that could have the potential to affect the marketability of the hand woven clothes which may discourage traditional weavers to continue their duty.

Low demand for hand woven product:according to the interview respondents' response,the large portions of traditional weaving products are used for domestic consumption. Mostly the domestic demand for hand woven products depend on occasions/seasons that they are required like during public holidays, wedding ceremonies, festivities and different occasions. Traditional hand woven cloths are not worn as casual cloths and the demand for it is limited. Export market for this product was also limited and not used properly, because only two enterprises are exporting the woven

product to European and USA markets by communicating by themselves. They take order from foreign customers online and send product for the customer by postal service and this approach was not supported by government to encourage the enterprises and to increase foreign demand of the product. Interviews made with manufacturers of hand woven cloths reported that some cloths produced for MTS may stay for long times to be sold because of lack of demand and this challenge identified as fifth challenge by 58% of the total respondents. From this it is possible to conclude that design and other innovative practices made to encourage domestic use are not adequate.

High competition from power loom products: according to the interview respondents' response, currently there is a competition from imported power loom products. These products with similar color, design, low quality and low price is highly competing in the market of woven products. Because production and distribution process of traditional looms is very ungainly and involved intensive labor which increases the cost of preparing and marketing it. Cost is the major factor behind the increase in the competition from power loom products imported from abroad with lower quality and low cost and this problem was identified as sixth problem by 51.6% of the total respondents.

4.6.5. Return process

Return process in SC is the process of returning defective or excess products of source or make. According to interview respondents, return process was not practiced in the case industry and give no emphasis to return defective or excess products in the company, because as a trend most of the supplied raw materials and delivered products were not retuned back. Because there is no rework process and scrap retuning process in this traditional handmade textile manufacturing industry. According to the interview informants in case defective products were supplied from suppliers, they discourage the supplier by not buying any product from that supplier for the next time.

4.7. Questionnaire result of supply chain performance analysis

The questionnaire contained many close-ended items based on SCOR model performance attributes like reliability, responsiveness, flexibility, cost and asset management efficiency that was prepared in English language and translated to Amharic considering educational background of the respondents. This method is used to measure supply chain performance of the case industry taking reliability, responsiveness and flexibility from customer facing attributes and cost and asset

management from internal facing attributes. Five-point Likert's scale was applied in the construction of questionnaires to show the level of agreement: 1= strongly disagree (SD), 2= disagree (D), 3= neither agree nor disagree (ND, 4= agree (A) and 5= strongly agree (SA) to have uniform response. Totally 75 respondents 31 from SME weaving associations and 44 from their customers purposively selected that can read and write Amharic and the questionnaire was distributed to respondents the researcher himself giving short orientation to fill and return on another time. From 75 respondents selected 71(94.7%) were returned the questionnaire by filling the information required.Considering gender, males dominate the respondents' list registering 76% of the total respondent and (65.3%) were aged between 26 to 45 years and majority with educational qualification below secondary school (52%) and secondary school complete (29.3%) and diploma and first degree holders together only 18.7% of the total.All the respondents have with weaving experience of more than 10 years and all the traders have an experience more than 5 years.

As described in the methodology part, the designed method is descriptive analysis to analyze the SC performance of the HMTMI. Descriptive statistics using data obtained from questionnaire method of data collection was used to assess and examine the mean scores and the corresponding standard deviations under the respective scales of each of the measurement items of the dimensions. Hence, this particular attempt has the importance of answering some of the research questions on the basis of the perceptions of the respondents on the level of supply chain performance of the case company and also to answer on which key performance indicator the companies perform better and which one needs to be tighten. For the analysis of all these variables, the collected data from respondents were analyzed using Minitab software and mean and standard deviation was used to identify the level of performance of each attribute of SC. Particularly mean value of the respondents has considered as an important indicator to the extent of the industry's practices on each attribute. To conclude, the overall performance of the case industry's practices on each variable, group mean was calculated and used. SC performance based on reliability, responsiveness, flexibility, cost minimization and asset management is analyzed based on the response of the respondents.

4.7.1 Supply chain reliability performance of HMTMI

Supply chain reliability refers to the trustworthiness of the facility which addresses the ability of facility to perform tasks as required. It is an indicator of external performance measure in SC and focuses on the predictability of the outcome of a process. Metrics for the reliability attribute

include: delivery on-time, with the right quantity, and with the right documentation. Based on the questionnaire result from respondents the mean value that showing the agreement on orders delivered in full was 2.8. This shows moderate performance showing only few enterprises fill their orders correctly, but most of them unable to deliver the order in full. Customer commit date attainment and orders delivered without quality problem have more problem than delivery fullness and average values 2.67 and 2.72 respectively. Customer complaint solving and order validation and verification process was also in below good level. Considering measurement of customers order completion performance and taking improvement action, the respondents' response mean value was 2.6 which indicating poor performance or customers order completion performance measurement is not practiced well to know how many orders are delivered complete and how many are delivered incomplete and no corrective action was taken. The order received from customers was not validated and verified thus, the mean value of respondents' result was 2.58 which shows disagreement on the idea. SC reliability is crucial point of performance evaluation regarding external performance point of view and need improvement to satisfy customers of the industry. Based on questionnaire result from the table 4.2 reliability activity performance obtained by respondents' response shown it was below good in neither agree or disagree extent decision level on basis of five-point Likert's scale criteria because mean value scored was 2.67.

Table 4-2:Reliability performance indicators measurement

	Activity: **Reliability performance**	N	Mean	SD
1	Always customers' orders were delivered in full without quantity problem	75	2.8	1.03
2	Order delivery is performed on customer commit date	75	2.67	1.1
3	Orders are delivered meeting the requirement without quality problem fulfilling specification like 'tibeb' design	75	2.72	1.2
4	There is defined customers complain solving procedure	75	2.6	1.1
5	Orders received are validated and verified by suppliers.	75	2.58	1.2
	Reliability performance mean value		2.67	1.13

4.7.2. Analysis of SC Responsiveness performance of HMTMI

Responsiveness is a SC attribute that describes the speed at which tasks are performed. Responsiveness addresses repeated speed of doing business and its metrics are cycle time metrics related to speed to source, to make, and to deliver. The SCOR key performance indicator for responsiveness is order fulfillment cycle time and it is a customer focused attribute. On time delivery is a measure of responsiveness and it is important to measure customers' point of view.

From Table 4.3 the respondents' response result of responsiveness activity performance of handmade textile manufacturing enterprises was poor, because the mean value scored was 2.56 and this can be considered as low performance level on the basis of criteria designed for a five- point Likert's scale. This shows the performance of delivering quality product with the right quantity to the product buyers by responding to customers' needs making production lead time short as much as possible was at low level. This means the SC of the industry did not respond quickly to customers regular and urgent orders delivering before or on committed date.Handmade textile manufacturing industries are not regularly measuring the speed of order delivery, giving low impasses for the reduction of lead time.

Table 4-3: Responsiveness activity analysis

	Activity: **Responsiveness** performance	N	Mean	SD
1	The organization respond to customers need making short production and delivery lead time as much as possible	75	2.52	1.19
2	The organization responds quickly to customers regular and urgent orders delivering before or on committed date	75	2.54	1.09
3	The organization deliver quality product with right quantity at right time to customers	75	2.62	0.95
	Responsiveness performance mean value	75	2.56	1.07

4.7.3. Supply chain flexibility performance of HMTMIs

Supply chain flexibility analysis describes the ability to respond to external influences and the capability and speed of change. External influences include: Non-forecastable increases or decreases in demand, suppliers or partners going out of business, natural disasters, availability of financial resources or the economy, labor issues. Agility/flexibility is a customer focused attribute.

From the questionnaire result as shown in table 4.4 the result of flexibility activity performance was on the level of poor performance. Implementing flexibility practice based on respondents' response scored mean value of 2.52. The supply and demand change and its unbalance management practice was poor scoring 2.54 and 2.43 respectively and this shows disagreement describing low performance of flexibility practice in the industry. Hence, HMTM associations should optimize their inventory to overcome the supply and demand fluctuation and to be flexible based on the demand of the customer.

Table 4-4: Flexibility activity analysis

	Activity: Flexibility performance	N	Mean	SD
1	Change in supply and demand is managed quickly in the organization	75	2.54	1.17
2	The production volume is flexible based on market demand	75	2.58	0.97
3	The organization is flexible to overcome supply and demand unbalance based on raw material availability	75	2.43	1.08
4	The quantity produced and delivered can be changed without great challenge based on demand change		2.53	0.98
	Flexibility performance mean value	75	2.52	1.05

4.7.4. Analysis of SC Cost minimization performance

Costattribute describes the cost of operating the supply chain process. Typical costs include labor, materials and transportation costs. It is an internal performance indicator of an organization showing performance level of business operation. The practical cost performance picture in HMTMI based on SCOR model according to the questionnaire respondents' response by considering practice of cost minimization process to minimize cost of SC, the use of economic order quantity of inventory, using economies of scale during raw material order, production and transportation were low. The enterprises were not practicing cost minimization approach to minimize their SCM costs.

According to the questionnaire respondents' result all scores show the disagreement decision level having an overall value of the performance of cost minimization result is shown in Table 4.5. From the respondents' response, the practice of cost minimization system to minimize cost of SC, the use of economic order quantity of inventory, using economies of scale during raw material order,

production and transportation and all scores for the responses were disagreement decision level having an overall value of the performance of cost minimization 2.37 as described in the table 4.4.

Table 4-5: Cost minimization performance analysis

	Activity: **cost minimization** performance	N	Mean	SD
1	The organization has practiced cost minimization system	75	2.19	0.95
2	Economic order of quantity is used regularly during sourcing	75	2.39	1.01
3	The organization use economies of scale during raw material order, production and time of delivery	75	2.53	1.0
	Cost performance mean value	75	2.32	0.99

Cost minimization is an important activity for HMTMIs to be profitable and compete in the market but the results have been showing that they have poor performance on cost minimization. Several studies were conducted to show how to achieve cost minimization in any business organization with in business operation process. For example as suggested by Langley (2008) economic order quantity of inventory is important to minimize production cost and holding cost. Considering the economies of scale for production and transportation, researcher can conclude the larger and consolidated order, production and transportation with the lower unit costs can be spread over a larger quantity of load and production units. Therefore, in HMTMIs by using economies of scale cost reduction can be achieved through size increase and the outcome is a decreased unit cost of production. Therefore, an economy of scale is crucial point for the cost minimization in HMTMIs.

4.7.5. Asset Management Efficiency analysis

Asset management efficiency describes the ability to efficiently utilize assets. Asset management strategies in supply chain include inventory reduction and insource and outsource strategies. It is one type attribute of SC performance measurement regarding inter-organizational point of view.

Based on questionnaire result as shown in table 4.6 the mean value score of asset management activity performance was 3.08 and it was below good performance level on the bases of Likert's five-point performance level decision criteria. The mean value of cash-to-cash conversion cycle time which is the time it takes for an investment made to flow back into a company after it has been spent for raw materials 2.74 andinventory turnover performance was moderate according to respondents' response scoring mean value of 2.89. Hence, it is possible to conclude that the result

revealed that it needs improvement to have improved performance in HMTMI asset management performance. From the result of questionnaire here the main problem of the handmade textile manufacturing enterprises considering asset management is that there is no evaluation system to identify the gap and take corrective action. Practice of evaluation system of asset management efficiency with in a given time interval and improving inventory management performance in enterprises will improve their production system by minimizing production interruption due to stock outs and can improve the efficiency of the industry.

Table 4-6: Asset management analysis of respondents' response

	Activity: Asset management performance	N	Mean	SD
1	There is high performance of return on investment of fixed and working capital	75	3.1	1.03
2	Investment on raw materials flow back time is short in the organization	75	2.74	0.94
3	The organization practiced evaluation of asset management with in given time interval	75	2.88	0.94
4	The organization use fast inventory turnover to accelerates cash-to-cash cycle time	75	2.89	0.93
	Asset management performance mean value	75	2.9	0.96

To improve the performance of asset management efficiency have a high performance of return on investment and accelerated cash-to-cash cycle time, fast inventory turnover is important. The inventory turnover is related to cash-to-cash cycle time and it is important to have accelerated time of cash-to-cash conversion for the case industry(Langley, 2018). Therefore, inventory turnover has high benefit for a company to recover its inventory investment rapidly and to have reduced inventory holding cost. Therefore, the study result described HMTMIs should have high inventory turnover to have a fast return on their fixed and working capital investments.

The overall existing SC performance of HMTMI considering most of the performance criteria for reliability and asset management efficiency was moderate and for responsiveness, flexibility and cost minimization was poor and it needs improvement. Considering reliability weavers have some care about order delivery fullness and quality issues that is why it was in moderate performance level. In case of asset management efficiency return on investment on working capital is fast

because the case of tying up working capital for long time is rare and use fast inventory turnover to accelerates cash-to-cash cycle time performance is in moderate level in the enterprises. When cost minimization performance is considered it has lowest performance than other activities. Because practice of cost minimization activities like order consolidation and economies of scale to transport materials was poor. The performance of SC flexibility was also poor, because changing production process in hand looms immediately is difficult that means the loom type to weave netela and buluko are different and to change the production from one product type to another,it needs newly setting of loom. When we see generally SC performance of the case industry has indicated in the Table 4.7 having a performance level of 2.59 from sub-topics 4.5.1 up to 4.5.5 showing that SC performance was poor and needs improvement.

Table 4-7: The existing overall SC performance of HMTMI

Process and activity	**N**	**Minimum**	**Maximum**	**Mean**	**Std. Dev.**
Reliability performance	75	2.58	2.72	2.67	1.13
Responsiveness performance	75	2.52	2.62	2.56	1.07
Flexibility performance	75	2.43	2.53	2.52	1.05
Cost performance	75	2.19	2.54	2.32	0.99
Asset management performance	75	2.74	3.1	2.9	0.96
Existing SC performance				2.59	1.04

Source: Field survey result (2022)

4.8. Observation result

In this section for the assessment of the existing SC operation of HMTMI, observation was used as an instrument to collect the information about the flow of material, informationand processes to map the existing supply chain.Totally 31 SME weaving associations were observed using observation checklist prepared to collect information about sourcing, production and delivery process of the case company. Observation of selected associationsused to visualize supply chain links to have clear picture about HMTMI SC processes. This information helped the researcher to visualize the SC processes to map the SC of the case industry in the study area. The information

gained from observation also helped the researcher to identify the SCM challenges, weak links and gaps and to understand the flow of materials in SC in each SCOR processes in the industry.

4.8.1. Supply chain sourcing process

Based on observation result one of the challenges of sourcing process was its long chain due to non-value adding actors of SC.

