Manufacturing Industry Supply Chain Modeling and Improvement in Developing Countries

Vom Fachbereich Produktionstechnik

der

UNIVERSITÄT BREMEN

zur Erlangung des Grades
Doktor-Ingenieur
genehmigte

Dissertation

von

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Tag der mündlichen Prüfung: 04.02.2015

ABSTRACT

Manufacturing industries are in dynamic changes in both developed and developing countries. It has increasingly been argued in the literature that for a company which strives for market competitiveness, it does not suffice just to excel at managing company's assets. Indeed, it has been suggested that "supply chains compete, not companies" (Lambert and Cooper, 2000). To this effect supply chain modeling and improvement is gaining more and more attention from academics and practitioners. With the recent emphasis by businesses around the world on the division of tasks, more and more activities are being outsourced to manufacturing firms in developing economies. Being the source of primary raw material, the performance of firms in developing countries is expected to contribute to the improvement of the entire supply chain. It is, therefore, important to seek a business process–oriented model that facilitates their modeling and improvement efforts. The need for such model is augmented after considering a recent trend of global supply chain integration of firms.

The motivation for this thesis is an interest to improve the supply chain processes that involves developing countries associated with the developed countries firms in production activities. Currently, different supply chain models have been developed that enable firms to model, evaluate, and improve supply chain activities. Among all the models, the most promising for supply chain modeling and improvement is the supply chain operations reference (SCOR) model. However, this approach is tailored to the needs of western, developed industries. Particularly, the early processes and products situated in the developing countries have totally different conditions and constraints. In consequence, these early processes in the supply chain have not been considered in the model. Many cross-cultural studies provide evidence that because of the existing business practices and operating environment differences, models in one country need to be adapted for effective use in another.

This research work seeks to investigate the current characteristics of supply chains that support adaptation works. The research utilized a two-phase, mixed methods research design supported by literature review. After thoroughly understanding the characteristics of the supply chain, the research adapted the SCOR model that suits the situations of firms in developing countries. The main contribution of this research is an adapted business process with appropriate building blocks for an adapted SCOR model for firms in developing countries. Then, the proposed model has been implemented as a case study in a leather and leather products industry. Future practical implementation and application of the adapted SCOR model in

situations of different manufacturing industries in developing country would allow for analyzing and possibly quantifying the benefits of the model.

ABSTRAKT

Die zunehmende Globalisierung der Wertschöpfungsketten stellt Produktionsunternehmen, ob in entwickelten oder sich entwickelnden Volkswirtschaften, vor immer wieder neue Herausforderungen. Die kontinuierliche Verbesserung der Leistungsfähigkeit eines einzelnen Unternehmens alleine reicht im globalen Wettbewerb heute nicht mehr aus. Im Zentrum steht immer mehr die Vernetzung eines Unternehmens mit anderen Unternehmen zu sogenannten Lieferketten (Supply Chains). In der Folge konkurrieren heute nicht mehr Einzelunternehmen miteinander, vielmehr stehen die aus einer Vielzahl von Unternehmen geformten Lieferketten heute miteinander in Konkurrenz. Entsprechend dieser Entwicklung hat in der industrialisierten Welt die Logistik in Praxis und Wissenschaft in den letzten Jahrzehnten eine quasi explosionsartige Ausweitung erfahren. Logistik, im Sinne einer die Produktion von Waren und die Verteilung von Waren unterstützenden Funktion, gehört heute in vielen Industrieländern zu den stärksten Wirtschaftszweigen. Demgegenüber steht die Logistik in vielen Schwellen- und Entwicklungsländern, trotz vieler Fortschritte und partiell guter wirtschaftlicher Wachstumsraten vor einer Vielzahl von Herausforderungen. Die Ursachen hierfür liegen u.a. in Defiziten hinsichtlich der infrastrukturellen, informatorischen und organisatorischen Dimensionen der Logistik

Das Supply-Chain-Operations-Reference-Modell (SCOR) dient zur Beschreibung aller unternehmensinternen und unternehmensübergreifenden Geschäftsprozesse entlang einer logistischen Lieferkette. Die Grundidee von SCOR ist die Entwicklung einer Standard-Methode mit der alle Gesichtspunkte einer Supply Chain (SC) beschrieben (modelliert) werden können. Während sich SCOR in den Industrieländern heute zu einem De-facto-Standard entwickelt hat, ist dessen Verbreitung im Bereich der Entwicklungsländer, abgesehen von den Aktivitäten großer, multinationaler Konzerne, gering. Dies beruht u.a. auf der Tatsache, dass bei der Konzipierung von SCOR die besonderen Herausforderungen von Entwicklungsländern nicht explizit Berücksichtigung fanden. Die frühen Prozessschritteeiner Lieferkette, die auf Basis von Rohstoffen vielfach in Entwicklungsländern durchgeführt werden, haben jedoch ganz andere Rahmenbedingungen und stehen vor anderen Herausforderungen. Mit dem Fokus auf die produzierenden Länder wurden diese frühen Prozesse in der Supply Chain im SCOR-Modell bisher kaum berücksichtigt. Viele interkulturelle Studien belegen heute, dass aufgrund der bestehenden kulturellen, infrastrukturellen und wirtschaftlichen Unterschiede im Unternehmensumfeld Konzepte und Modelle nicht ohne entsprechende Anpassungen von einem Kontext in einen anderen Kontext übertragen werden können.

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Ziel der vorgelegten Arbeit war es sowohl einen Beitrag zu einem besseren Verständnis der Herausforderungen im Supply Chain Management in Entwicklungsländern zu leisten als auch, darauf aufbauend, einen Vorschlag für die Anpassung des SCOR Modells in Bezug auf dessen Anwendung im Supply Chain Management in Entwicklungsländern zu entwickeln. Im Rahmen der Beschreibung der Zielsetzung wird der angestrebte Beitrag im Kontext der Unterstützung der Entwicklung leistungsfähiger logistischer Lieferketten in Entwicklungsländern anschaulich konkretisiert.

Zentrales Ergebnis der Arbeit ist ein Vorschlag zur Erweiterung des SCOR Modells damit dieses besser den besonderen Anforderungen von Schwellen- und Entwicklungsländern gerecht werden kann. Die vorgeschlagenen Erweiterungen basieren auf den Ergebnissen einer im Rahmen der Arbeit in Äthiopien durchgeführten Studie zu den spezifischen Herausforderungen und Rahmenbedingungen bei der Gestaltung und dem Betrieb von Produktions- und Logistiksystemen in Entwicklungsländern. Als wesentliche Grundlage der Studie diente eineigens entwickelter Bezugsrahmen, der die verschiedenen Dimensionen einer angemessenen Implementierung leistungsfähiger Produktions- und Logistiksysteme in Schwellen- und Entwicklungsländern systematisch beschreibt.

Das vorgeschlagene, erweiterte SCOR Modell wird abschließend im Rahmen einer Fallstudie im Bereich der äthiopischen Lederwarenindustrie umfassend umgesetzt. Die dabei gewonnenen Erfahrungen werden ausführlich diskutiert. Die Arbeit schließt mit einem Ausblick hinsichtlich einer weiteren praktischen Umsetzung und Anwendung des angepassten SCOR-Modells in verschiedenen Fertigungsindustrien der Entwicklungsländer.

Acknowledgements

I gratefully acknowledge the financial support of the Engineering Capacity Building Program (ECBP) and Hawassa University. The completion of this thesis would not have been possible without the committed support of several people. First of all, I would like to express my deep appreciation and sincere gratitude to my supervisor, Professor Dr.-Ing. habil Klaus-Dieter Thoben. He has guided me with his invaluable guidance and critical comments from the beginning to the end in the course of my thesis. I am also grateful to my co-supervisor, Prof. Dr.-Ing. Marcus Seifert. He always gave insightful comments and reviewed my work. They are both excellent mentors and have provided me support throughout my PhD study. I would like to extend my heartiest thanks to them for their patience and kind involvement in this study. Special gratitude is also extended to Prof. Dr. hab. Haasis who was my second reviewer and the first Supervisor when I have arrived in Germany during my first three months. I express my gratitude to Prof. Jürgen Pannek, for his being member on my final oral examination.