As seen from observed SME weaving associations, raw materials for the production of hand woven products like yarn/"dir" for warp, "mag" for weft and colored threads/"tilet" for decorative purpose passes through different stages until it reaches weavers. From 31 observed associations,only 3enterprises have their own spinners and others buy hand spun yarn from local spinners to produce their woven products. Enterprises with spinning units produce yarn/"mag" from cotton fiber and deliver to preparatory process.In case of enterprises that buy weft /mag/ from market there are many non-value adding chains like cotton traders, hand spun yarn traders (whole sellers and retailers). For instance as information gained during observation, the raw material price to produce a single 'gabi' is 350-400 birr which was sold at producers level by 200-250 birr. The price increase in 150 birr was due non-value adding actors. Cotton traders buy raw cotton from farmers and sale it on market centers like Chano and Shelle market centers to spinners and spinners gin and spin cotton fiber and again sale to yarn collectors and these yarn collector traders sale to weaving associations. This process takes longer time until yarn/"mag" reaches weavers. This long chain resulted in longer lead time of sourcing delivery and change in scheduled product delivery.In addition to this, profit margin made, loading unloading and transportation costs are added on yarn/"mag" until it reaches weavers and resulted in increase in price of raw materials.Sourcing of warp and colored threads/"tilet", is also long process and many intermediaries involved. As seen during observation, associations purchase warp threads from local retailers and these retailers buy the product from wholesalers that buy from hank makers in Arba Minch. These middlemen are non-value adding actors that increases the price of warp yarn when reach to weavers. Colored decorative yarns sourcing process also follows the same fashion as warp yarn sourcing process that wholesalers sell to middlemen or retailers; and retailers sell to weavers. Marginal profit and other costs are added on until it reaches weavers and the final price of the raw material is extremely high when it reaches to weaving associations and number of non-value adding actors should be minimized.

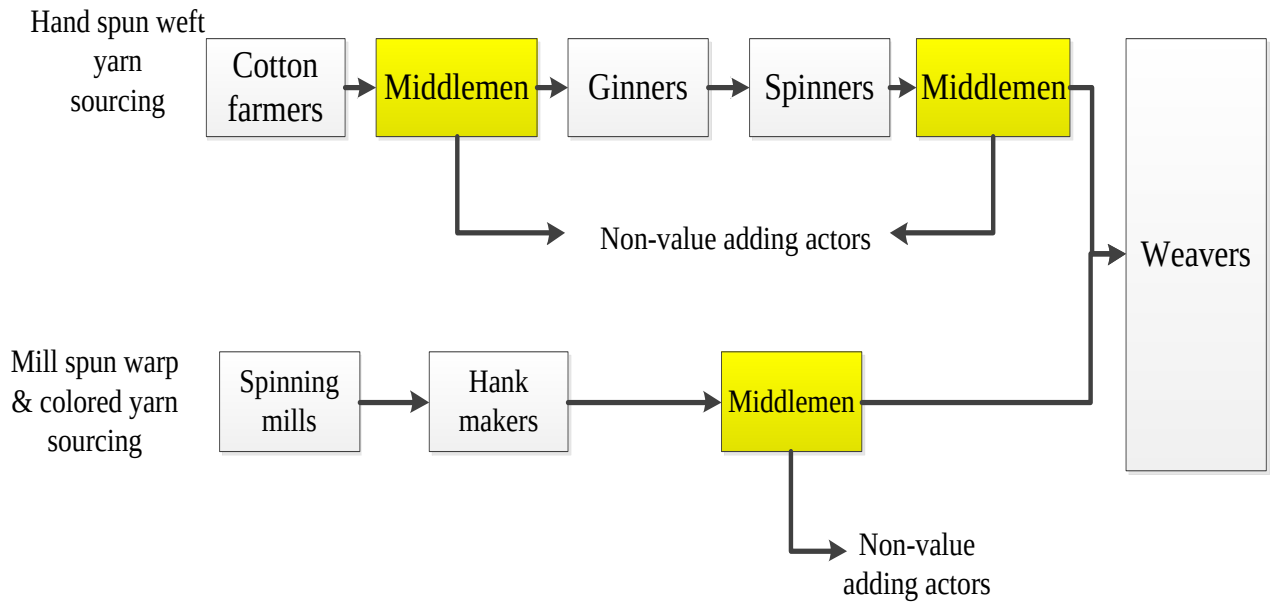


Figure 4-4: Sourcing process diagram

4.8.2. Make process

Production process in handmade textile manufacturing industries is mainly the process of weaving preparatory work, weaving and garment making. From observation result after the raw material is purchased weaving preparatory work starts. This includes sizing of warp yarn done by boiling with starch or other chemical and then squeezed out the moisture and dried by sun light as shown in appendix 5. This is to increase the strength of the yarn to resist the tension during weaving process. After sizing the warp yarn, the next step is process of warping that involves stretching the warp yarn on the pointed rod on the ground at both ends of the length equals to the length of the fabric to be produced in the loom by using local warping instrument called ‘wagumbo’. Also winding the weft yarn or ‘mag’ and decorative colored yarn on the hollow ‘qesem’, meaning reed by handusing bobbin winder or spinning wheels called ‘diwera mekina’ mostly done by women or children. Once the weaver prepared warp, weft and colored yarn for weaving, he passes the warp threads through each harness and tooth of memcha or the comb which is the main part of loom and starts weaving. Mostly decorations or ‘tibeb lekema’ is done at both ends of the fabric according to the design required or ordered by the customer. As seen during observation time, weaving process needs special care to avoid faults due to the breakage of weft or warp threads, because missing a single thread creates a large production fault in the final product.The following are some SC challenges related to production process obtained from field observation.

Unmodified processes of weaving preparatory work

As observed during observation time, preparatory process of weaving includes preparing three types of yarns (warp yarn, weft yarn and colored threads/"tilet")to make ready for weaving. Preparatory part processes are time taking and are not modified in most weaving associations except only 15 enterprises that are using weft winding machines to wind weft yarn. Warping, weft winding and sizing processes are very time taking when compared with using modified instruments.This preparation process includes designing of the type to be produced and then sizing of warp yarn, warping of warp yarn, winding weft yarn on kesem, knotting the warped yarn on loom and setting the loom for weaving. As observed from the site these processes are very time taking and long, because of lack of modified technologies to increase the speed of the preparatory work. For instance weft winding by using winding machine is four times faster than winding by hand and using modified looms completely eliminates warping process.

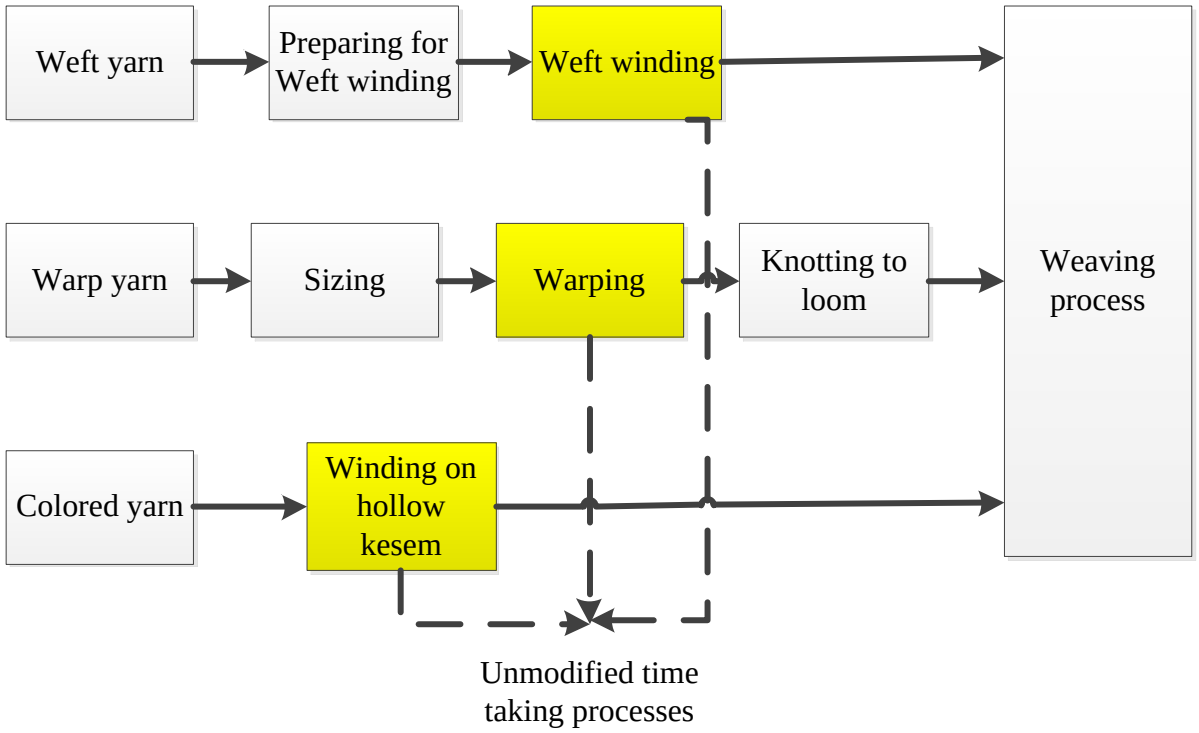


Figure 4-5: Weaving preparatory process diagram

Low productivity of traditional looms:as observed, the weaving process using traditional looms have very low productivity. The main challenge here in production process of HMTM is the unimproved weaving process. Weaving by unmodified traditional looms has very low productivity

when compared to modified handlooms. It is impossible to weave wider and thicker fabrics by using traditional looms. Traditional looms also need space that can be dug to make hales on the ground to set up looms. It needs only traditional way of weaving that is taught from generation to generation. From observed 31 weaving associations only 1 association is using modified looms researcher comparedtraditional looms with modified loomsbased on their productivity and modified loomshave higher productivity.It can weave wider and thicker fabrics with lower time and energy consumption. As observed from the association using modified looms, these looms have production rate to weave 1.5m/hr. and 1.5m wide fabric that is 2.25 times faster than traditional looms that has maximum speed of 1m/hr. and can weave only 1m wide fabric. This modified loom can alsoeliminate the process of warping by taking warp yarn directly from wound yarn source adjusted at the back of the loom.

a. Traditional loom- with maximum production rate 1m wide & 1m per hour =1m2/hr

b. Modified loom- with maximum production rate 1.5m wide & 1.5m per hour = 2.25m2/hr

Figure 4-6: Traditional and modified looms

4.8.3. Supply Chain challenges in delivery and marketing process

Lack of transparency on costs of inputs among the supply chain actors: as observed from field the prices of inputs like warp, weft and colored threads/”tilet required for weaving at all levels including at the producers, wholesaler, retailer is not transparent. Similarly, hand woven products prices at the salesman/middleman, licensed trader/enterprise responsible for the design and finishing up the process till selling the hand woven product to the end user is not transparent. All actors add up their own marginal profit as they wish and there is no transparency among them. For

instance as information gained during observation, the raw material price to produce a single ‘gabi’ is 350-400 birr which was sold at producers level by 200-250 birr. They process it and sale the final product for birr 430-500. This product was being sold for 700-800 birr at final market passing different SC middlemen that increase the price without any value addition. This shows that product sellers and others that set their own profit by themselves get large amount of profit by raising the final price of the product that hinders the competition on the market and discouraging weavers from producing the woven product. This unstructured pricing system in the SC of HMTM created a system that buyers ofhand woven products are determinants of the price of any kind of hand woven product but not by producer.

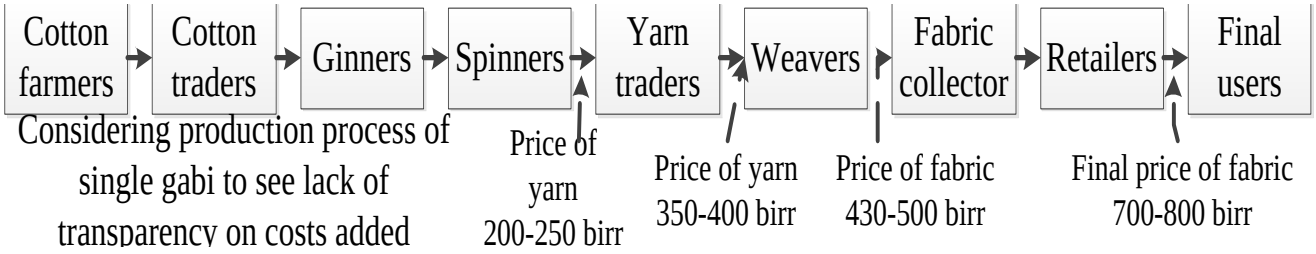


Figure 4-7: Diagram to show transparency of costs added

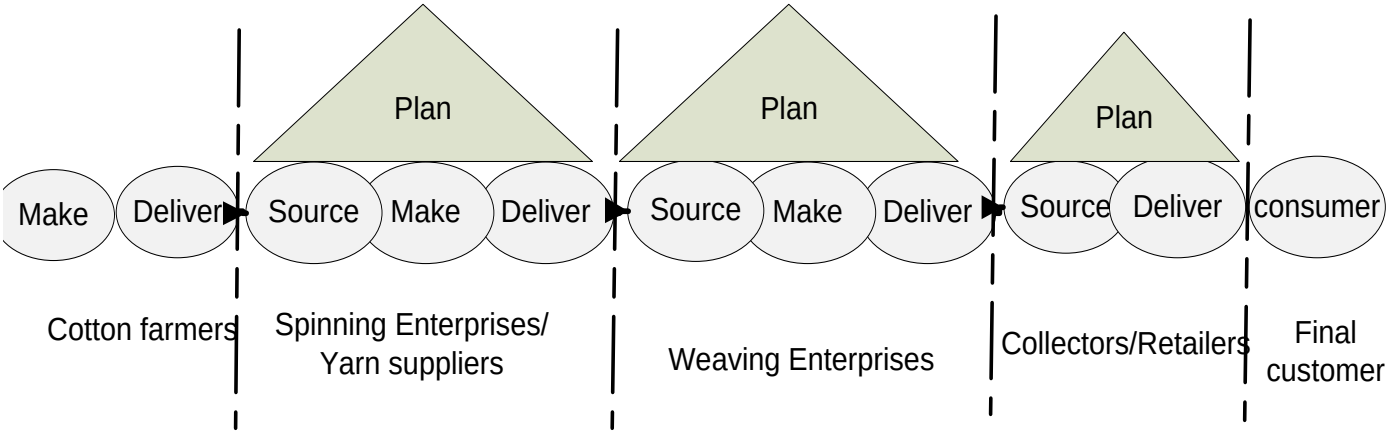


Figure 4-8: SC level-1 of HMTMIs

4.8.4. Existing SC level II process of HMTMIs

To understand the supply chain of an organization, recognizing the type and form of inter-organizational processes is very important factor. Hence, SC analysis on the second-level processes of the SCOR model using observation to identify and allocate each of these processes to the

relevant sections is important. In this regard, the SCOR thread map is utilized as the basis for analyzing and understanding the supply chain. Level-2 process diagram helps to identify structural issues in the supply chain and shows the flow of products and information including tangible goods and services as a chain of linked activities. Product flow represents the transfer of a product from one process to another and with purpose to use the SCOR model to capture the AS-IS or current status of a supply chain of the case industryto identify the weak links that hinder the operation of SC. The SCOR processes related to each step of the supply chain were described below:

Plan process: According to the information obtained through observation the case industry was following informal planning with no regularity. There was no regular plan of SC (sP1), sourcing (sP2), production plan (sP3) and delivery plan (sP4). So, the company SC planning process needs improvement to fulfillcustomers' needs in organized way to satisfy the customer.

Plan source (sP2) - is the planning of the offered product range and the necessary suppliers, but there was no adjustment for sourcing raw materials based on quantity, quality, type and place of sourcing for the product to be purchased.The location of the suppliers has strong influence on lead times and order sizes and thus stock levels and necessary production capacities.

Plan make (sP3) - there is also planning gaps of production/ weaving that it does not concern product seasonality of the industry and have no forecasting system based on the past records.

Plan delivery (sP4) – delivery plan is planning based on customer requirements, including product type, quantity, time, delivery mode, and to minimize cost delivery and satisfy the customer, the plan for delivery was very weak to satisfy customers.

Sourcing process: there are two main sourcing types in HMTMIs SC: source MTS products and MTO products.Level-2 source processes includeplan source or planning for raw material requirements including hand spun and mill spun yarns and sizing chemicals (sP2), source stocked product or sourcing raw materials with persistent storage in which no customer reference or customer order detail is exchanged with the supplier (sS1), Source Make-to-Order product or ordering and receiving raw materials based on customer order (sS2). As observed by the researcher weavers use three kinds of raw materials warp /dir/, weft/mag/ and decorative colored/tilet/ that are sourced in different sourcing process.

SCOR metrics to measure the process performance for source process in level-2 are order fulfillment cycle time, source cycle time, current source volume, cost to source, cost to receive product, return on working capital and inventory days of supply - raw materials.

Source MTS products - most of the raw materials were purchased from stocked raw materials (sS1) like warp yarn, decorative colored yarns and sizing chemicals. Since mill spun yarns are produced based on the market demand to be stored, retailers bring it from wholesalers of Addis Ababa and Adama and store in their shops without receiving the order, and they are only produced and stored based on sales forecasts, then, the relevant delivery activity is (sD1), which is performed for the delivery of the stocked product. They get raw materials like mill warp yarn and colored yarn from local shops (sS1). As observed from the working site different types of colored threads/"tilet" named "work-zebo", "saba" etc., are required for producing traditional weaving products. These raw materials are sourced from Arba Minch town from retailers shop about forty kilometers far away from their working sites. Sourcing of warp yarn has also a problem of increasing cost due to many actors participation. Hank makers purchase the yarn in the form of cone from Addis Ababa or Adama textile factories and they change it in to hanks and sale to wholesalers in Arba Minch town. These wholesalers sale to retailers in Arba Minch or Chencha towns and weavers purchase this raw material from these shops. This long process increases the price of the yarn due to the weak SC linkage between suppliers and weavers as shown in Figure 4.9.

Source MTO products - some of the raw materials like hand spun yarn from local spinners, some ordered items including warp yarns of special quality are purchased based on their plan to meet customer requirements (sS2). Since hand spun yarns are ordered to the supplier according to the thickness, quality and the amount of the yarn required for production of the fabric ordered, the spinning association attempts to produce and deliver upon receipt an order. Based on the observation spinners that produce hand spun yarn "Mag" used for weft get raw cotton from local traders and they gin raw cotton and spin it according to the order provided from weaversbased on the thickness and quality of the yarn required to produce the specific fabric needed for special customer order. Therefore, the act of their delivery (sD2) is related to the delivery of products based on the order or in other words, delivers Make-to-Order Product (MTO).Most of hand spinners are living in highland areas around Chencha and Dorze area and the source of raw cotton is low land area around Arba Minch zuria district and the market center for raw cotton is chano and Shelle markets in Arba Minch zuria district. There is also shortage of raw cotton supply

byindividual farmers due to abandoning of cotton farming by individual farmers. Even though there are many large cotton investment farms in the area, there is SC weak link as shown in figure 4.9. This is because there is no SC linkage created with this large cotton farm investors around Arba Minch zuria districtand this large cotton farms are not voluntary to sale raw cotton for local spinners and weavers because they deliver to central market or for larger modern textile factories in large volume only, since these spinners are small purchasers.Lack of quality raw cotton forced handmade textile firms to use raw cotton of inferior quality (might be grade B and C) with highest cost. Because quality raw cotton (grade-A) is either exported or goes to large domestic textile mills. This also raises a major issue in the final quality of the product produced for local market or for export. Because of this three of the weavers associations observed,purchase the raw materials like ginned cotton from Addis Ababa and Adama modern ginners by incurring high cost of transport and pay for spinners about 150 birr per kilo gram of ginned cotton.As weavers stated during observation time, the quality problem of hand spun cotton yarn suppliers is caused by not only by raw cotton quality problem but also it may be caused due to hand spinners cotton handling system and storage problems, so it needs careful handling and storage. Moreover the supplier especially local suppliers should be conscious about the effect of raw material quality on the final product. The main quality problem of raw materials in handmade textile manufacturing process is the strength of the yarn. This problem is critical because it reduces the quality of the final product, increases production time, cost and creates depression on the weavers. As observed from the site high frequency of yarn breakage results in more time to knot each thread to continue weaving. So to get quality raw material, the sourcing process of handmade textile manufacturing enterprises should be improved.

Production/Weaving processas observed from production site about 50% of the products produced were produced for stock or without specific customer order (sM1), and the remaining 50% is produced based on the customer orderor for a specific customer order (sM2).

SCOR metrics to measure the process performanceof make process in SCOR level-2 are order fulfillment cycle time (RS.1.1), make cycle time (RS.2.2), current make volume (AG.3.38), cost to make (CO.2.3) and cash-to-cash cycle time (AM.1.1).

Make-To-Stock – most of the time MTS products are produced by using mill spun yarns for both warp and weft like netela/kuta, kemis and scarf and others that produced without specific order.

Half of the weavers' products were produced for MTS to be sold in based on market demand. When there is high market demand for one product, they produce it based on the information they gained. But the productivity of traditional looms very low to have the advantage of market demand by producing in large amount. The productivity of the weaver is determined by the quality of raw material, 'tibeb' design complexity, skill of the weaver and working environment. A weaver can weave in average 1metre square plain fabric per hour by using traditional looms. That means one gabi (meaning traditional cloth measured 10-12m in length and averagely 80cm wide fabric with the same pattern at both ends and sewn in two pairs side to side to increase width and thickness) takes 8-12 hours to weave it. One of the challenges for the weaving performance is lack of modified weaving instruments and technology**.** As observed from working site all associations except one association that have nine modified looms, use only traditional looms with very low productivity that means cost to make (CO.2.3) is very high increasing the final price of the product. The association that using nine modified looms have thirteen traditional looms with some modified preparatory instruments.As observed from this association production process, modified looms have capacity to weave 1.5m/hr. and 1.5m wide fabric that is 2.25 times faster than traditional looms that has maximum speed of 1m/hr. and can weave only 1m wide fabric. Preparatory processes like warping, sizing, knotting it on the loom and winding weft yarn on reed are extremely time taking. It is impossible to weave wider and thicker fabrics by using traditional looms.

Make-To-Order - this production strategy in the case industry varies following seasons and holiday celebration times. When there is a holiday like Timket, Meskel and other religious or cultural ceremonies, weaving for orders exceeds weaving for stock and there is warm market activity for hand woven products like netela, habesha kemis, kuta, dunguza scarf and others at that time.If the woven product produced is semi-finished product, it goes to local garmenting enterprises to produce products like kemis, coat, and home furnishing clothes and other cultural clothes. They produce different handmade textile products by using different raw materials as shown in figures in appendix 5. Some of these products are buluko, gabi, table clothes, blankets and others which are produced mostly by using hand spun yarns as weft and mill spun yarn as warp based on the order given from customers and the problem here is its continuity problem that depends on the occasions.

Delivery or distribution process:

Deliver or distribution process is the process of delivering the product sourced or made to the customer through different way of delivering and its SCOR metrics are perfect order fulfillment (RL.1.1), order fulfillment cycle time (RS.1.1), deliver cycle time (RS.2.3), downside deliver adaptability (AG.2.8), current delivery volume (AG.3.32) and order management cost (CO.3.14).

Delivery of MTS products - as can be seen from the figure 4.9products produced to stock are delivered either to open market or collectors that are collecting the stocked products from the weavers working site (sD1). Distribution system of the associations has no its own center to display its products. Because of this they were selling their MTS products on open market for collectors by the price fixed by collectors. The SC link between weavers and their consumers is weak identified as shown in Figure 4.9 that middle actors are gaining more profit than weavers and increase delivery cycle time (RS.2.3).

The main problem here is lack of own distribution center, market premises or shed for producers in urban centers or even near their working site. Because of this problem middlemen collect the product and fix their profit margin as they want and sell the product by high price that hinders the competition of woven products by price in the market. This lack of direct linkage with the final consumers is also another weak link as shown in the Figure 4.9 in the SC of the case industry. Because if they have their own distribution center, they can produce in large volume based on market demand and the products can be displayed in the display center.

Delivery of MTO products –MTO products are directly delivered to the customer based on their order and the product requirement without intervention of middlemen in the delivery process (sD2).

Customer Sourcing processes: The customers are also planning to source products (sP2), retailers purchase their products from the weavers, where the company's products are stored for the local market (sS1). Foreign customers also purchase their products based on demand from local shops that purchase products from local collectors and storing it to sell based on demand (sS1).

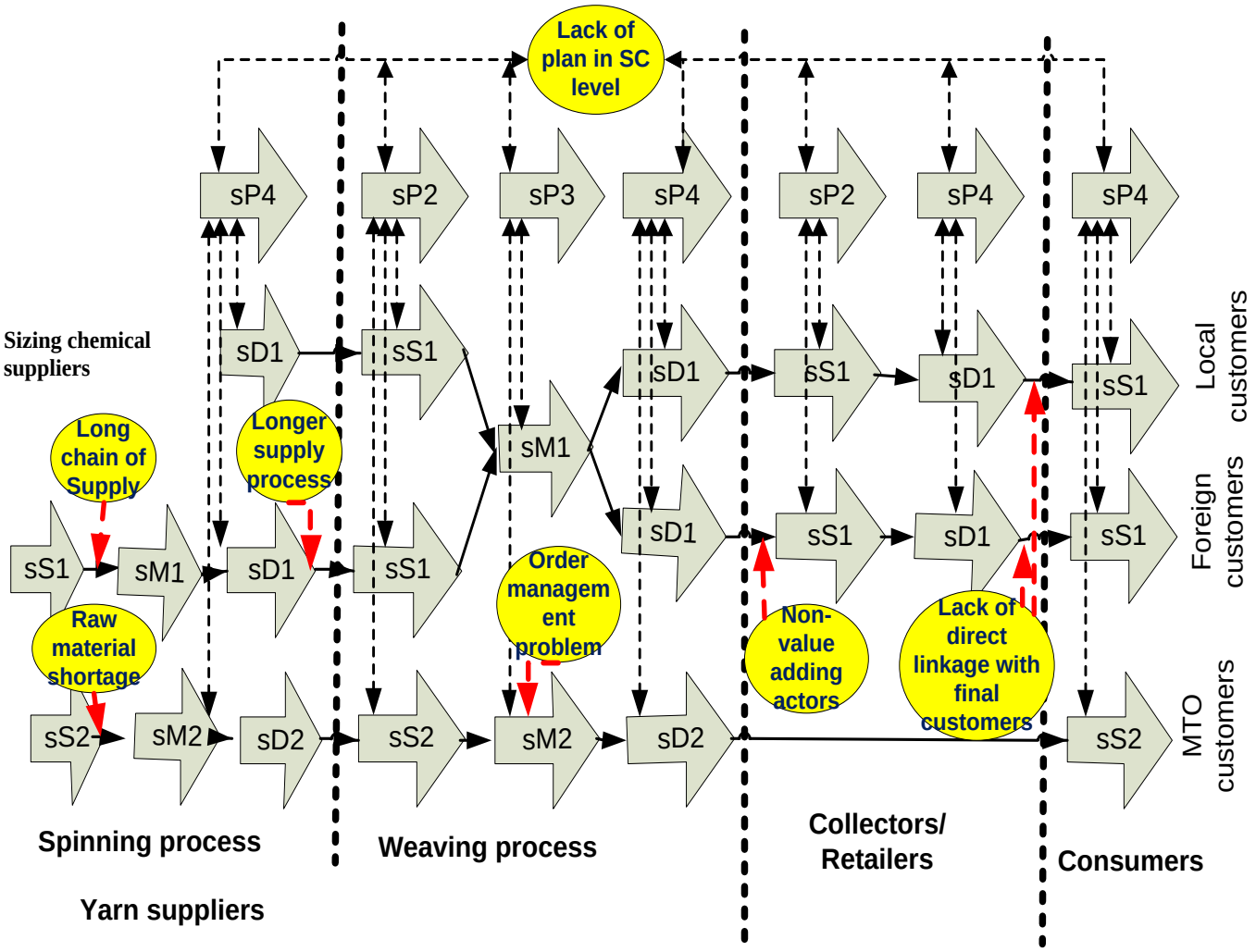


Figure 4-9: Exiting SC level II of HMTMI

4.8.5. Existing SC level-3 analysis of HMTMI

To plan the supply chain improvement and to define appropriate goal, understanding the inputs of processes and predicting outcomes is very important factor. Therefore, identifying related third-level supply chain processes and examining the criteria associated with these processes will help the case industry to plan and make the right decisions.

To identify the weakness of supply chain and to make right decision for improvement, it is also important to visualize level-3 processes by mapping SCOR model level-3. In this study "AS IS" analysis using sub process elements considering the weak links of the supply chain of the case company was used. "AS IS" analysis of HMTMIsis used to suggest that where the improvement action can be taken to respond effectively to the challenges that currently facing in business

operation processes holding back their SC processes of planning, sourcing, production and delivery by mapping the existing supply chain.