I am also indebted to the University of Bremen for offering me the opportunity to participate in this Doctorate Program. It is difficult to overstate my gratitude to Dr.-Ing Ingrid Rügge; Managing Director of International Graduate School for Dynamics in Logistics (IGS). In addition, I would like to thank all of my colleagues in BIBA-IKAP and IGS, especially, Raul Zuniga, Dr.-Ing Mehdi Safaei, Stefan Wiesner, Dr.-Ing. Thorsten Wuest, Dr.-Ing. Pierre Kirisci, Elaheh Nabati, and Robert Hellbach who has supported me in the different stages of the PhD processes. Moreover, it is important to appreciate all my Ethiopian friends, who helped me with their valuable comments and encouragements. I would like to thank also whole heartedly all friends in Hawassa University. My gratitude also goes to all representatives from participating companies who provided personal accounts and primary material for the thesis.

My final acknowledgements go to the people in my life who supported me throughout this process. I thank my mother, Alemitu Asrat; my wife, Amelework Abebe; my children, Zemene & Fikir, Mariyamawit; my sister-in-law, Mulualem Abebe, father-in-law Abebe Wudneh and all family members who provided their encouragement through my research. However, most of all my biggest gratitude goes to my beloved wife, Amelework, for her support, patience, understanding and constant love. I dedicate this work to her.

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1 INTRODUCTION

The manufacturing industries in developing countries (MIDC) are involved in the earlier stages of international supply chains, often producing raw material or doing basic assembly work of products that are then further processed or packed for consumption in the developed world. Firms both in developed and developing countries are trying to integrate activities such as sourcing, manufacturing and delivery processes into their production. The developing countries can be defined for this research: "a low- and middle-income country in which most people have a lower standard of living with access to fewer goods and service than do most people in high-income countries. There are currently about 125 developing countries with populations over 1 million; in 1998, their total population was more than 5.0 billion" (Davidson, 2007). The MIDC has been a part of global supply chains for long time as a supplier of raw material and manufacturer of finished products. Figure 1 shows the typical leather industry supply chain that involves firms from developing and developing countries. When looking at the leather and leather products supply chain, more of the upstream portion (closer to raw materials) is located in developing countries. However, firms in developed countries are more involved in final finishing activities at the end of supply chains (final products manufacturers and retailers). Such type of supply chains between countries existed for centuries, however recent advances in information and communication technologies now mean that decisions made in one country are almost instantly felt in another.

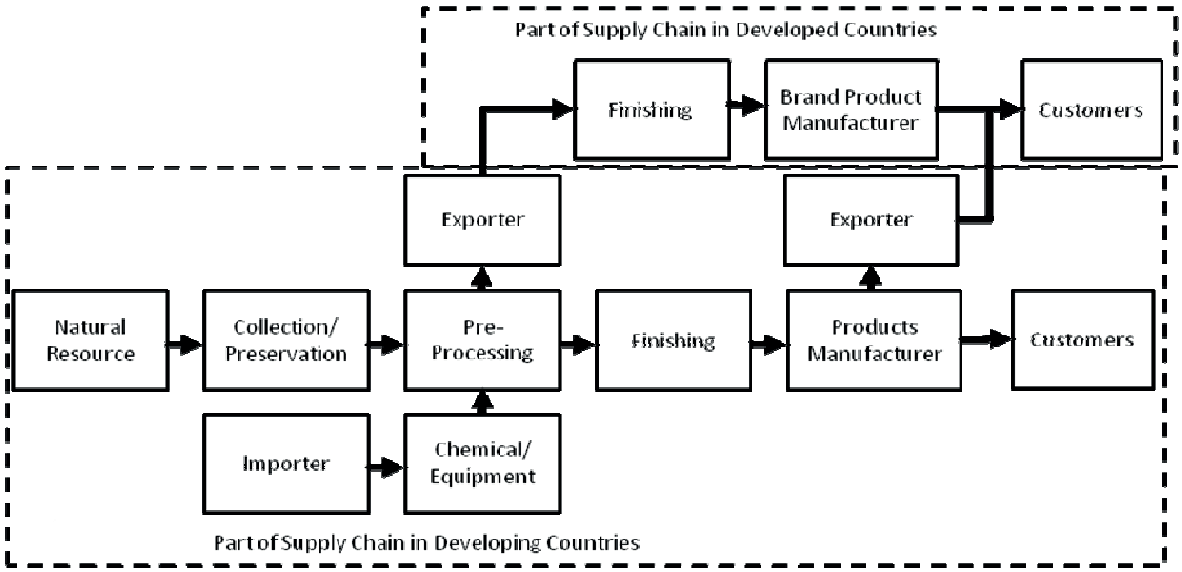

Figure 1-1: Typical leather supply chain involving developing countries

Recently, global markets fierce competition, growing customer demand, and ongoing development of ICT have forced business to invest in and direct attention to their supply chains. Supply chain management is becoming a strategic tool with

advancement of information and communication technologies (ICT) and physical infrastructure. A company versus companies has been replaced by supply chain versus supply chain competitiveness strategy. Firms in developed countries have started different initiatives to collaborate and share benefits and risks in the form of partnerships with their counterpart firms in developing countries (Ivarsson et al., 2005; Fleury et al., 2001; Humphrey, 2004; Trienekens, 2011). Nevertheless, most of the firms in developing countries still have focused their attention on the improvement of separate business functions. Hence, the anticipated improvement of the entire supply chain has been unsuccessful. Due to the recent trends and practices that suggest improving the entire supply chain as a tool for competitiveness, firms needs to model, measure, benchmark, and devise a mechanism for improvement. The SCOR model is an industrial standard for supply chain management, "a model that provides a unique framework for defining and linking performance metrics, processes, best practices, and people into a unified structure" (Stewart, 1997; Huang et al., 2004). The firms in both developed and developing countries which aim to improve their supply chains should consider their entire supply chain for successful improvement programs.

1.1 Motivation

Increased globalization and fierce competition have forced firms to focus their attention on designing, modeling, and improving supply chains (SC) as a whole rather than separate business functions on their own. Company success today depends on how the company integrates its supply chain. In recent years, the lack of process-oriented models has been recognized as the major problem in business process modeling, evaluation, and improvement of supply chains in the MIDC (Abdel-Salam, 2009; Deloitte, 2009; Irfan et al., 2008; Magder, 2005). Supply chain models can bring positive experience and benefits for the manufacturer in developing countries if they are adapted and implemented appropriately (Altekar, 2005). It is the capability of the supply chain that determines the competitiveness of firms and fully satisfies customer orders and requirements. A company can propose many initiatives in the form of best practices to solve different problems at different levels. It is one best practice for the firm to select appropriate improvement tools and evaluate the different initiatives before full implementation. In order to exercise the evaluation process, SC members involved must have a clear view of the current supply chain and what it looks like after implementation of the initiatives.

The SC model will help to find the improvement gap and select the best tools with high potential for improvement. Therefore, a supply chain model that describes the characteristics of the supply chain such as the relationship between partners, all business processes, and information flow should be created and understood. This creates opportunities for the development of different models for supply chain

modeling and evaluation activities. The supply chain operations reference (SCOR) model has established itself internationally in research as well in the industrial practices as a cross-industry standard for depicting supply chain management processes (SCC, 2010). The following question should be addressed before proceeding to the next discussion: Why has this research focused on the standard and complex model developed for western firms in developed countries? Three main reasons can be given: SCOR is composed of three building blocks: process modeling, performance measurement, and best practices. The model integrates performance metrics into the process model – which of course has to be adapted to the manufacturing industries in developing countries, e.g. by considering the existing supply chain practices and challenges. Secondly, the model is an inter-branch standard process reference-model and offers the integration of organizations from different sectors, such as industry, retail, and (logistic) service providers. Thirdly, the SCOR model is currently considered as industrial standard to design, model, and evaluate the supply chain. A large number of companies in developed countries have already implemented the model for their improvement efforts. Effective integration of the whole supply chain using the SCOR model must also include firms in developing countries, so that the entire supply chain can be modelled, measured, and analysed in terms of the influence of each organization's performance in the performance of the whole supply chain. Moreover, the language used for model development is easily recognized and common in the supply chain area.