Suppliers' delivery process: To analyze the SCM of the case company using level-3 SCOR model each process element should be analyzed based on researcher observation result. Here supplier part starts with planning SC delivery process (sP1.4) and receive order from weavers, validate it (sD1.2/sD2.2), determine delivery date (sD1.3/sD2.3), receive product from source (sD1.8/sD2.8) and deliver the product to manufacturers (sD1.12/sD2.12). The main challenge in suppliers' delivery process is the order management problem because order is not consolidated to minimize transportation cost and there deliveries delay to deliver the product to manufacturers.

Sourcing process: To begin analysis of existing SC operation of source process of the case industry based on the information collected by different toolsusing SCOR level-3, source process(sS1/sS2) is broken down into five process elements, starting from scheduling raw material receipt (sS1.1/sS2.1), receiving it (sS1.2/sS2.2), verifying the quality and quantity (sS1.3/sS2.3), and transferring to inventory (sS1.4/sS2.4) as well as authorizing payment (sS1.5/sS2.5). Both sourcing activities Make- to- Stock products (sS1) and Make-to-Order (sS2) process include all five process elements mentioned above. However, the process element authorize supplier payment & product transfer is switched in terms of process flow in the case industry, in that authorize supplier payment now comes before the product transfer.

SCOR metrics in this level used to measure source process performance are percentage schedules changed within supplier's lead time, average days per schedule change, schedule product deliveries cycle time, percentage orders processed complete, receiving product cycle time, percentage product transferred on-time to demand requirement and inventory days of supply.

In existing supply chain of the case company in this level, there is a problem of reliability on product receipt that leads to schedule change. The other problem here is order consolidationduring sourcing raw materials that weaving associations purchase raw material like warp and weft yarn in small amountrather than consolidating it to gain advantage of transportation and other costs.Because of this there is frequent stock out of inventory in their production process. There is also a problem of identifying inventory amount to prevent the inventory stock out.Order validation and verification of hand spun yarns also has some problems. The main problem related to sourcing

forweaving associations israw material delay, quality checking problem, purchasing orders consolidation, weak linkage with local suppliers to minimize cost of sourcing and transportation and to purchase from larger suppliers of raw materials because of this there is high cost of sourcing and the SC process takes long time.

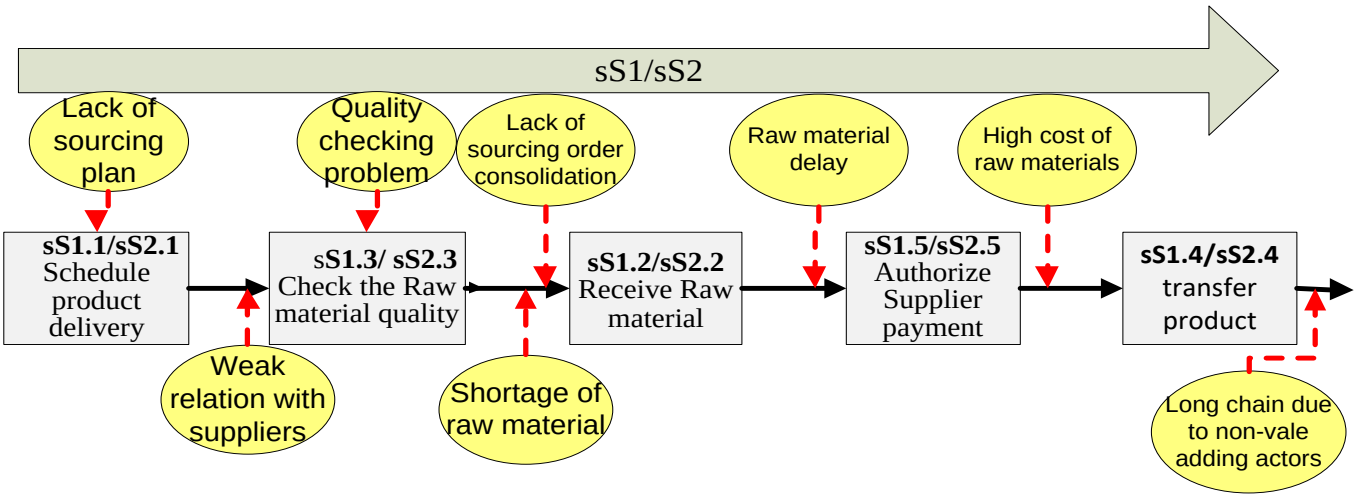


Figure 4-10: Existing SC of source process

Production/Weaving process:make process ofthe existing supply chain includes activities like schedule production activities(sM1.1/sM2.1),issue raw material and begin production(sM1.2/sM2.2), produce and check quality of the product(sM1.3/sM2.3),packaging or sacking with suitable bag and storage in suitable place(sM1.4/sM2.4) anddistribute finished products to customers(sM1.6/sM2.6).

SCOR metrics used to measure the SC production process performanceare schedule achievement (RL.3.49), schedule production activities cycle time (RS.3.123), capacity utilization (AM.3.9),fill rate (RL.3.36),produce and test cycle time (RS.3.101), cost to make (CO.2.3) and direct material cost(CO.3.11)

From the observation to get information about the SC operation of the case industry, result obtained shows that production scheduling activity is very weak except 5 association that have production schedule in written form. When we see schedule achievement, it was poor and their capacity

utilization (AM.3.9) when compared with maximum capacity is about 60%. Lack of appropriate production schedule is one of the main problems in production process of associations that contributes for poor management of working time. This leads weavers to produce without appropriate decision of when to produce, what type of product in what quantity and quality. There is also a problem of capacity utilization that hinders the industry's competition in the market due to weak production schedule. From 31 weaving associations observed only one (3%) of the associations use modified looms to improve their productivity. Production approach does not follow the seasonality of the products. For instance netella and habesha kemis have high demand when timket ceremony is coming and buluko and gabi are demanded in highland areas when summer cold season is coming. This condition is not supported by production plans and schedules due to lack of documents of past demand and production. Even though they produce quality products, they are not benefited from their effort because they are not following the production seasons properly. The other activity highly considered in make process is the storage and packaging activity which is highly important for the quality of the woven product because if the product is stored without care it can simply stain by dust particles but not practiced properly in weaving associations. From 31 observed associations only two associations (6.5%) of the total association were considering about the packaging system of their product properly and other have no concern about the packaging of their product to deliver they simply put in local sacks produced from local materials.

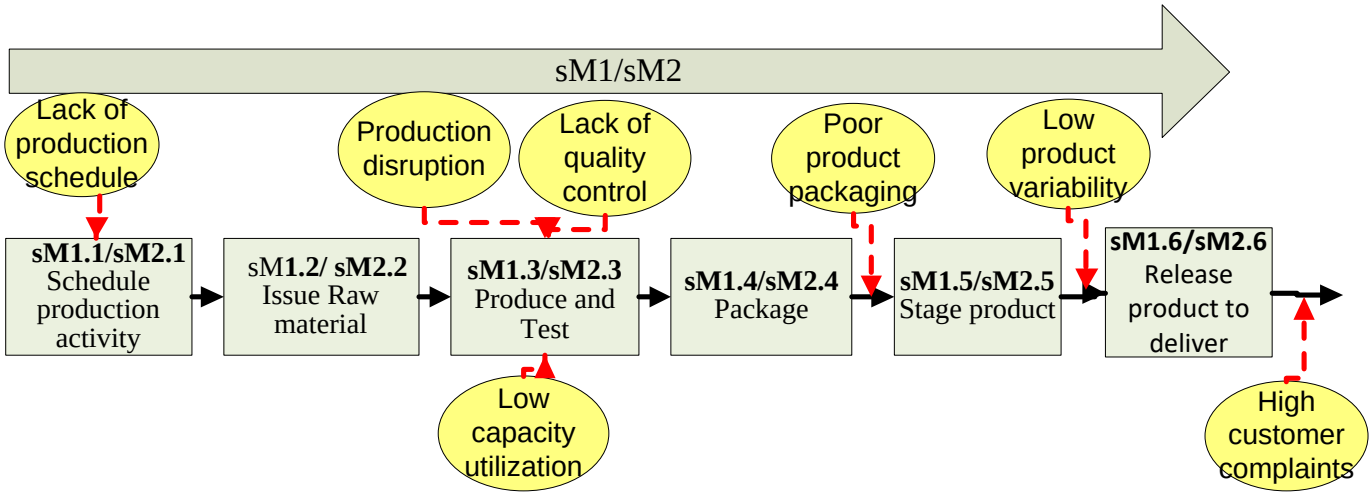


Figure 4-11: Existing SC of make process

Delivery or distribution process:product delivery process in existing SChas process elements of process inquiry (sD1.1/sD2.1), receive, enter and validate order (sD1.2/sD2.2), reserve inventory and determine delivery date (sD1.3/sD2.3), consolidate orders (sD1.4/sD2.4), receive product from make (sD1.8/sD2.8), pick product (sD1.9/sD2.9), pack product (sD1.10/sD2.10), deliver product (sD1.12/sD2.12) and receive and verify the product by customer (sD1.13/sD2.13).Deliver process includes activities like order verification, picking products and packing it in appropriate manner and transporting it to the customer.

SCOR metrics to measure the deliveryprocess performance are order management costs(CO.3.14), cost to deliver (CO.3.14), delivery item accuracy (RL.3.33), delivery quantity accuracy (RL.3.35), percentage of orders delivered in full (RL.2.1) and delivery performance to customer commit date (RL.2.2).

There is poor order management for delivery of stocked products and ordered products to the customer. In delivery process there is also a gap in order consolidation to minimize cost of delivery. From field observation about 50% of the products were produced to be sold based on market demand (MTS) and the remaining 50% was produced for specified orders (MTO). Delivery process for customer commit date is related to Make- To- Order process and most of the time weaving associations that produce handmade textiles have a problem of achieving committed date of delivery (RL.2.2) and this resulted in customer complains about the time of delivery, quality and quantity. This is due to the problem of receiving and validating orders appropriately. Because, every handmade textile product has its own design and specification, that should be fulfilled to satisfy customers. Also there is lack of appropriate production schedule and sometimes weavers are giving unwanted promise of short lead time to deliver the product knowing that it is not achievable time of delivery. The other problem that contributes to delivery date failure of the enterprises is that they have no recorded information about how long it takes to deliver the product to the customer starting from the time of receiving that specific product order. They have no appropriate order receiving format to record the order given from customer with important information. There was no delivery lead time record and how often it was delivered on the committed date of delivery and how often it was not achieved due to different reasons. The weavers mostly deliver small amount of product to long distance that increases the price of the final product and minimizes competition power. The other problem in delivery case is lack of product returns system, that there is no system

to return once delivered product to the deliverer. Also inventory management problem hinders the delivery process by creating delivery delay to fulfill customers order.

The map in Figure 4.12 shows delivery processof existing SC gaps like order management, order consolidation and weak market linkage.The other SC challenge of production process in this level is poor inventory management that resulted in production disruption. Lack of inventory management system that exposed the enterprises to frequent stock out and production cut-offs. This is because weaving associations purchase raw materials in small volume and when the inventory gets out of stock, the production process is interrupted until the product produced is sold and raw material purchased.

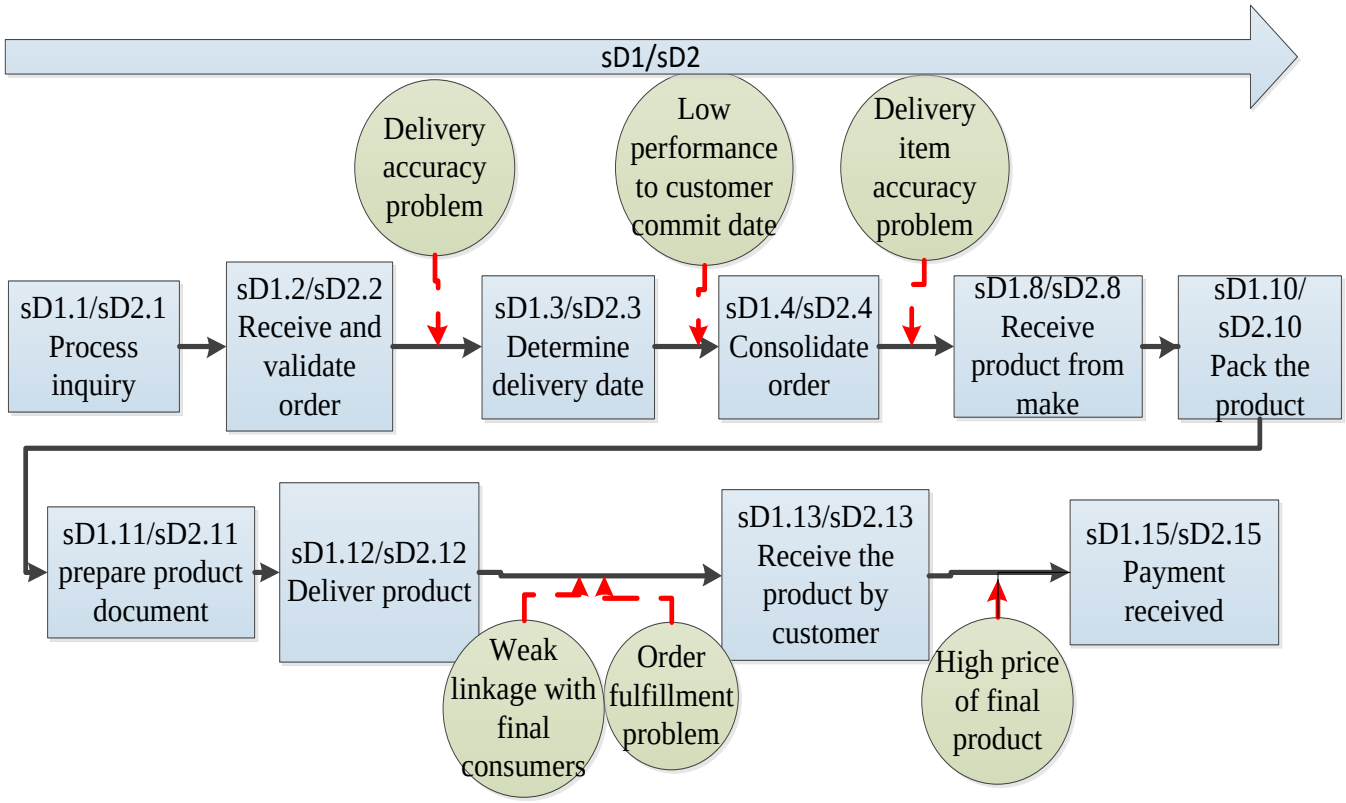


Figure 4-12: Existing SC of delivery process

Table 4-8: To show existing SC problems, causes and metrics

Problem	Causes	Improvement opportunity	Metrics
Lack of SC plan	Lack of experience for forecasting and aggregating SC requirements	To plan and forecast SC requirements properly, provision of training for association is very necessary	Forecast accuracy for supply and demand (RL.3.37)
Shortage of raw material	Weak linkage with potential suppliers around the study area	Raw material purchase order consolidation	Current source volume aggregation (AG.3.42)
Increasing cost of raw materials	Long chain of supply	Minimize non-value adding actors & change source point to local supplirs	Cost to source (CO2.2)
Raw material quality problem	Quality checking problem	Improving quality checking process of raw materials	Verified product quality (sS2.3)
Prolonged SC	Involvement of non-value adding actors	Shortening SC process by minimizing non-value adding actors	% Schedules changed with suppliers lead time (RL.3.27)
Weak relation between suppliers and producers	Weak communication system	Develop collaboration with suppliers	% schedule achieved (RL.3.49)
Low capacity utilization	Weak production schedule	Improvement on implementation of production schedule	% schedule achieved (RL.3.49)
Weak production schedule	Low forecasting and scheduling experience	Improvement on production scheduling	% schedule achieved (RL.3.49)
Production disruption	Weak inventory management	Inventory management improvement by awareness creation	Average days per schedule changed (RS.3.10)
Lack of quality control management	Product quality checking problem	Improve quality checking after production	Produce & test cycle time (RS.3.101)
Poor market linkage	Presence of many intermediaries	Minimize number of middlemen	Perfect order fulfillment (RL.1.1)
Poor order management	Lack of order validation and verification	Receive, verify & validate order using format	% orders delivered in full (RL.2.1)

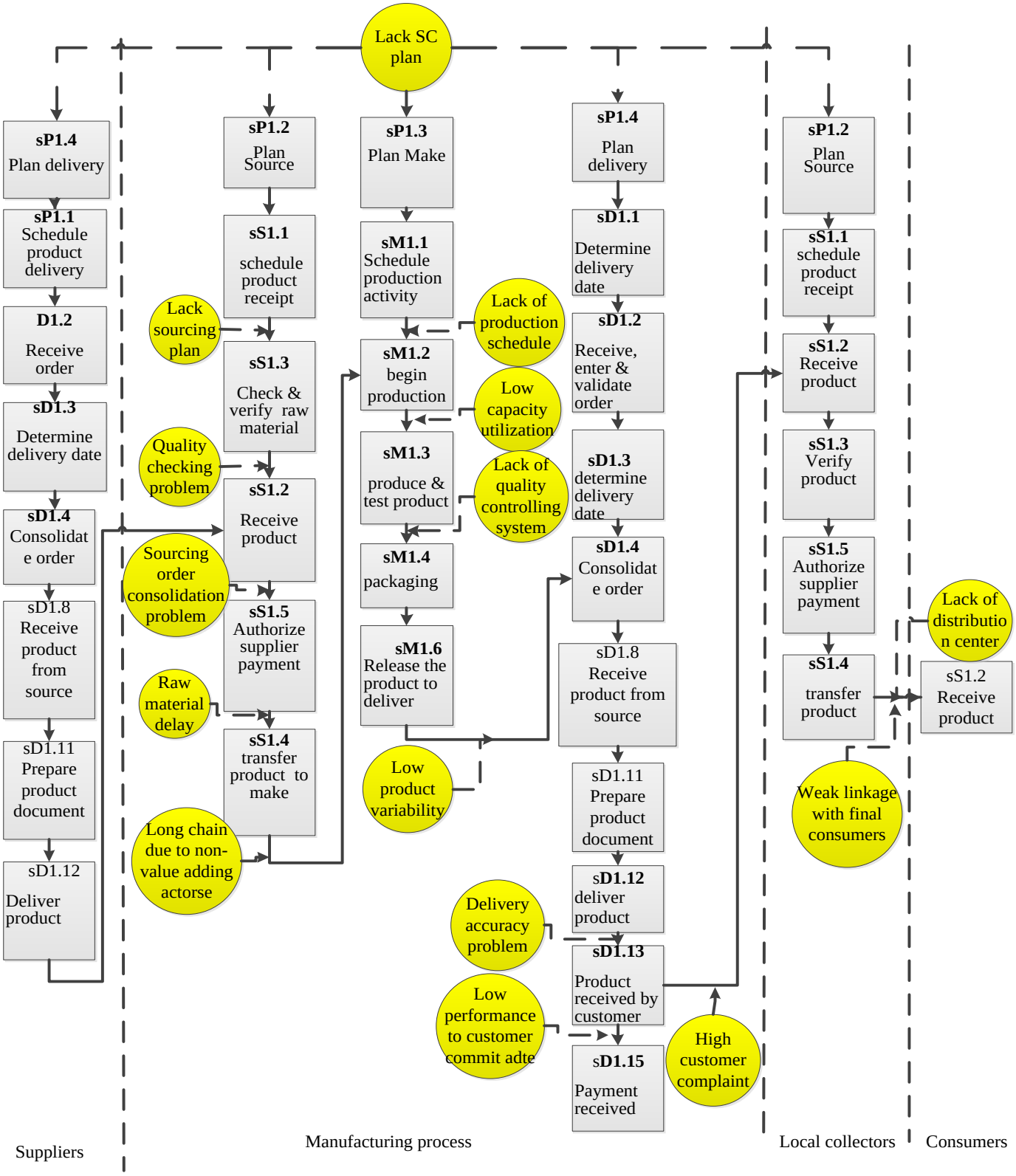


Figure 4-13: Existing SC level-3 process map

4.9. “To-Be” analysis of Supply chain operation of HMTMI

In SC process improvement “To-Be” analysis can be needed for SC operation improvement as it is one of the most important steps to go forward with company- wide improvement initiatives. Analysis of exiting SC operation challenges and gaps were used as inputs to facilitate improvement activities. The results from interview, questionnaire and observationused to analyze the “As-Is” supply chain process revealed real practical and actual situations in the case industry. This will be the base for further improvement activities. For this reason to overcome the challenges that were existed as a gap in “As-Is” SCM of business operation process in HMTMI SC in the previous section, the actions to be taken can be mentioned in the following “To-Be” analysis of SCM analysis that is needed in the future time.

4.9.1. Identifying improvement opportunities based on best practices of SCOR model

SCOR is the best supply chain analysis tool that offers an efficient way to identify improvement opportunities. The activities are associated with developing the plan for change. This includes identifying the steps required to implement changes to facilities, staffing, automation, and process. Specific changes are assigned to unique owners. This includes reviewing the specific change with key stakeholders (SCC, 2012). With the analysis of the level-2 and level-3 processes of the supply chain, and based on the best practices of the supply chain operations reference model as well as existing opportunities, some improvement plans have been proposed to improve supply chain management of the HMTMIs.

4.9.2. Improvements on level-2 processes

Planning process improvement:There should be supply chain plan for HMTMIs that can show raw material sourcing process, production activity showing thatwhat type of product at what time and amount should be produced based on the market demand. Their plan must follow the product demand seasonality to be successful in the market. Production plan of the associations have to show the production strategy that what amount of product can be produced for MTS and MTO following the market demand based on forecastingand on the past history of production and specific orders. Planning process improvement of the case industry should be based on the customer satisfaction to fulfillcustomers’ needs in organized way to satisfy the customer.

Sourcing plan should include sourcing process of raw materials based on quantity, quality, type and place of sourcing for the product to be purchased. Planning production/ weaving should concern product demand seasonality of the industry. Plan delivery or product distribution should be based on the customers'requirements to satisfy customers.

Sourcing process improvement:

Sourcing MTS products:to avoid raw material receiving delay for MTS products like warp yarn, colored decorative yarn and sizing chemicals and to minimize quality problem, it is important to minimize the non-value adding SC actors. Also linking with potential suppliers like wholesalers of warp yarn and spinning mills directly will minimize the cost of sourcing. Raw material purchasing volume of weaving associations should be improved by consolidating the purchase order to larger size to purchase from potential suppliers. They are purchasing raw material only for single or two products at oncefrom retailing shops. If they purchase collecting the demands for a given period of time, they can get potential to purchase from wholesalers with reduced cost of raw materials near their production area. Integration with suppliers of raw materials also should be improved to insure the sourcing continuity of raw materials from reliable suppliers.

Sourcing MTO products: MTO raw material for weaving associations is hand spun yarn and its sourcing process is very long. Shortening the length of SC of cotton by linking individual cotton producers with spinners can avoid non-value adding middleman to minimize cost of raw material. It is also important to purchase from large cotton producing farms around the study area by consolidating raw material demand of the associations. Changing the sourcing point to localsupplierscan improve relation with raw materialsuppliers to insure continuous raw material supply from reliable suppliers to utilize full capacity. This can improve sourcing problems and reduce overall SC cost and replenishment lead time. Because there is huge cotton farm with ginning factory around Arba Minch that can supply quality raw cotton to the case company if they create potential to purchase larger volume. This would reduce both transportation and inventory costs and delivery lead time. This could impact service level and revenue objectives depending on balanced demand and supply decisions. Currently some of the associations are using ginned cotton from Addis Ababa or Adama and if they use local suppliers, it can save transportation and other costs incurred by purchasing raw materials from far distant. This can be achieved by planning sourcing properlyto matchproduct requirements with the necessary

resources. The process of source planning should be formal and understandable and should clearly indicate the quantity, quality, type, time and the place where the raw material should be purchased.

Production process improvement

Scheduling production activities is very important issue to be successful in the current market. Production planning and scheduling should identify production strategy and type of product to be produced.

Weaving MTS products: Seasons and occasions should be considered to produce woven products for stock. This production strategy should follow seasons and holiday celebration times like Timket, Meskel and other religious and cultural ceremonies to get appropriate market for the product produced. Production capacity utilization of associations should be improved by improving production continuity through improvement of inventory management. The productivity of HMTMIs should be improved by using modified looms and preparatory technologies because modified looms have a productivity of 2.25 times more than traditional looms. Also weft winding modified technologies are more than four times faster than traditional weft winding way by hand. Modified looms can also minimize the time taken by preparatory processes like warping, sizing, knotting warp on the loom and winding weft yarn on reed. Therefore encouraging and supporting associations to use modified looms and technologies can improve their productivity and competition in the current market

Products specialization is also another important issue in production processcan be achieved by producing causal wears that everyone can wear in everyday activity. The case company most of the time is engaged in producing traditional wears andthe usual hand woven products like “Kemis, Netela, and Gabi”, etc. that makes them get immediate income. Due to this, most of the weavers engaged in producing any kind of hand woven products from which they can earn immediate income rather than focusing on specialization. Therefore, some of the case company should be encouraged to produce causal wears with continuous demand to earn more income.

Quality controlling technique is important activity in production process after the product is produced. The woven product should be checked for its quality (M1.3/M2.3) even though there is no established quality standard for hand woven products. To support quality controlling

system, institutional support from technical support giving bodies should be provided to the case company to improve the quality of the product.

Weaving MTO products: about half the products produced by weaving associations were produced for specified orders and this demand amount increases when there is occasions like religious and cultural ceremonies. Mostly products produced for orders kemis, netela, scarfs and coats of different cultures and needs some occasion or reason that needs sharp delivery from producers. So weavers should have discipline to follow the customers commit date to satisfy the customer. Time management problem should be avoided by scheduling the production properly to meet customers' requirements.

Improvement ondeliver and distribution process:the case industry should improve product distribution system to satisfy the customer by minimizing the time delay of delivery. Time compression of the product delivery can be achieved by improving sourcing and production processes and by establishing its own distribution centers in urban areas near their production centers in Arba Minch or Chencha town. Distribution centers that may be established in Arba Minch and Chencha towns can increase the competitiveness by price of the woven enterprises by increasing marketability of its products. The customers near the distribution center can buy the product directly from the distribution center and customers far away from the distribution center can get products through retailers. In any case by the presence of distribution center, weavers can be empowered to negotiate on the price of the product and price fixation only by buyers will be minimized.

In the other way distribution system can be improved by linking the market directly with the potential buyers in large cities in the country and foreign customers. Associations also should integrate each other to overcome the challenges by themselves and to use any opportunity that can improve their productivity and competitiveness.