Therefore, SCOR is accepted as a powerful tool in supply chain modeling and improvement. But the researcher cannot ignore that it originates from firms in developed countries. The successful model from developed nations may face new and different challenges in developing countries. A SCOR model preparation was mainly based for its initial development and revision on actual practices of firms from developed countries. It is also based strongly on the idea of information & communication technologies. To further enhance its modeling capabilities, it is worthy to consider the special characteristics of manufacturing industry supply chains in developing countries. Shewchuk (1998) says that "one size does not fit all," signifying a strong recommendation to find the best fitting supply chain management approach and model based on respective business activities and processes, and operating conditions and factors. There is, therefore, a need to examine the supply chain characteristics of the manufacturing industry in developing countries for successful adaptation and application of this model. This research based its background on how such type of model can be suited to unique situations in developing countries.

1.2 Research problem

In order to actively steer the design, modeling, and evaluation of the entire supply chain, a standard business process-oriented model with a reliable performance

measure and best practices is needed. Models and thorough understanding of the entire supply chains that involve the firms in developing countries are desirable in order to take the right measures in management. There are standard models in use to be able to analyze, compare, and measure different supply chain strategies, from strategic to operational levels. Models such as the SCOR model enable supply chain-wide modeling, evaluation, and improvement of processes. However, this approach is tailored to the needs of western, developed industries. The core argument is that business processes, best practices, and key performance indicator KPIs in the SCOR model rely on the fact that companies in developed countries are working in different environments and situations. This is the main reason why SCOR in its existing form is not appropriate for companies in developing countries. The core research problem is to find a model which considers and incorprates the unique conditions in developing countries in order to enhance the capability of the model for an end to end supply chains with one model – SCOR & d-SCOR.

The manufacturing industries in economically developed countries, such as the USA and EU, are well-designed and supported by an outstanding ICT and physical infrastructure. This, in turn, enables smooth flow of information and physical goods between suppliers, manufacturers, and customers. This is highly based on recent advances in information and communication technologies. With the lack of available resources and knowledge, it is difficult to implement this model in the manufacturing firms in developing countries. Importantly, the early processes' products come from developing countries; those industries have totally different conditions and constraints. The existing models did not meet these needs. As a consequence, the early processes in the supply chain often cannot be considered in a model because it was not applicable. The lack of such a standard industrial framework in firms of the developing country makes modeling and improvement efforts complicated. Such a supply chain model would also be much needed when productivity improvements and global supply chain integration efforts are required in the entire supply chain system. Many cross-cultural studies provide evidence that because of cultural and operating environment differences, successful models, approaches, and practices in one country need to be adapted for effective use in another country. By not considering the existing supply chain practices and engineer a SCOR model to fit the unique situations of firms in developing countries, even successful, well tested strategies and models that worked in developed economies can fail.

The models have been created and operated in developed country scenarios; they have faced different challenges and barriers, which may not exist in developed nations. As part of the initial literature review process, the author has identified the main challenges and barriers from previous research works focused on the challenges of supply chains in developing countries. In this thesis, these barriers

and challenges of SCM implementation are identified and classified (Gargeya et al., 2005; Khalifa, 2008; Swaminathan, 2007; Flores et al., 2008; Msimangira, 2009; Easton et al., 2002; Hamisi, 2011; Darroch, 2010; Barbbar, 2008; Hernandez, 2007, Kureshi et al., 2010; Ruteri, 2009; Holmes et al., 2006; Razzaque, 1997; Babbar, 2008; Stewart et al., 2002; Han et al., 2002; Al Falah et al., 2003). Figure 1-2 is a systematic representation of supply chain challenges and barriers in the MIDC. Generally, lack or limitation of resources, weakness or lack of ICT, cultural and organizational challenges, technical and physical infrastructure, shortage of qualified and experienced professionals, manual and semi-automated supply chain operations, and other factors that influence the success of supply chain models for companies in developed economies are largely different from those of the developing countries. Some of the challenges and barriers are discussed as follows.

Most firms in developing countries are importing manufacturing equipment and machines from the developed world. This requires a huge financial investment in heavy machinery and modern equipment. Advanced technologies to support the production processes also need considerable investment. Lack of private financial sources and bank loans remain as important barriers and challenges.

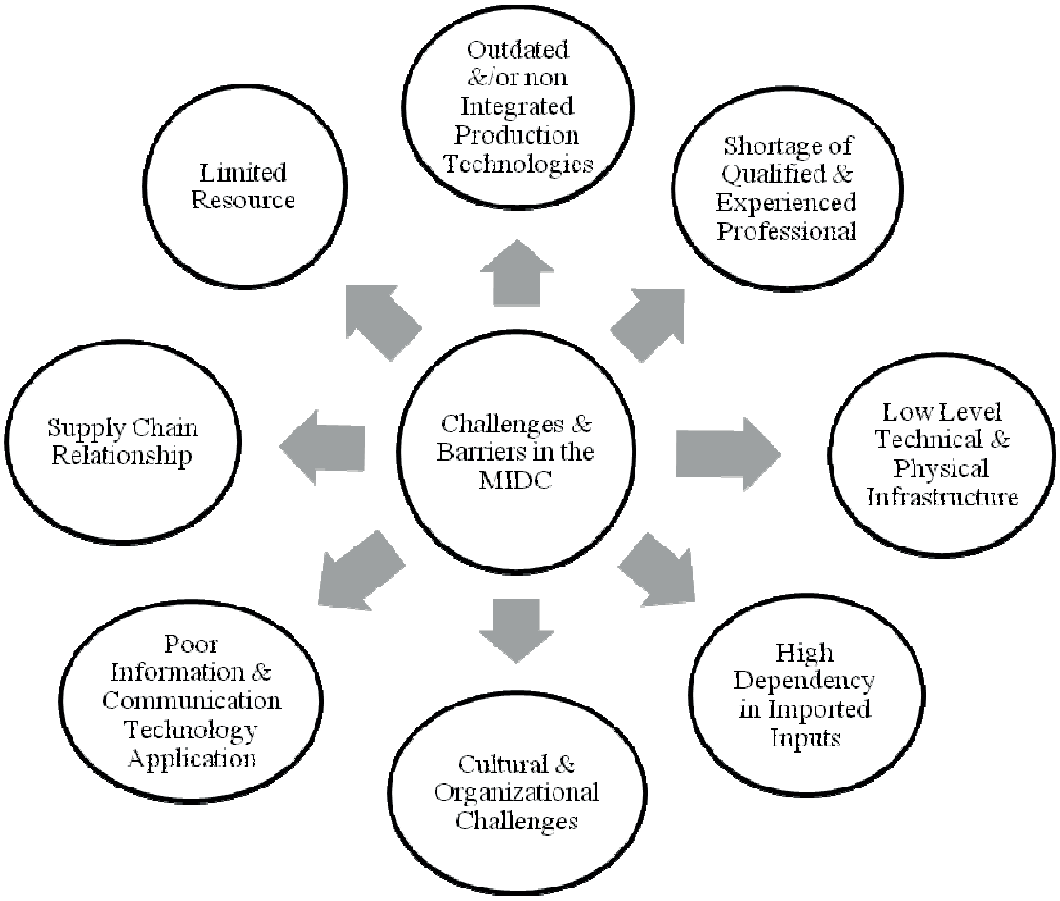

Figure 1-2: Supply chain challenges & barriers in the MIDC

From a technical perspective, supply chain operations have been operated and controlled on a manual or semi-automated basis with the support of basic or legacy applications. Even though there were some efforts to upgrade the production system, the existing machineries are based on outdated technology. Lack of connectivity, limited resources, and skilled labour are still challenges for direct application of the model. Lack of basic information technology infrastructure creates tremendous barriers for smooth information flow. While the benefits of having supply chain integration software are tremendous, the costs associated with purchasing, operating, and maintenance of such a system can be prohibitive. In association with low enablers facilities, data collection, analysis, and decision making becomes difficult for performance measures (Andersen et al., 2006). Lack of computerized systems and reliable, high-speed internet services are challenges to link suppliers with customers. The overall lack of skills and expertise often make it not viable for developing countries to develop complex models. The major challenge is to identify, evaluate and design the appropriate process-oriented model for assessing performance. Even if models are highly helpful, their adoption and implementation in developing nations' situations are often constrained by different business operation environments. As the issues of global integration and collaboration with the firms of developing countries are becoming important points of research agendas, the supply chain members and strategies vary from one country to another, and the KPI are bound to reflect those differences (Karuhanga, 2010).