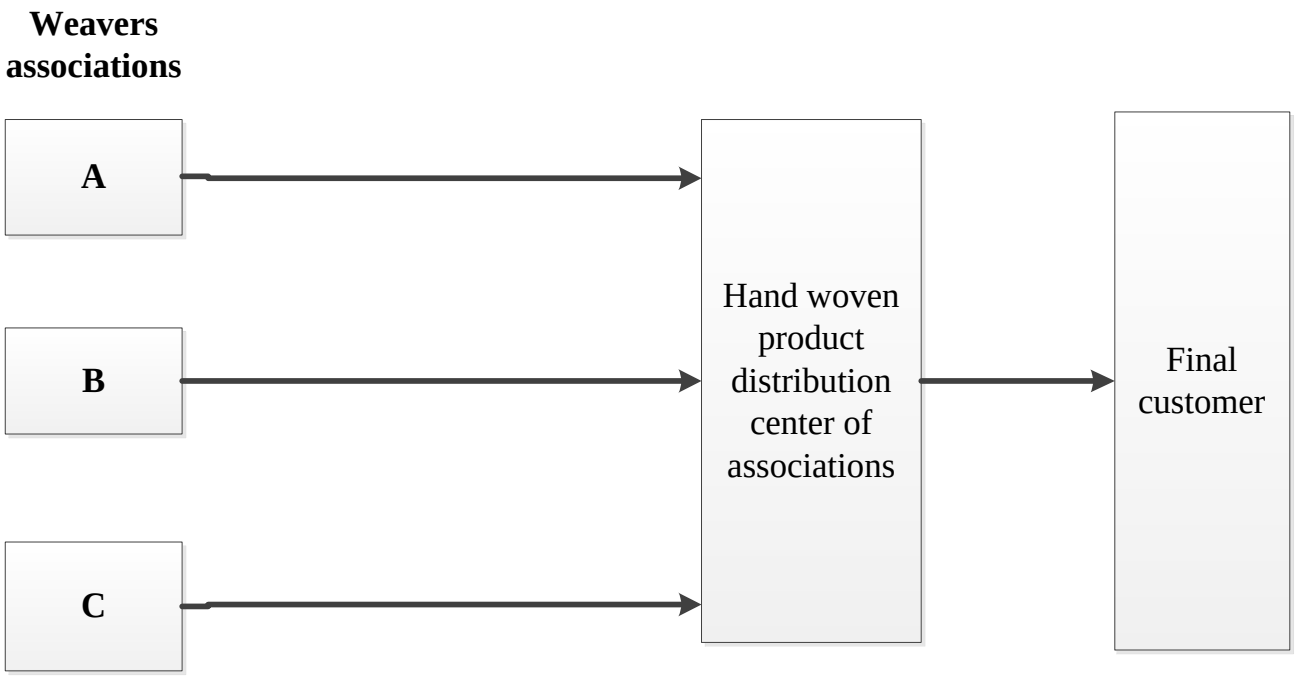
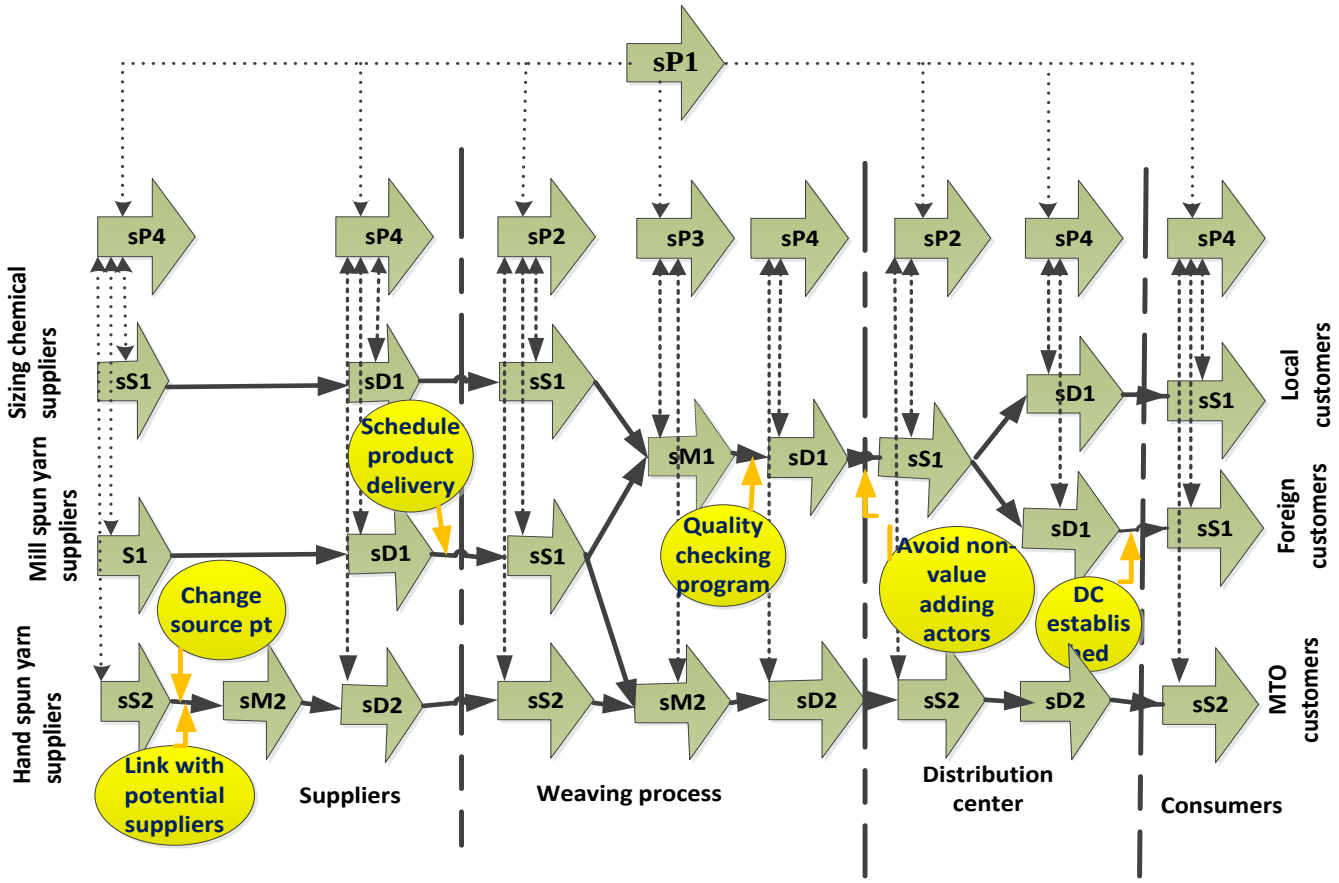


Figure 4-14: Distribution system improvement plan for HMT products

By the presence of distribution center, the product distribution channel will be changed as shown in figure 4.14. According to the improved distribution channel majority of the product will be channeled through distribution center that means most of the customers will buy the product from associations' distribution center. All associations will display their product with its selling price on the distribution center that any customer can get the product required from this center by reasonable price and high quality. This system will help the associations to get more revenue from their effort and reduces the selling price of the products. Most of the products will be sold directly from distribution center to customers by the price determined by weavers that minimize for instance the cost of kemis and netela 1700-3000 birr to 1200-1500 birr including sewing and finishing process. Also retailers can get the product as their requirement from the distribution centers to supply to other areas, because all product types will be available in the distribution center.



HMTMIs SC level-2 "To-Be" process map

sP1: Plan SCsS2: Source MTO products

sP2: Plan sourcingsM1: Make to stock

sP3: Plan production processsM2: Produce for MTO

sP4: Plan delivery processsD1: Deliver stocked products

sS1: Source stocked productssD2: Deliver MTO products

Figure 4-15:Map of "To-Be" analysisof level-2 process of HMTMIs

4.9.3. "To- Be" analysis of SCOR model level 3 processes

A business operation process improvement is visualized by mapping SCOR model level III and in this study it is used as "To-Be" analysis using sub process elements considering the result, discussion and data analysis. "To-Be" analysis of HMTMIs suggested that improvement action can be taken to respond effectively to the challenges that currently facing in business operation processes holding back their SC processes of sourcing, production and delivery were mapped for

improvement. The improvements required in this level based on SCOR model best practice are changing sourcing decision to local source point and potential suppliers, sourcing order consolidation, use of appropriate production schedule, and improvement on inventory management, improvement on product distributionand delivery process and use of modified technologies. Proper management of these activities can reduce sourcing price, production disruption, delivery date failure and increase capacity utilization and productivity of the case industry. In this level all suppliers, manufacturers and distributors should plan or prepare SC schedules for supply of raw materials, production and delivery process. Each participant need to validate the order by checking the availability of inventory to respond the needs properly.

4.9.3.1. Source process improvement map

Sourcing process problems identified in this level in 'As-Is' analysis were challenges related to raw material shortage, raw material quality problem, sourcing order consolidation, prolonged process of supply due to non-value adding actors and raw material on time delivery to production activity. On the basis of "To-Be" analysis, the following procedures were recommended based SCOR model level III business operation process elements. Primarily the sourcing point for raw cotton should be changed from individual cotton farmers to larger cotton farmers by consolidating purchasing volume and by creating linkage with potential suppliers. By this action number of non-value adding actors will be minimized and the cost of raw material for instance to produce single 'gabi' will be minimized by at least 100 birr as shown in problem analysis. Association should improve their relation with suppliers of raw materials like raw cotton, warp and weft yarn and sizing chemicals to use the advantage of long lasted customer relation from the suppliers to avoid production disruption when raw material shortage occurs. When the enterprises buy raw materials either raw cotton or yarns of different type, they should have a schedule for receiving for both MTS (sS1.2) and MTO (sS2.2) by checking the fulfillment of quality level. Checking and verification of quality and quantity of raw materials for both MTS (sS1.3) and MTO (sS2.3) should be performed seriously because; the quality of final product is determined by the quality of raw materials used in HMTMIs. Therefore, transferring raw materials to the production process should be performed after quality checking process (sS1.4) of MTS and (sS2.4) of MTO as shown in the figure 4.12 after verification production begins (sM1.2 and sM2.2).

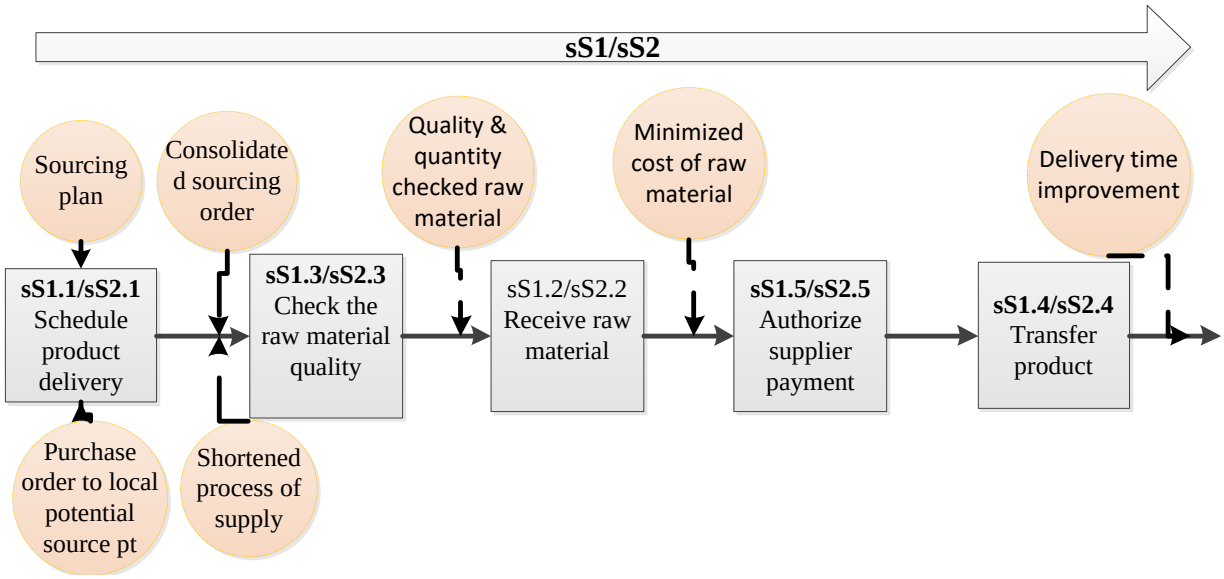


Figure 4-16: ''To-Be'' map of Source Process

4.9.3.2. Production process improvement map

In production process every activity should be scheduled properly to minimize the wastage of time and to improve capacity utilization.The improvement on production schedule can improve the production process of case company that contributes for improvement of working time management. Therefore scheduling production (M1.1/M2.1) and managing production process according to the plan is very crucial to compete in the current market. Production plan and schedule should clearly indicate what type of product will be produced following different seasons and occasions that affect the demand of woven products. Some seasons have high demand for woven products in the area, so weavers' plans should consider these seasons to balance the demand requirements by producing what is needed at the time. This increase in demand of products following some holy days, festivals and cultural ceremonies for instance netella and habesha kemis should be produced when 'Timket' and 'Meskel' ceremony is coming and buluko and gabi should be produced when summer cold season for highland areas is coming. Capacity utilization and productivity of the weaving associations should be improved by improving raw material supply, inventory management and using recent technology developed like modified looms and other technology to improve the productivity.Modified loom is 2.25 times more productive than traditional looms as reported from observation result in previous section and weft winding preparatory machine is 4 times faster than winding by hand. So,

weaving associations should be encouraged by providing financial and training support by any stock holder to support the development of HMT industry to use modified handlooms other improved technologies. A new improved loom technology implementation will increase quality and quantity of production and enhancefaster development of weaving knowledge to an industrial level.Alsoweaving associations should use weaving preparatory technology that can help them to improve their productivity. Weaving preparatory processes can be improved by using some simple technologies like modified local weft winding and modified hand spinning techniques that can improve their production. The other important activity in production process of HMT products that needs improvement is inventory management that resulted in frequent production interruption. The raw material purchasing volume should be optimum to support continuous production. The amount of yarn required to produce a product for instance gabi, netela, kemis and other should be determined and availability should be checked before starting production. To improve inventory management system of the case company, weavers should have some know how about the importance of the inventory management. Inventory management is an important issue to run production process continuously and to satisfy customers by delivering the product on the committed date.

Production process of HMTMI should be improved by diversifying the products they produce. They have to produce products other than 'Kemis', 'Netela', 'Gabi' and etc. that are their usual products. It is possible to weave different products by using hand looms like fabrics to make shirts, T-shirts and other fashion wears, home furnishing fabrics like table cloth, bed sheets, pillowcase and others to widen the market of the products. So, weavers should be encouraged to produce causal products that can be worn at any time by any one that wants to wear it.

The other issue that needed improvement is quality controlling system of the case company. After production of the fabric, it should be checked for its quality and design fitness to check whether the 'tibeb' is according to the order or not for MTO products and for other faults. Storage of the product in production process needs attention, because most of HMT products are sensitive to dust and other staining dirty particles and can lose its quality simply. So, its storage and packaging process needs care. So, packagingprocess should be performed considering the value that it gives to quality of the product.

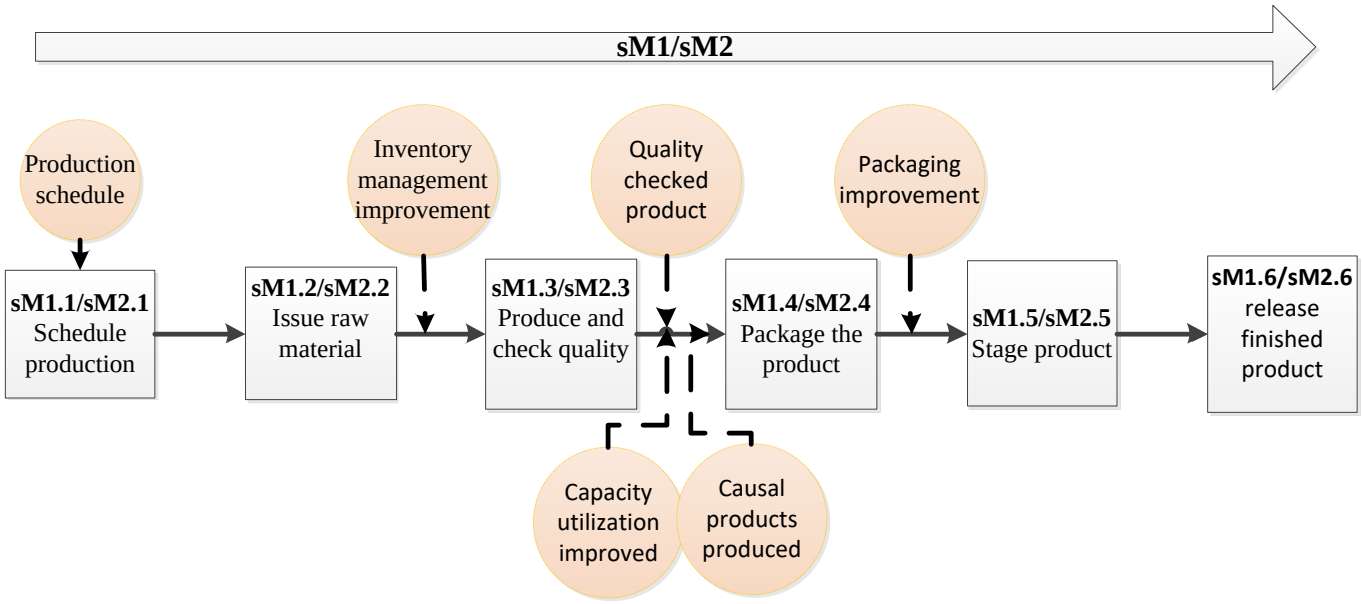


Figure 4-17: 'To-Be' map of make process

4.9.3.3. Deliver and marketing process improvement

Product distribution and marketing process of the case company has many challenges that are related to activities of order management like lack of order receiving format, validation process and determining delivery date properly. There was also problem of order consolidation to deliver and packaging problems. Because of this and other reasons there was failure of delivery committed date that resulted in customer complaint. To fulfill customers order and satisfy customers, order management processes like receiving, validating and checking inventory availability should be performed properly. Half of the overall product produced was produced for specified orders (MTO) in the case industry in the study area and customer commit date is related to order process managements. Customers' order commit date fulfillment should be improved to minimize customer's complaints due to late delivery and delivery with quality and quantity problems. Quality in HMT highly matters, because every handmade textile product has its own design and specification and the delivery should be according to the specification and design ordered. Weavers should avoid unachievable promise of delivery date that minimizes customer satisfaction. In this case order receiving, entering and validating is very important activity that needs attention to avoid customers complain. To improve customers' satisfaction association should record past information that how long it took to deliver the product to the

customer starting from the time of receiving order. Delivery records are important to design procedures to eliminate causes of delay and failure of delivering on a committed date implementing improvement on processes. Weavers have to use order receiving format that has basic information about the order received as shown in appendix 5. The other activity that needs attention is inventory management practice. The inventory management should be optimized using an economic order quantity level in production and throughout SC. To be cost effective in transportation, the load size to be transported should be considered in terms of cost or transport rate. In transportation the recommendable approach is using economies of scale to minimize transportation cost per unit load of a product should be considered.

The other important activity that should be improved in SC of HMTMI is product marketing activity. To improve product marketing system weavers should use product promotion and advertisement system by using modern communication system to improve the demand of the product in the market. The weaving associations have to communicate directly with their customers or end users to sale its products avoiding middleman intervention. These middlemen in SC of HMT increase highly the price of the hand woven products because they only think their large profit margin. In this case the hand woven products cannot compete with global textile markets and loses its marketability. For instance the final price of ‘gabi’ will reduced by birr 200-300 by avoiding middlemen from marketing system by directly linking final customers. By this the price of HMT products will be minimized and the demand of the product also increase.

So, to avoid poor marketing and insufficient market linkage with in the SC that upsets the industry from growing and weavers earning more revenue, weavers have to establish direct means of communication with their customers by using modern technologies like internet by creating web sites to advertise their products.

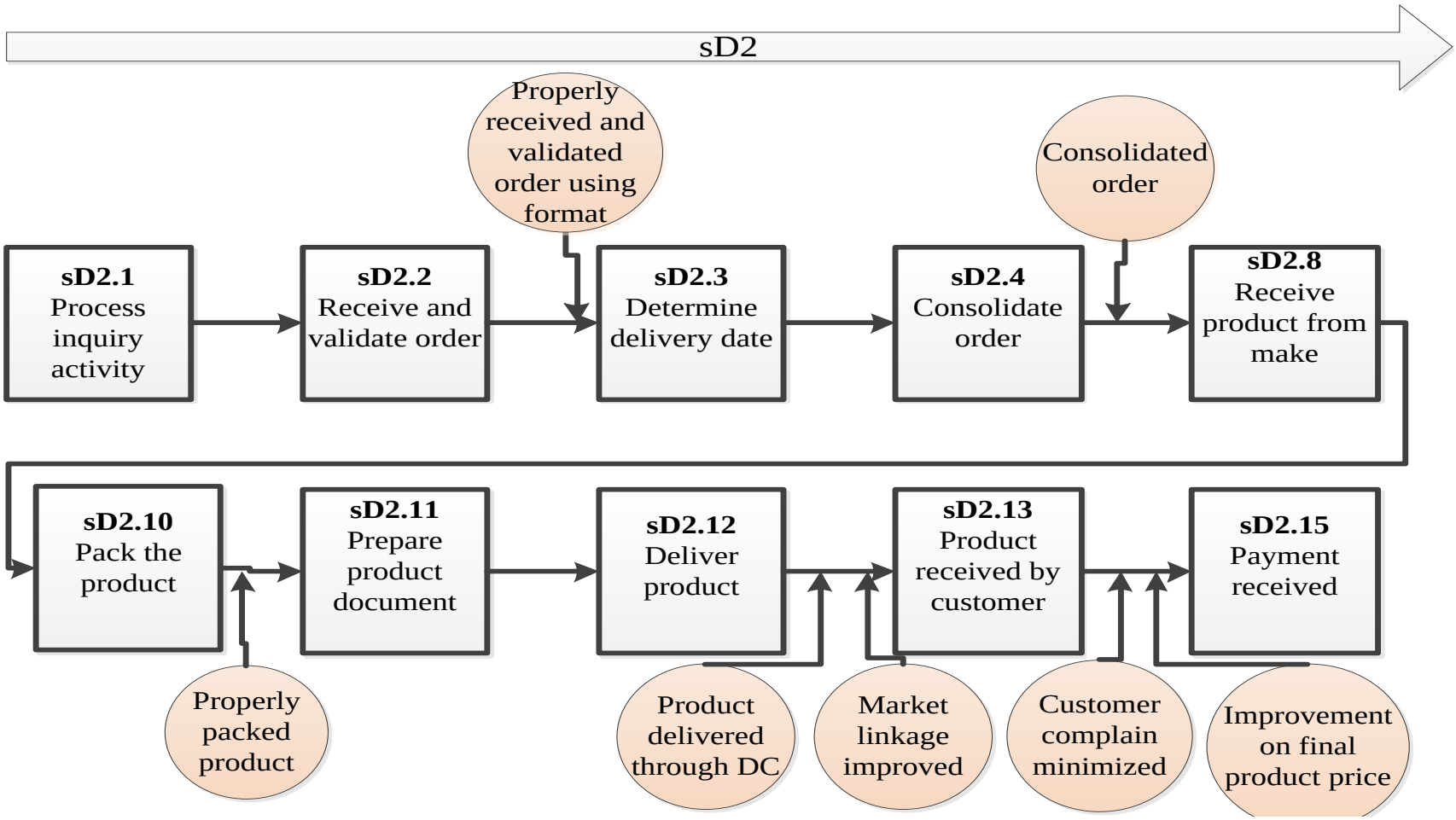


Figure 4-18'To-Be' map of delivery process

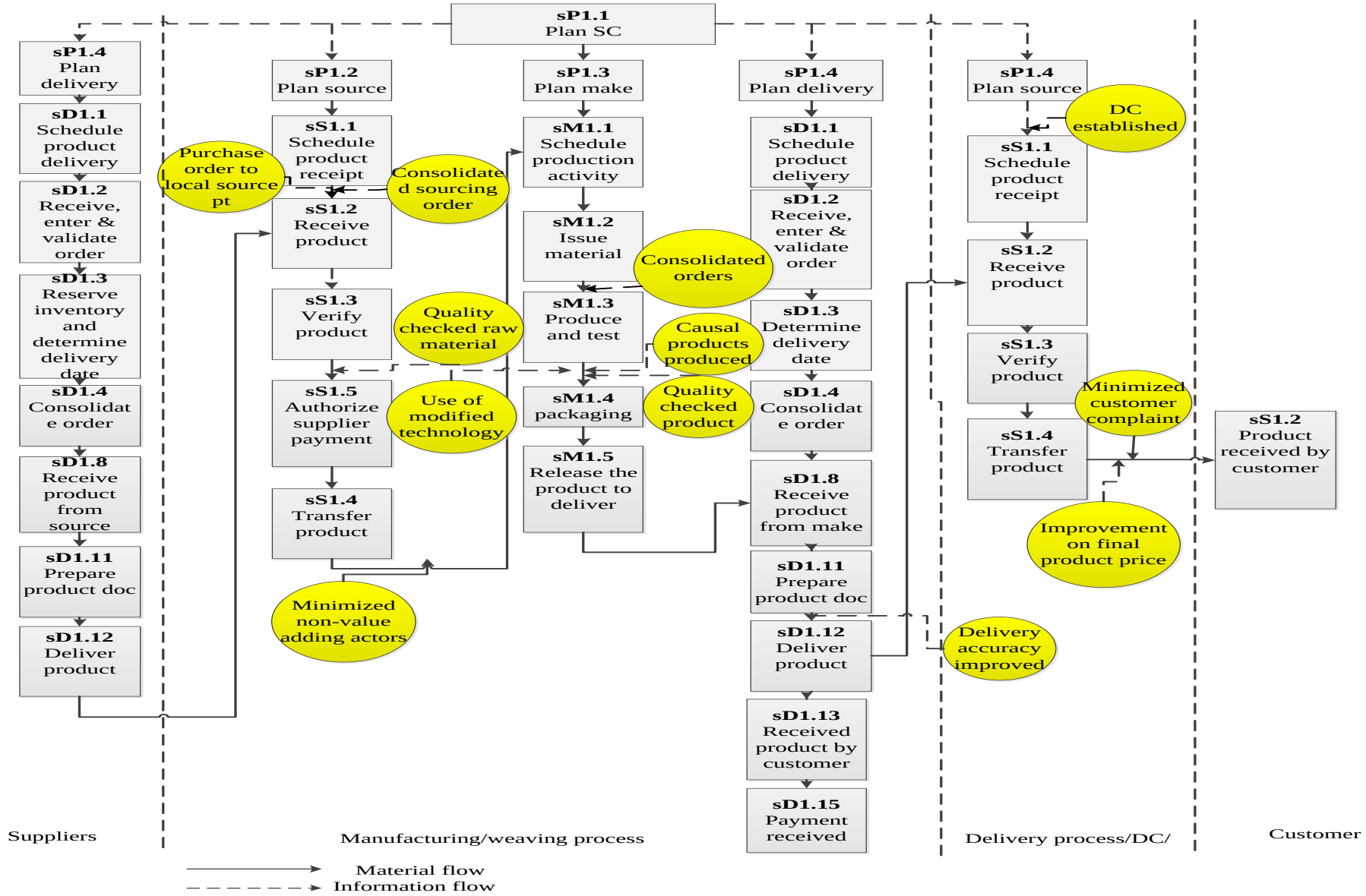


Figure: 4-19: Improvement model of level III process of HMTMI

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1. Conclusion

The final chapter of this thesis is conclusion and recommendation based on the finding of the study focusing on the SC operation analysis of HMTMIs. Hence, the following conclusions were made from the discussions made on chapter four of the study.

SCOR model was used to identify SC challenges and gaps and improvement opportunities of handmade textile manufacturing industry.The findingsin this study identified the weaknesses of the SC operationsof HMTMIs that holds back the efficiency of the SC operation of the industry and should be tackled for thesustainability of business operation within an organization and throughout the SC. From the study result the researcher determined that SC processes like plan,source, make and deliver processes of HMTMI has many challenges that upsets its efficiency.

Sourcing process of HMTMIs has a problem ofincreasing cost of raw materials like cotton and yarn and shortage and quality problem of the required raw material in the area. Also weavers were facing a great challenge of inventory stock outs and production disruption due to sourcing process problems. There was also prolonged process of raw material supply due non-value adding SC actors. The linkage between suppliers and manufacturers was weak and because of this there was reliability problem of raw material supply for weavers associations.

The other Supply chain challenge identified from the analysis related to production process were low capacity utilization, weak production scheduling, poor inventory management use of unmodified weaving instruments with low productivity, low product variability and lack of quality control system.

The other conclusion that made in the study was that the case industry has a great SC gap related to product distribution and marketing.This is due to poor order management, lack of own distribution center, insufficient market linkage, high competition from power looms, lack of transparency on price on each SC level and lack of product promotion and advertisement.

From supply chain performance measurement result also it can be concluded that the performance of the case industry supply chain based on reliability, responsiveness, flexibility, cost minimization and asset management metrics as analyzed based on the questionnaire response of the respondents was poor that it needs improvement to satisfy customers. Due to these problems the customers of the industry were no satisfied and have many complains coming from customers.

From the SC problem assessment of HMTMI, it can be concluded that SCM system of the case industry is full of challenges that upsets the SC efficiency and productivity of the firms. So, there is a need of improvement for the SC management processes.

Sourcing problems can be minimized by consolidating sourcing orders, avoiding non-value adding SC actors by linking weavers with potential raw material suppliers near the study area and with their final customers and raw material quality problem should be improved by practicing quality checking activity, becausequality of raw materials has great impact on final product quality.

Production improvement can be achieved by encouraging the use of modified handlooms that can increase productivity by 2.25 times more than traditional looms and weaving preparatory simplifying technologies that can minimize time of winding weft yarn 4 times than winding using hands and ‘inzrit’. Appropriate production plan and schedule and improving inventory management also can improve productivity of handlooms.

Also it can be concluded that marketing and distribution challenges can be minimized by establishing distribution centers for woven products at urban areas, product promotion, creating direct linkage with final users of woven products and advertisement using modern technologies and order management improvement are important activities that can improve marketing performance of the woven products.

Generally there are so many SCM challenges and gaps and by this they were losing their production potential and a power to compete with power loom products imported from abroad with low price. So, the ever growing fierce competition globally by cost and delivery time in textile product area were giving sign of warning for HMTMIs that it must provide customers a quality product at comparably lower cost and whenever demanded at a required amount. To do

so and stay in competition the industry have to try to avoid the weaknesses of SCM and must tighten the belt in fighting these challenges using opportunities to continue improving unless otherwise the field in the marketing competitionspecially competition from power loom products becomestighter and tighter forcing to be out of the competition.

5.2. Recommendation

The following recommendations were forwarded based on finding of the study concerning SC analysis of HMTMI based on results and discussion. This study would like to suggest the following recommendations to improve the SCM systemof the case industry.