Several cultural and organizational challenges are faced in ICT based advanced manufacturing technology implementation. When models are applied directly in the cultural context of developing countries, however, the systems face different types of challenges than in the developed nations. The models may not be designed to include all cultural aspects that influence individual and organizational behaviour in these countries. Because of these potential difficulties, the implementation of models in diverse environments is beginning to receive the attention of researchers (Karuhanga, 2010; Wall, 2007; Bititici, 1997). Rejc Buhovac & Slapnicar (2007) in their studies about models for performance measurement in Eastern Europe, point out those models should be designed for the context in which the company operates, implying that a system arising from a developed country must be adapted to the situations in the developing country. The other most comprehensive research on developing countries was done by Holmes et al. (2006). They have argued that implementation of the models in developing countries is difficult due to lack of resources, politicization of public administration, and corruption.

Lack of well-developed technical and physical infrastructure, which is a pre-condition for successful supply chain improvement, imposes big challenges. Unreliable electricity supply has been a long term problem. This does not only

affect production activities but also product delivery and information flows. Poor infrastructure leads to unresolved issues that are demonstrated in late deliveries and material shortages. Magder (2005) has exposed this issue by investigating the Egyptian apparel industry. He emphasized the need to improve the supporting infrastructure of the country to increase its export rate of industries such as: apparel, fresh food, and flowers.

Therefore, the SCOR model, developed for firms in the developed country environment, may not be suitable for the MIDC. In order to improve the entire supply chain, there is a need to include the unique supply chain characteristics of the firms of developing countries into the SCOR model. Hence, it is mandatory to assess and include the unique characteristics of the manufacturing firms in developing countries in order to enhance the SCOR model. This research is trying to fit the model to developing countries' environmental and local factors. It focuses on adapting the SCOR model with its building blocks: business processes, performance measures, and best practices to their local scenarios and conditions. The result of this research facilitates easy information exchange and flow in the entire supply chain. In addition, the model enables the transparent observation of material flows along the supply chain back to the raw material suppliers.

1.3 Research objectives and questions of the thesis

In the previous discussion, the researcher has shown a lack of supply chain models that consider the manufacturing industry in developing countries. In addition, successful implementation of a model created in developed countries is challenging, given the different conditions in developing countries. Therefore, the situation of the firms in developing countries does not fit within the SCOR model. The aim of the thesis to effectively utilize the SCOR model to measure, benchmark, and finally improve the entire supply chain. It also aims to adapt the SCOR to be able to integrate companies' business processes in DEVELOPING COUNTRY into the SCOR model in order to facilitate end-to-end supply chain design, model, and evaluation activities. Therefore, it is necessary to formulate a number of fundamental questions to guide the research analysis. As a result, the thesis research starts by assessing the current supply chain models. The literature review reveals that various supply chain models exist; some are general while others are for specific purposes. This raises the question about adaptability. Therefore the first question is:

- "Can the SCOR model be extended or adapted to suit firms in the supply chain of a developing country?"

In answering the first question, the literature suggests that adapting the existing models to the manufacturing industry in developing countries is one possible option (Georgise et al., 2012; Hamisi, 2011; Ohemeng, 2010). In fact, attempts have been made to adapt the SCOR model for different requirements in different

situations (Di Martinelly et al., 2009; Xia, 2006; Legnani, 2011; Paxton and Tucker, 2010; Yong et al., 2010). The previous results demonstrated that SCOR model adaptation to different situations is a possibility. However, in order to adapt the model to new situations, understanding of the existing conditions and defining the new requirements are the first steps for this research activity. The SCOR model has its building blocks: business processes, performance measures, and best practices. In addition, the successful implementation of the model depends on the existing information technology enablers. Research needs to focus on identifying supply chain characteristics in relation to business processes, performance measures, and best practices. The next research questions assess the existing situations and find gaps in the supply chain practices with the SCOR model:

- "What are the current characteristics of the manufacturing industry supply chain in developing countries?"
- "What are the differences between the supply chain's business processes in developing countries and the SCOR model's business processes for supply chain design, modeling, and evaluation activities?"
- "What type of key performance indicators and best practices are used currently in developing countries' manufacturing industry supply chain?"

After review of the current literature and field analysis, the results determine the unique characteristics of the firms in developing countries. This leads to the new requirement definition for the SCOR model adaptation. Then, the next step becomes the fifth research question:

"Which parts of the business processes are to be added, adapted, or removed in the adapted model with appropriate performance metrics and best practices in the MIDC supply chains conditions?"

The thesis has started by reviewing the available literature on supply chain modeling and improvement concepts, which helps to encapsulate various research outcomes in a structured manner. It helps also to formulate the survey questionnaires and semi-structured interview questions. This leads to the road for industrial investigation in local manufacturing industries. Utilizing the SCOR model and results from the literature review, an industrial survey was conducted using questionnaires and semi-structured interviews in the Ethiopian manufacturing industry. An industrial analysis has been carried out to assess how supply chains are managed, measured, evaluated, and improved in the manufacturing industry and detailed investigation studies were carried out in different organizations in Ethiopia.

The Figure 1-3 below shows an approach for adaptation. The MIDC industrial analysis was used to understand the characteristics of the manufacturing industry

supply chain. The output from the industrial survey was used to adapt the corresponding elements of SCOR model. The industrial analysis results then were compared against the SCOR model process elements. Corresponding process elements were chosen to regenerate manufacturing industry supply chain process elements, which would be based on the SCOR model concept. There is also a corresponding selection of suitable performance metrics and best practices for each process element to adapt the existing metrics or add new ones. Similarly, tasks can be done to the SCOR best practices to suit the supply chain characteristics.

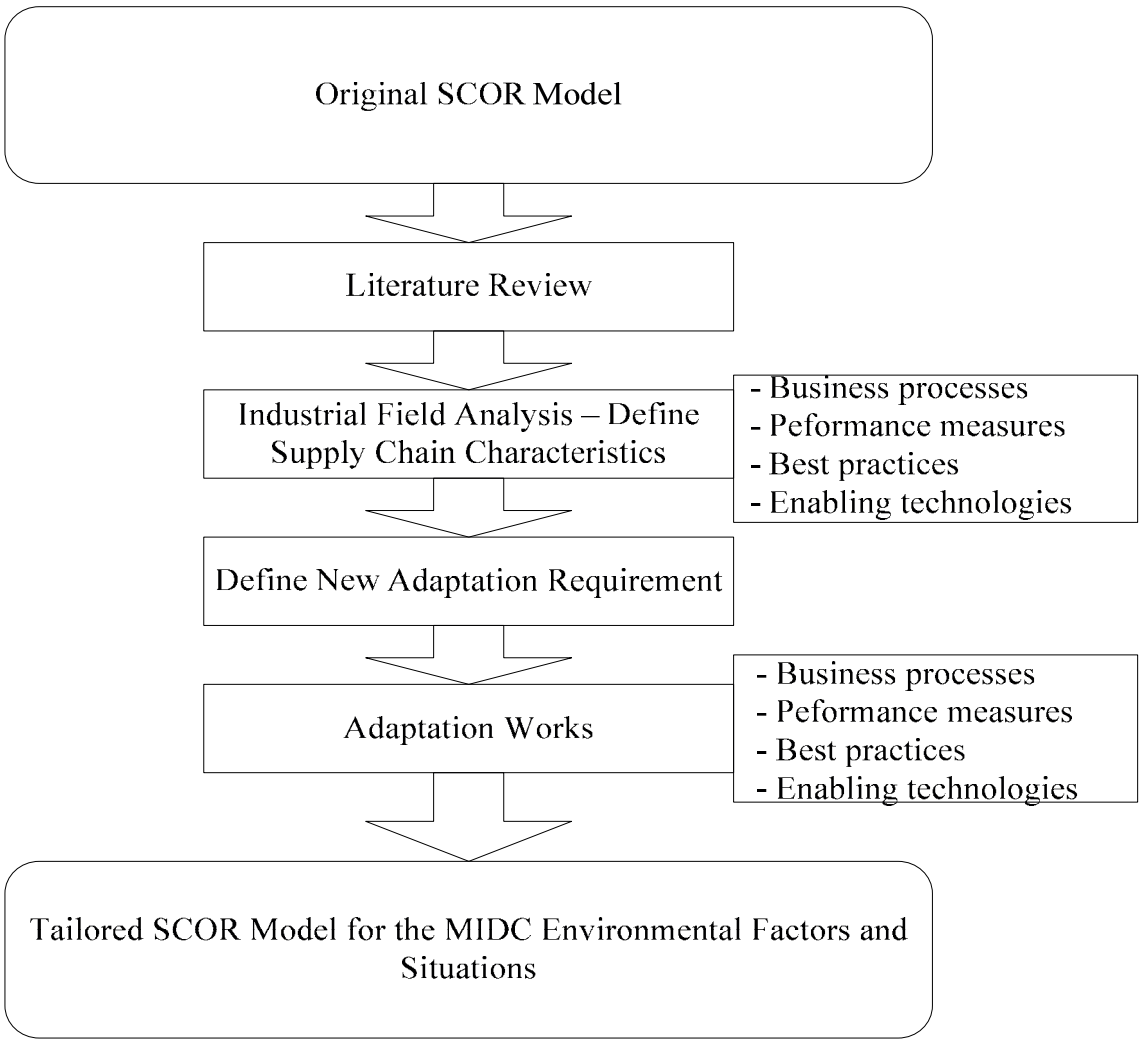

Figure 1-3: Approach for adaptation

1.4 Structure of the thesis

The thesis chapters follow the research approach that described in the previous section. Each chapter and its alignment to the research process are illustrated in Figure 1-4 below. A summary of each chapter is explained as follows. Chapter one introduced the topics of this thesis, problem statement and research objectives. It

states that the methodology and an overview of the approach followed for the research while illustrating how this relates to other chapters. Chapter two is the first part of literature review. It presents the review of the processes-oriented models, selection suitable model for further adaptation, the overview of the SCOR model and its previous adaptation to different scenarios.

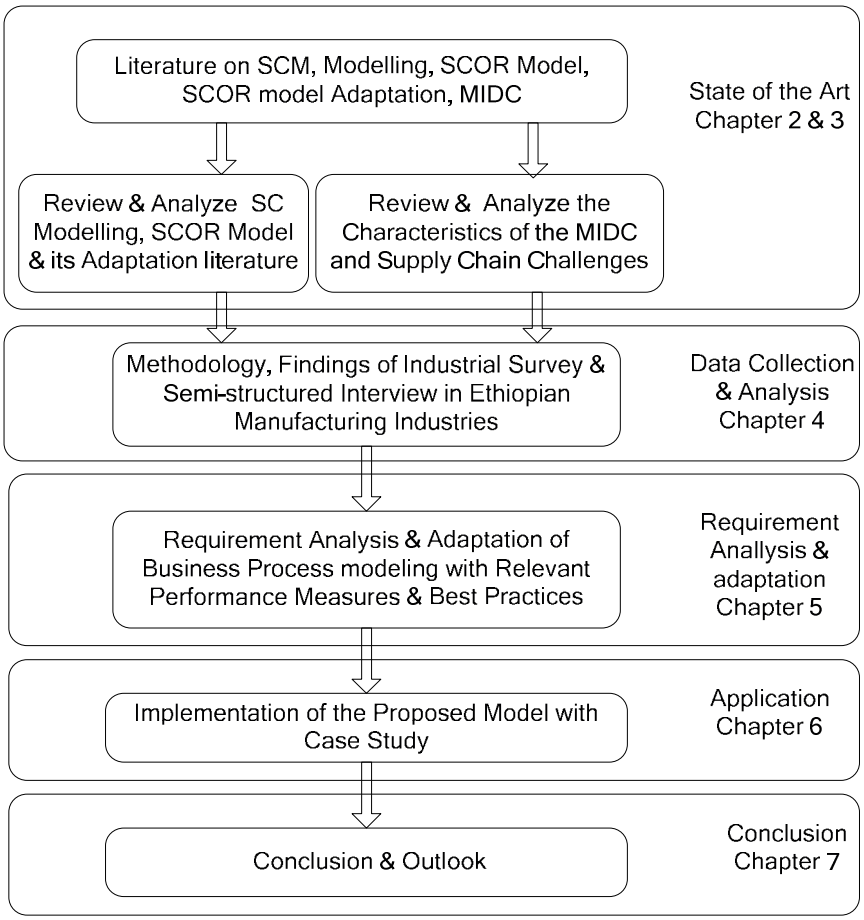

Figure 1-4: Outline of thesis

Chapter three is the second part of literature review. It discussed the participation of developing countries in global supply chain, the characteristics of manufacturing industries, supply chain challenges in developing countries and finally, manufacturing industries in Ethiopia. Chapter four focuses on the field research design and results. It explains the approach or the way in which the research process has undergone. It also introduces the results of questionnaire survey and semi-structure interviews. It provides an understanding of current supply chain characteristics, challenges and available enablers associated with SCOR model adaptation. The chapter is concluded by defining the existing characteristics of the supply chain.

Chapter five presents the requirements and results of the SCOR model adaptation activities. First, it discusses the requirements based on the results of the two studies and the literature review, and then determines the characteristics of the business processes, performance measures and the best practices in the context of a developing country. Secondly, it provides the adapted business processes with suitable key performance indicators and best practices. Chapter six provides implementation case study using leather and leather products industry. Chapter seven provides an overview of the thesis and a summary of the important research findings. This chapter includes implications of the research findings for researchers and practitioners, particularly those involved in SCOR model adaptation. The limitations of the study and future research directions are also provided in this chapter.

2 MODELING AND IMPROVING SUPPLY CHAIN

As new ways of doing business, a growing number of firms have begun to realize the strategic importance of modeling, measuring and then improving the business processes for entire supply chains. The application of the supply chain model describes the characteristics of the supply chain, such as the relationship between members, business processes and flow of information. Intra- and inter-company processes can be presented in well structured and clear ways that allow companies to analyze their processes and to identify possible inefficiencies. One way to address these issues is to systematically identify and visualize all involved members, processes and their interactions. However, the firms in developing countries which have interface with the companies in developed countries are not considering well: business processes modeling, performance measurement and the use of technology. In order to do this for the firms in developing countries, there are several proved process modeling and analysis approaches especially in the area of process-oriented models like SCOR model.

This chapter synthesizes the recent developments, existing supply chain modeling and improving activities and models used in the literature. The first section presents the overview of the processes-oriented supply chain reference models. In this section the researcher demonstrates the different reference models and identifies the potential supply chain reference model that can be adapted to suit the situations of the firms in developing countries. The second section presents an overview of the SCOR model. It discusses the SCOR model building blocks and analyzes the model for the possibility of further adaptation. Finally, the literature reviews are concluded by presenting previous works on the SCOR model adaptation to different situations. The objective of this section is to understand the previous adaptation works on the model and take a lesson focusing on the new situations for the model and methodology they have followed for their adaptation.

2.1 Process-oriented supply chain reference models

In companies' renovation activities of business process, process design is a key phase. The result of the process design is the foundation for better understanding and improving the processes. Such modeling and process design activities are challenging and very time-consuming tasks. The use of business process templates significantly increases the proper application of the process design. The process templates are generally called business process reference models (Kirchmer, 2009). Literature related to supply chain modeling and improvement provides a detailed history of the development and evolution of business process-oriented reference models. Therefore, this section presents the current state of supply chain models.

Before going to the detail discussion about the process-oriented reference models, it is important to discuss the basic concepts on business process and reference

models. Business processes put longer chains of connected activities with a possibly closed outcome into the centre of examination. The term "business process (BP)" is intensely discussed in literature. There are many definitions of the term "business process". The definition of Schulte-Zurhausen (2005) is adapted for this thesis: "A business process is a chain of functionally connected activities using information and communication technologies, which lead to a closed outcome providing a measureable benefit for a customer." In the literature the researcher found several definitions of reference models. Rosemann (2003) defines reference models as generic conceptual models that formalize recommended practices for a certain domain. Fettke and Loos (2003) contended that a reference model represents a class of domains. Reference models have the following characteristics (Fettke & Loos, 2007; Fettke & Loos, 2003): a representation of best practices; universal applicability; and reusability. Bringing together the notions of business processes and reference models allows the introduction of process reference models. Process reference models are a specific kind of object-oriented reference model focusing on the behavioral aspects of an organization through the analysis of its business processes. Process reference models can serve as bases for the selection and adaptation of reference processes according to the purposes of specific organizations. Here, benefits can be reaped in terms of reusability, benchmarking, improvement of transparency, collaboration and cooperation, process control, as well as process optimization, amongst others.