- To improve the sourcing process of the case industry, associations should be given support to link the supply system with raw material producers around the study area.
- Associations should be encouraged to use modified looms to improve their efficiency.
- Distribution center and display shops for woven products should be established to improve marketing system of the products.
- HMTMIs should improve their communication system by using modern ICT like websites for product marketing andshould updated information.
- Infrastructure and financial credit support should be provided through enterprise development department to solve their productivity problems related with these issues.

5.3. Future work

Based on the result researcher wants to suggest two points for further studies.

Firstly this research used weavers association and their customers only as respondent; the private weaver's opinion was not included due to the limitation of time and other resources. Therefore, for future study researchers may use private weavers as respondent to more diversified information in order to have more reliable findings.

Secondly, the researcher only considered the HMTMIs in Gamo zone, but there are so many participants of HMTMin other areas specially Addis Ababa and further research can be conducted considering wide area to cover more diverse area in order to have more findings.

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APPENDIXES

Appendix 1: Interview and discussion questions

1. What are supply chain management challenges ofyour enterprise?
2. How your organization plans supply chain considering supply chain as a whole, sourcing, production, delivery and return processes?
3. What are sourcing process challenges of your enterprise?
4. What are the challenges related to production process and capacity utilization of your organization?
5. What production strategy does your enterprise follows?
6. What are the challenges to delivery process of your enterprise?
7. How your enterprise manages return process?
8. Rank the challenges of each process of supply chain from highest to lowest based on the potential to affect supply chain performance.
9. How your enterprise manages product marketing process?
10. How can the relation between your organization and its suppliers be described?
11. Describe any internal or external challenge that constrains SC management of the organization.

Appendix2:Questionnaire

Questionnaire for Supply chain analysis of handmade textile manufacturing industry

PART I General information and demographic profile of respondents

1. Age: i) 18-25 years ☐ ii) 26-35 years ☐ iii) 36-45 years ☐ above 45 years ☐
2. Gender: i)Male ☐ ii) Female ☐
3. Educational Levels: i) has no informal education ☐ ii) Below college diploma
   iii) College diploma ☐ iv) First Degree and above ☐
4. Current engagement area i) weaving ☐ ii) spinning ☐ iii) weaving preparatory ☐
   iv) administrative work ☐
5. How long have you been engaged in handmade textile manufacturing?
   i) Less than 1 year ☐ 1-4 years ☐ 5-10 years ☐ Over 10 years ☐
6. Present organizational status?
   i) Private ☐ ii) Cooperative ☐ iii) Share company ☐ iv) MSE organization ☐

PART II ASSESSMENT OF SUPPLY CHAIN PERFORMANCE CLOSE ENDED QUESTIONS

Performance rating for the following performance evaluation questionnaires

Strongly disagree (SD) = 1, Disagree (D) = 2, Neither agree nor disagree (NA) = 3, Agree (A)= 4 and Strongly agree (SA)= 5

1. **Performance of Supply chain Reliability**

	Activity: **Reliability performance**	SD	D	NA	A	SA
1	Always customers' orders were delivered in full without quantity problem					
2	Order delivery is performed on customer commit date					
3	Orders are delivered meeting the requirement without quality problem fulfilling specification like tibeb design					
4	There is defined customers complain solving procedure					
5	Orders received are validated, and verified by suppliers.					

2. **Performance of Responsiveness**

	Activity: **Responsiveness performance**	SD	D	NA	A	SA
1	The organization respond to customers need making short production and delivery lead time as much as possible					
2	The organization responds quickly to customers regular and urgent orders delivering before or on committed date					
3	The organization deliver quality product with right quantity at right time to customers					

3. Performance of Flexibility performance

	Activity: **Flexibility performance**	SD	D	NA	A	SA
1	Change in supply and demand is managed quickly in the organization					
2	The production volume is flexible based on market demand					
3	The organization is flexible to overcome supply and demand unbalance based on raw material availability					
4	The quantity produced and delivered can be changed without great challenge based on demand change					

4. **Performance of Cost minimization**

	Activity: **cost minimization performance**	SD	D	NA	A	SA
1	The organization has practiced cost minimization system					
2	Economic order of quantity is used regularly during sourcing					
3	The organization use economies of scale during raw material order, production and time of delivery					

5. **Performance of Asset management**

	Activity: **Asset management performance**	SD	D	NA	A	SA
1	There is high performance of return on investment of fixed and working capital					
2	Investment on raw materials flow back time short in the					

	organization					
3	The organization practiced evaluation of asset management with in given time interval					
4	The organization use fast inventory turnover to accelerates cash-to-cash cycle time					

Questionnaire translated to Amharic

<u>መጠይቅ</u>

የሽመናውጤቶችማምረቻኢንዱስትሪየአቅርቦትሰንሰለትትንተናለመስራትየተዘጋጀመጠይቅ

ክፍል I አጠቃላይመረጃእናየመላሾችአጠቃላይመገለጫ

1. ዕድሜ: ሀ) 18-25 ☐ ለ) 26-35 ☐ ሐ) 36-45 መ) 4☐ት በላይ

2. ፆታ፡ ወንድ ☐☐ ሴት ☐

3. የት/ት ደረጃ ሀ/ ምንም ያልተማረ ☐ ለ/ ከኮሌጅ በታች ☐/ ኮሌጅ ድኘሎማ ☐

መ/ ድግሪና ከዚያ በላይ ☐

4. በድርጅቱ አሁን እየሰራ ያለው ሥራ፡ ሀ/ መሸመን ☐/ መፍተል ሐ/☐መና ዝግጅት ☐

መ/አስተዳደራዊ ሥራ ☐

5. በሽመና ሥራ ዘርፍ ምን ያህል ዓመት ሰርተዋል ሀ/ ከ1 ዓመት በታች ☐

ለ/ 1-5 ዓመትሐ/ 6☐ዓመትመ/ ከ10 ዓመት☐ይ ☐

6. ድርጅትዎ የትኛው ዓይነት ድርጅት ነው

ሀ/ የግል☐/ ህ☐ሥራ ማ/ር ☐ ኃ/የተ/የግ/ማህበር ☐

ክፍል II የሽመና ውጤቶች ማምረቻ ድርጅተ አቅርቦትሰንሰለትአፈጻጸምግምገማጥያቄዎች

ለሚከተሉትየአፈጻጸምግምገማመጠይቆችየአፈጻጸምደረጃ

በጣምአልስማማም (በእ) = 1፣አልስማማም (አ) = 2፣ምንም (ም) = 3፣እስማማለሁ (እ)= 4 እናበጣምእስማማለሁ (በእ)= 5 በመስጠት ደረጃ ይስጡ

1. **የአቅርቦትሰንሰለትአስተማማኝነትአፈጻጸም**

	ተግባር፡ተአማኒነትአፈጻጸም	በ. አ	አ	ምን ም	እ	በ. እ
1	ሁልጊዜየደንበኞችትዕዛዞችያለችግርሙሉበሙሉይደርሳሉ					
2	ትዕዛዙየሚቀርበውለደንበኞችቃልበተገባው ቀንላይነው።					

3	ትእዛዞችየሚቀርቡትመስፈርቱንየሚያሟሉእንደጥበብዲዛይንለ ውጥ ያሉየጥራትችግርእንዳይኖሩ ተደርጎ ነው					
4	ከደንበኞችየሚቀርቡ ቅሬዎችየሚፈቱበት አሰራርአለ					
5	ድርጅቱ ትዕዛዞችን ሲቀበል አረጋግጦና ተስማምቶ ነው					

2. **ፈጣንምላሽየመስጠትአፈፃፀም**

	አቅርቦትሰንሰለቱፈጣንምላሽየመስጠትአፈፃፀም	**በ.አ**	**አ**	**ምንም**	**እ**	**በ.እ**
1	ድርጅቱበተቻለመጠንበአጭርየምርትእናየማቅረቢያጊዜለደንበኞችምላሽይሰጣል					
2	ድርጅቱከተወሰነውቀንበፊትወይምበተሰጠውቀንለደንበኞችመደበኛእና አስቸኳይትዕዛዞችበፍጥነትምላሽይሰጣል፡፡					
3	ድርጅቱጥራትያለውምርትበትክክለኛውመጠንበትክክለኛውጊዜለደንበ ኞችያቀርባል					

3. **አቅርቦትሰነሰለቱቶሎየመቀየርዕድል**

	እንደሁኔታውየመቀያየርአፈፃፀም	በ.አ	አ	ምንም	እ	በ.እ
1	የአቅርቦትእናየፍላጎትለውጥበድርጅቱውስጥበፍጥነትይስተናገዳል፡፡					
2	የምርትመጠንበገበያፍላጎትላይተመስርቶተለዋዋጭነው፡፡					
3	በጥሬዕቃአቅርቦትላይየተመሰረተየአቅርቦትእናየፍላጎትሚዛንመዛባትን ለማሸነፍድርጅቱተለዋዋጭነው፡፡					
4	በፍላጎትለውጥላይየተመሰረተከፍተኛፈተናሳይኖርየሚመረተውእናየ ሚደርሰውመጠንለለወጥይችላል					

4. የወጪቅነሳአፈጻጸም

	የወጪቅነሳአፈጻጸም	በ.አ	አ	ምንም	እ	በ.እ
1	ድርጅቱየወጪቅነሳአሰራርንተግባራዊ ያደርጋል፡፡					
2	የሚታዘዙ ዕቃዎችን መጠን በማስተካከል ወጪ ቀነሳ ዘዴ በመደበኛነትጥቅምላይይውላል					

3	ድርጅቱበጥሬዕቃአቅርቦት፣በምርትእናበአቅርቦትጊዜየተስተካከለመጠንይጠቀማል					

5.ሀብትአስተዳደርውጤታማነትአፈፃፀም

	የሀብትአስተዳደርአፈጻጸም	በ.አ	አ	ምንም	እ	በ.እ
1	ቋሚእናየስራካፒታልኢንቨስትመንትቶሎ መመለስ ላይከፍተኛአፈፃፀምአለ፡፡					
2	በጥሬዕቃዎችላይኢንቨስትመንትበድርጅቱውስጥበአጭርጊዜውስጥይመለሳል፡፡					
3	ድርጅቱበተሰጠውየጊዜክፍተትየንብረትአስተዳደርግምገማንተግባራዊ ያደርጋል፡፡					
4	በድርጅቱጥሬ ዕቃ ከተገዛበት ጊዜ እስከ ተሸጦ ገንዘብ እስኪገባ ድረስ ያለውጊዜፈጣን ነው፡፡					

Appendix 3:Observation checklist

1. How is the supply chain management activityof the organization?
    - The knowledge about SCM and attention given to SC management
    - About challenges of supply chain management
    - The way they manage the challenges
2. About SC planning
    - How is the SC planning process performed in the enterprise?

3. About sourcing process
    - How sourcing process is performed?
    - Flow of raw material from first tier supplier up to production process
    - What are sourcing related challenges?

4. How the material, financial and information flow is taking place in the organization?
5. Considering production process:
    - Production schedule, time and capacity utilization
    - Production strategy used (MTS, MTO)
    - What are constraints that hinder productivity of the organization?
6. How is product distribution and delivery process?
    - Is there delivery plan?
    - Delivery reliability?
    - Customers commit date and order fulfillment level
    - Customer satisfaction level analysis

7. How is inventory managed in the organization?
8. What are the marketing challenges of the enterprise?

Appendix 4: Order receiving format

የትዕዛዝ መቀበያ

የ---------- ሽመና ማህበር ትዕዛዝ መቀበያ

1	**ትዕዛዝ ሰጪ ደንበኛ ስም**		**ምርመራ**
	ትዕዛዙ የተወሰደበት ቀንና ሰዓት		
2	**የተፈለገው ምርት ዓይነት**		
	የሚሰራበት ጥሬ ዕቃ ዓይነት		
	የመጠን መግለጫ		
	የዲዛይን ዓይነት		
3	**ምርቱ የሚደርስበት ጊዜ**		
	ትዕዛዝ ማስረከቢያ ቀንና ሰዓት		
4	**የክፈያ ሁኔታ**		
	የአንዱ ዕቃ ዋጋ		
	ጠቅላላ ዋጋ		
	ቅድሚያ የተከፈለ ክፈያ		
	ቀሪ ክፈያ		

ትዕዛዝ ተቀባይ ስም ----------

ፈርማ ----------

ቀን ----------

Appendix 5: Handmade textile raw materials and products Photo

Hand spun yarn

Mill spun yarn in hank form

Mill spun yarn in drying after sizing

Dyed Mill spun yarn

Bulluko

Gabi

Netela/kuta

Kemis

Scarfs

different handmade products

Knitted hats

Traditional loom

Modified loom

Appendix 6: Sub Process of SCOR model used for "To Be" analysis

sS-Source	
sS1: Source Stocked Product	**sS2: Source Make-To-Order Product**
sS1.1 Schedule product deliveries	sS2.1 Schedule product deliveries
sS1.2 Receive Product	sS2.2 Receive Product
sS1.3 Verify Product	sS2.3 Verify Product
sS1.4 Transfer product to production department	sS2.4 Transfer product to production department
sS1.5 Authorize supplier payment	sS2.5 Authorize supplier payment

Source sub process, Source: Sub process (SCOR v.12.0)

sM-Make	
sM1: Make-To-Stock	**sM2: Make-To-order**
sM1.1 Schedule production activities	sM2.1 Schedule production activities
sM1.2 Issue material	sM2.2 Issue material
sM1.3 Produce and test (quality assurance)	sM2.3 Produce and test (quality assurance)
sM1.4 Package	sM2.4 Package
sM1.5 Stage products	sM2.5 Stage products
sM1.6Release product to deliver the order	sM2.6Release product to deliver the order

Make Sub process. Source: Sub process (SCOR v.12.0)

sD-Deliver	
sD1: Deliver Stocked product	**sD2: Deliver Make-to-order product**
sD1.1 Process inquiry	sD2.1 Process inquiry
sD1.2 Receive, enter and validate order	sD2.2 Receive, enter and validate order
sD1.3 Receive inventory, determine delivery date	sD2.3 Receive inventory, determine delivery date
sD1.4 Consolidate order	sD2.4 Consolidate order
sD1.8Receive product from source or make	sD2.8Receive product from source or make
sD1.10Pack product	sD2.10Pack product
sD1.13Receive and verify product by customer	sD2.13Receive and verify product by customer
sD1.15Invoice	sD2.15Invoice

Deliver Sub process. Source: Sub process (SCOR v.12.0)

- Return of defective and excess products was omitted here because it was not practiced in most cases.