The scientific community presented different research results to guideline for modeling, techniques for construction, and criteria for evaluation of reference models (Becker et al., 2003; Vom Brocke, 2007). There are two ways to construct a reference model. This construction depends on either a large number of cases are investigated from which generic elements are derived that constitute a reference model, or an existing reference model is adapted to requirements identified. While the first approach depends on the number of cases, which is a requirement for being able to produce generally valid results that often is not easily met, the second approach is particularly reasonable if sufficient similarity can be identified between the domain of the basic reference model and the domain of the reference model to be developed. In practice, BP reference models are developed following deductive or inductive approaches depending on their practical or theoretical orientations. Most of the BP reference models available in the literature are completely or partly designed by scientists (inductive), only a small amount of them were developed by practitioners (deductive) (Fettke and Loos, 2003). While the new model development depends on the number of cases, which is a requirement for being able to produce generally valid results that often is not easily met. However, the model adaptation approach is particularly reasonable if sufficient similarity can be identified between the domain of the basic reference model and the domain of the reference model to be developed. This rational argument is a base for the adaptation of the SCOR model to the firms in developing countries. The use of the existing BP reference modeling has different

economic effects on the modeling process (Hilt, 2007; Fettke & Loos, 2007; Kirchmer, 2009): development costs of the reference model can be saved; a decrease in modeling time (the knowledge contained in the reference model reduces learning and development time, allowing the identification of and a direct focus on critical processes); reference models are proven solutions and provide better model quality and an awareness of own deficiencies; a decrease in modeling risk (the risk of failures during reference model usage can be reduced because reference models are already validated); and generally, it create a common language for use to supply chain improvement and communication across the members.

2.1.1 The existing process-oriented models

The literature review reveals the development efforts focused on supply chain models. The most prominent frameworks are the Supply-Chain Operations Reference (SCOR) model, the Global Supply-Chain Forum (GSCF) framework, Aachener PPS-Modell, the Customer-Chain Operations Reference Model (CCOR) and the Design-Chain Operations Reference (DCOR) model (SCC, 2010, Lambert et al., 2005; Ellram, et al., 2004; Lambert, 2006; Lee, and Billington, 1995). Other framework which is important for the development SCOR, CCOR and DCOR is the original Hewlett-Packard (H-P) (Ellram et al., 2004; Heinzel, 2005).

Global Supply-Chain Forum – is a widely accepted framework, besides SCOR. It is the framework developed by the Global Supply Chain Forum. The composition of the forum includes representatives from academia and industry. When implemented, the framework creates an integrated business unit. The framework essentially combines all of the functions necessary for a business to integrate into a single SC unit. The functions which GSCF includes in the integration are "customer relationship management, customer service management, demand management, order fulfillment, manufacturing flow management, supplier relationship management, product development and commercialization, and returns management" (Lambert, 2006).

Aachener PPS-Model - is "Aachener" Production Planning and Control System Model. It uses to describe production planning and control processes from different points of view. These so-called reference perspectives are required for separate stages and address IT-based and managerial aspects. There are four dimensions considering tasks, a process architecture, processes, and functions of planning and control of production systems. Thus, the model exclusively refers to this application area and has to be abstracted from that to create a possible input for a reference model for the supply chain (Schuh et al., 2006).

SCOR model –is a business process modeling tool, which takes place among several enterprises in a Supply Chain. The processes are comparable by the process

reference model. The supply-chain operations reference model (SCOR) is the first quasi-industry framework for evaluating and improving enterprise-wide supply-chain performance and management. It links process elements, performance metrics, best practice, and the features associated with the execution of a supply chain. SCOR integrates well-known concepts such as business process reengineering, benchmarking, and process measurement into a cross-functional framework. SCOR has become an accepted standard for the design of internal and cross-functional organizations (SCC, 2010). The SCOR model is presented in the next section in detail.

Customer Chain Operations Reference Model: is a relatively new operations reference model which released by the Supply Chain Council in June 2004. The Hewlett-Packard Business Process Management Group has developed the model. The model consists of 5 processes: Plan, Relate, Sell, Contract and Assist (SCC, 2004). Presentation of the CCOR model detail is much like SCOR, using similar notation, definitions and presentation. The intent of the CCOR model is to provide a structure for the customer interaction in the sale and delivery of a product. The model is significantly focusing on the relationship processes. This is evident in the provisioning of a Relate process, Contract process and Assist process. Each process involves the relationship with the customer.

SAP R/3 reference model –originates from business practice and is based on the ARIS-model. It provides different sections such as Financials, Logistics, and Human Resource Management. There are plenty of versions designed for different business processes (Keller et al., 1999; Lietschulte and Keller, 1998). The reference model is highly associated with the domain of manufacturing.

2.1.2 Selection of process-oriented reference models for adaptation

The reference models which have been discussed in previous sections have different objectives and hence have also different concerns in development activities. This section presents the selection criteria and selected reference model. Even though, there is no direct literature that is relevant for the firms in developing countries, the researcher has used the experience of different researchers selection criteria followed by Deindl et al. (2010) Seifert (2007) and James (2006). For this reason, the required features of process-oriented model for the manufacturing firms in developing countries are described with the following five criteria:

i. Process-Oriented - The recent development and high business process demands a process oriented perspective of the reference models that can facilitate the integration of process model. It should also provide non-financial perspectives that combine with financial performance indicators.
ii. Domain specific requirements - The available reference model is suitable only if it can be implemented for the specific process modeling situation.

For this reason, the designed reference model must be applicable to the manufacturing industry in developing countries situations.

iii. Multi-tier relationship - The new global supply chain trends gear the manufacturing industry in developing countries to focus more on integrating that involve with different customers and suppliers. The model ability to integrate global supply chain leads to contribute for inter-organizational process chains. That is why the analysis of the processes with differing range is required in the entire supply chain analysis.

iv. Acceptance and dissemination - Other factors to be considered in the selection process is the acceptance and the degree of dissemination of a reference model in both academia and practical areas. The number of recent researches and publications, and companies involving in the application the reference model allow estimating practicability of the reference model.

v. Adaptability - A reference model must be flexible to account and to suit the new requirements of the manufacturing firms in developing countries. It is usually required for the reference models to balance between adaptability and universal applicability of the model, which is crucial.

vi. Universally applicable - When the selection criteria are set for the consideration of the reference model, there must be generic ones that can be applicable to different situations and also almost be valid in the long term.

Based on the experience of previous selection criteria and reference models behaviour, the selection analysis is conducted. Figure 2-1 is illustrated the selective approaches to business process reference models including a qualitative assessment of their convenience to the firms in developing countries. Among the above reference models, the SCOR model represents the best choice as starting point for further adapting the model to suit the manufacturing firm in developing countries. The main arguments are:

(i) The SCOR model can be viewed as a quasi-standard for the modeling of process chains and appears globally, because of the world-wide net of the Supply Chain Council. So, the business processes in the manufacturing context are well represented in the model. This fact facilitate the entire supply chain improvement programs that involve firms in the developing countries;

(ii) SCOR includes key performance indicators that facilitate a better performance measurement efforts that involve the raw material suppliers and the manufacturing operations;

(iii) SCOR includes best practices that help companies' benchmark and improvement activities.

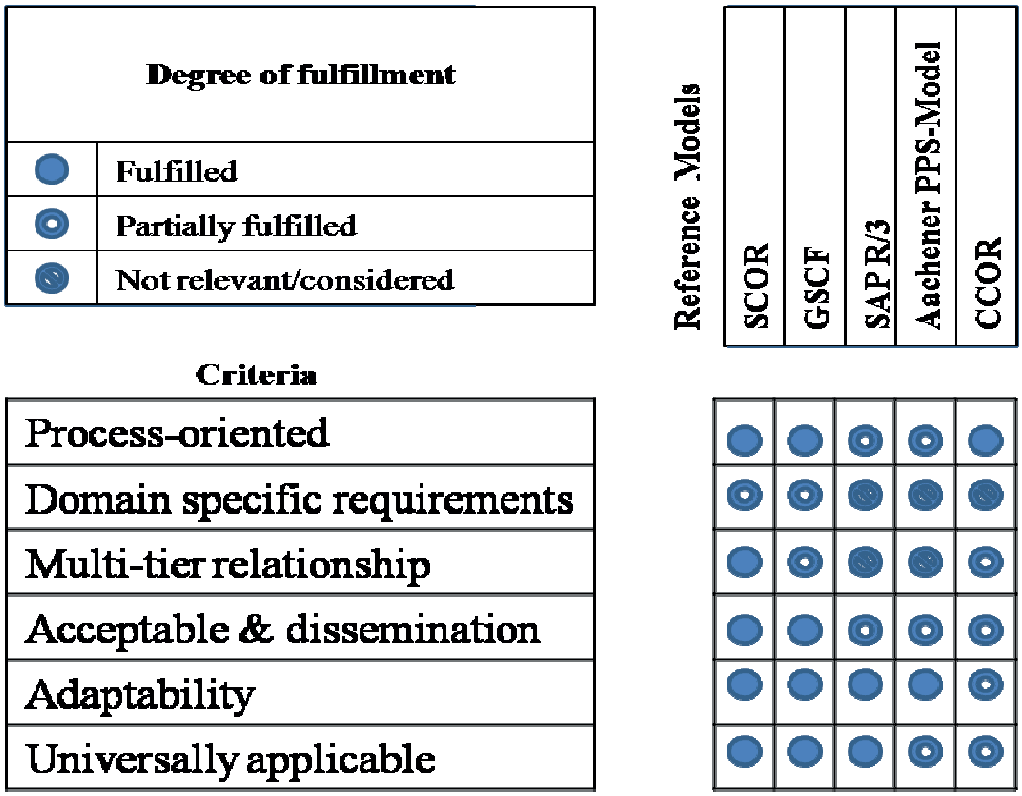

Figure 2-1: Selection of process-oriented reference models for adaptation

Generally, SCOR model provides the most comprehensive approach, but it has to be investigated to suit for the challenges in developing countries. For this reason, the SCOR-approach is taken as initial point for adapting the model for the manufacturing industry in developing countries within the scope of this thesis. Originally intended for the modeling of supply chains in developed countries situations, it has to be checked for its applicability to firms in developing countries. For this, the overview of the SCOR model is described in section 2.3.

2.2 Performance measurement systems

From recently published papers and literature, it is apparent that the terms, frameworks, models, and systems are often used interchangeably within performance measurements. For the purpose of this thesis, the researcher considers the performance measurement system as useful way of thinking about modeling, evaluating, and improving supply chains. Lee and Bilington (1992) suggested SC performance measurement systems (PMSs) as necessary for firms to successfully implement SCM. According to Neely et al. (2002) “A Performance Measurement System is the set of metrics used to quantify the efficiency and effectiveness of past actions” and “it enables informed decisions to be made and actions to be taken

because it quantifies the efficiency and effectiveness of past actions through the acquisition, gathering, sorting, analysis, and interpretation of appropriate data." PMSs are considered to be tools for gaining competitive advantages and continuously reacting and adapting to external changes (Cocca, 2010).

Love and Holt (2000) and Mbugua et al. (1999) make distinctions between performance indicators, performance measures, and performance measurement. Mbugua et al. (1999) state that performance indicators determine the required measurable evidence to prove that a planned effort has achieved the expected result. Based on their definition, indicators are called measures when they can be measured without ambiguity and with some degree of precision. In other words, performance measures report clearly about the relationships between program activities, outputs, and outcomes associated with them. He also claims performance indicators are less precise than measures, as they usually provide only a proxy indication of the performance of a program or system. When it is not possible to find a precise performance measure, it is better to refer to performance indicators. However, performance measures and targets are key elements of performance measurement (Love and Holt, 2000 and Mbugua et al., 1999).

Research on performance measurement systems (PMS) have mostly been focused on a single company. However, in the last few years focus has shifted to incorporate a supply chain perspective, with several PMSs being proposed (Holmberg, 2000; Van Hoek 1998; Lapide, 2000; and Chan and Qi, 2003). An important step in transforming the individual business units into a fully operational integrated supply chain member is the design and implementation of supply chain performance measures and performance measurement systems. From such a design each business enterprise will take responsibility not only for its own business performance but also for the overall performance of the supply chain (Gunasekaran, Patel and Tirtiroglu, 2001). Hence there is an increasing focus on supply chain measures and overall performance. The organizational dependency and supply chain relationships are growing more complex, from linear to multi-echelon, outward-facing networks. With increasing integration of global supply chains and involvement of developing countries, the manufacturing companies have faced more challenges and barriers to model, measure, and improve their supply chains.

In certain developing countries, such as India, performance improvement efforts are being concentrated on improving productivity (Bheda, 2002; Bheda, 2003). However, instead of simply improving productivity, companies should understand the basis of performance measurement in their supply chains and improve their operations to meet the terms of performance of their suppliers and customers. This idea is illustrated by the Triple P-model (Figure 2-2). This figure has also demonstrated that performance is based on profitability and productivity, and

includes attributes of quality, delivery, speed, flexibility, and price recovery (Tangen, 2005).

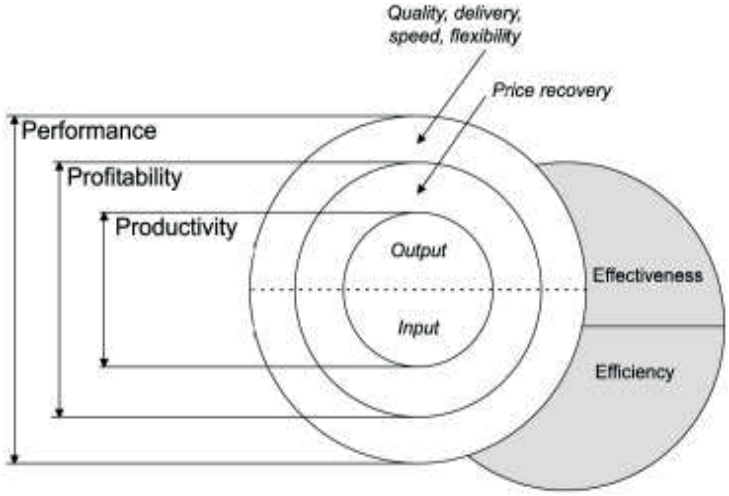

Figure 2-2: Triple P-model (Tangen, 2005)

However, Waal (2007) cites a number of studies, which show that recently there is increasing interest in performance measurement in most organizations in some African countries such as Burkina Faso, Egypt, South Africa, Kenya, Ghana, Uganda, and Ethiopia (Waal and Augustin, 2005; Abdel Aziz et al., 2005; Motswiane, 2004; Malinga, 2004; Tessema, 2005; Ohemeng, 2009). Despite such efforts, the researchers have argued that performance measurement has not made tremendous contribution to organisational efficiency and effectiveness in Africa (Ohemeng, 2009). Despite the increasing interest in performance management the 56 percent failure rate in the implementation process is still relatively high. Hence, there is an urgent need for companies in developing countries such as Ethiopia to adapt PMSs that suit their needs and contexts taking into account national issues, infrastructure, and organizational culture. The survey questionnaires and interview questions were developed from a critical review of the literature on performance measurement system, supply chain, and the SCOR model (SCC, 2010; Gosselin, 2005; and Hasan, 2008). The results of the literature review were used for developing better questionnaires.

2.3 Overview of the Supply Chain Operations Reference (SCOR) model

The Supply-Chain Operations Reference-model (SCOR) developed by the Supply-Chain Council is a process reference model that serves as a diagnostic tool for supply chain management. In 1997, the Supply-Chain Council released the first version of the SCOR model. It included Plan, Make, Source, and Deliver as the stages of the supply chain in addition to performance measures, best practices, and enabling technology (Phelps, 2006). The SCOR model (version 10.0) consists of four major components: **Performance**: Standard metrics to describe process

performance and define strategic goals; **Processes**: Standard descriptions of management processes and process relationships; **Best Practices**: Management practices that produce significant better process performance; **People**: Standard definitions for skills required to perform supply chain processes.

SCOR model has been warmly greeted by industries since it was introduced (Vijay, 2005). This process reference model is designed to facilitate communication among supply chain members (SCC, 2010). It provides a common language for communication and is used to describe, measure, and evaluate the supply chain configuration. SCOR combines the concepts of the business process reengineering, benchmarking and best practices. The SCOR model encompasses all the activities of suppliers, customers, material flows, and all market interactions. Figure 2-3 demonstrates the SCOR model with its five processes and interrelations.

Figure 2-3: Interrelation of five key processes of SCOR (SCC, 2010)

The lower case ``s`` in the SCOR model refers to the process belonging to the original SCOR model (SCC, 2010). The SCOR model consists of five basic processes, Plan (sP), Source (sS), Make (sM), Deliver (sD), and Return (sR). The SCOR modeling approach starts with the assumption that any supply chain process can be represented as a combination of the processes sP, sS, sM, sD, and sR. The Plan process balances to best meet the demand and supply the sourcing, manufacturing, and delivery requirements. SCOR model contains three levels of process details. Level 1 is the top level that deals with process types. It defines the scope of a supply chain. Level 2 is the configuration level, which deals with process categories. Level 3 is the process element level and is the lowest level in the scope of SCOR model. For the third level business processes, the figure demontrates in detail some selected level two processes. The SCOR model process definition at level I have shown in Table 2-1. The SCOR model business process element performances can be measured at several levels.

The performance section of SCOR consists of two types of elements: Performance Attributes and Metrics. A performance attribute is a grouping of metrics used to express a strategy. An attribute itself cannot be measured; it is used to set strategic direction. Metrics measure the ability of a supply chain to achieve these strategic attributes. Table 2-2 shows the definitions of the five SCOR model performance attributes.

Table 2-1: SCOR Level 1 Process Definitions (SCC, 2010)

SCOR Process	Definitions
Plan	Processes include gathering customer requirements, collecting information on available resources, and balancing requirements and resources to determine planned capabilities and resource gaps.
Source	Processes describe the ordering (or scheduling) and receipt of goods and services.
Make	Processes describe the activities associated with the conversion of materials or creation of the content for services.
Deliver	Processes describe the activities associated with the creation, maintenance, and fulfillment of customer orders.
Return	Processes describe the activities associated with the reverse flow of goods back from the customer.

Table 2-2: SCOR performance attributes and their definitions (SCC, 2010)

Performance Attribute	Definition
Reliability (RL)	The ability to perform tasks as expected. Reliability focuses on the predictability of the outcome of a process. Typical metrics for the reliability attribute include: On-time, the right quantity, the right quality
Responsiveness (RS)	The speed at which tasks are performed. The speed at which a supply chain provides products to the customer. Examples include cycle-time metrics.
Agility (AG)	The ability to respond to external influences, the ability to respond to marketplace changes to gain or maintain competitive advantage. SCOR Agility metrics include Flexibility and Adaptability
Costs (CO)	The cost of operating the supply chain processes. This includes labor costs, material costs, management and transportation costs. A typical cost metric is Cost of Goods Sold.
Asset Management Efficiency	The ability to efficiently utilize assets. Asset management strategies in a supply chain include inventory reduction and in-sourcing vs. outsourcing. Metrics include: Inventory days of supply and capacity

The performance measures developed by SCC use three performance metrics levels similar to the SCOR business processes according the needs of diverse control and information. The SCOR model version 10.0 in total presents 570

performance metrics. Reliability, Responsiveness, and Agility are considered customer-focused. Cost and Asset Management Efficiency are considered internally-focused. Associated with the Performance Attributes are the Level 1 Strategic Metrics. These Level 1 Metrics are the calculations by which an organization can measure how successful it is in achieving its desired positioning within the competitive market space. The SCOR model presents a three level business processes with their corresponding performance measures hierarchy for a supply chain. Appendix 9-6 demonstrates the SCOR model performance measures at level I with a definition of metrics.

Best Practices of the SCOR model are meant to give concrete approaches for the execution of processes that have been used successfully in practice. These were collected by the members of the SCC over time. A best 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 to 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. The SCOR model (SCC, 2010) defines "best practice as a current, structured, proven, and repeatable method for making a positive impact on desired operational results." SCOR best practices have been collected from diverse industries by SCOR practitioners. The SCOR model recognizes that several different types of practices exist within any organization: leading or emerging practices, best practices, common practices, and poor practices. What is 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 common, but be considered a leading or best practice in another industry (SCC, 2010). Best practice analysis follows the benchmarking activity that should have measured the performance of the supply chain processes and identified the main performance gaps. It is understood that not all best practices will yield the same results for all industries or supply chains (Georgise et al., 2013b). The Best Practice Section of the SCOR-model can be divided into 3 parts: Best Practices of SCOR in general, Best Practices of Green SCOR, and Best Practices of SC-Risk Management. It first appears in Version 9.0 of the SCOR-model. As already indicated before, each part contains several Best Practices, which are listed in alphabetical order with the processes they can be applied to. Thematically they deal with different ways of improving a process. For example, there are suggested complex management methodologies such as Six Sigma, Lean Management, and Kanban, and technological tools like Electronic Document Management, Customer Relationship Management. Even concrete advice is included, such as "Packaging Operation is an Integral Part of the Overall Production Process" or "Single Point of Contact for All Order Inquiries (including order entry)."

The SCOR models integrate three building blocks into a single framework. The performance metrics, for example, are linked to the processes to allow root-cause analysis of performance gaps. Similarly, the best practices are linked to the metrics and the processes; this allows users to identify implementation requirements and target performance improvements. Together, they form a framework that supports a relatively rapid, consistent method for defining supply chain processes and can then be used to manage and improve performance. For each process in the SCOR model, there are recommended corresponding best practice for implementation. An example of associations for process template "sM2.3: Produce & Test" is shown in Figure 2-4. Industry-proven best practices are associated with each activity available in the model.

2.4 Previous adaptation research on SCOR model to different situations

This section discusses the previous work on the SCOR model adaptation. The intention of the review was to understand previous research by focusing on the types of industries and the research approaches that have been used for the adaptation. This process has helped for focusing and guiding adaptation work with lesson learned from previous results. In addition to timely revision of the SCC, different academics and practitioners have been trying to adapt the SCOR to their local operating conditions and environmental factors. The literature review reveals a number of research works and papers on SCOR model adaptation. The SCOR model is designed to improve manufacturing firms in developed countries (Poluha, 2007). However, different academicians and practitioners have tried to apply it to many different industries. Examples include application for the service industry by Di Martinelly et al. (2009) and Xia (2006); for after sale by Legnani (2011); for government agency contract requirement by Paxton and Tucker (2010); for agriculture industry by Yong et al. (2010). Legnani (2011) and Di Martinelly et al. (2009) have pointed out that the SCOR model sometimes is too general and adaptations to different industries are necessary. Legnani (2011) adapted the SCOR model to the specifics of the after-sales processes, and Di Martinelly et al. (2009) to the health care supply chains. Both seem to have a top-down approach for adaptation. For this thesis, the research papers have been summarized into seven categories for discussion: manufacturing industry environment, construction industry, service industry environment, military environment, geographical information system (GIS) and information technology (IT) environment, logistics operations environment, and collaborative supply network environment.

SCOR model adaptation to manufacturing industry: Here the SCOR model is designed and applied for manufacturing industries. However, the SCOR model has also been adapted to suit the identified different conditions from the original SCOR model assumptions based on identified new requirements. Research results from different practitioners and academics were produced accordingly. There are a few research papers on adaptation of SCOR model to the manufacturing industry

situations. The ongoing research by Fronia et al. (2008) has shown how SCOR may be extended in order to develop a framework for supply chain design. The researcher has suggested six standard process models for source process in level II. In comparison to those original to SCOR, these six models show greater improvements, distinguishing more clearly between different modes of procurement. Consecutively, it is demonstrated how these level II models were detailed on the SCOR level III and IV. Using the above extended models and framework it is becoming possible to gather appropriate data for the process cost, and cost of capital tied up in the structure. The other research by Hwang et al. (2008) identified critical metrics for the sourcing processes in the thin film transistor-liquid crystal display (TFT-LCD) industry supply chain in Taiwan. Although the study focuses on the source management process, the other four management processes are also considered. No extensions are made to the model. Desodt et al. (2007) also collected information from textile and garment industry supply chains in order to model the supply chain. Then, using these performance data, they have identified important variables. They have investigated the endogenous and exogenous relationships among variables.

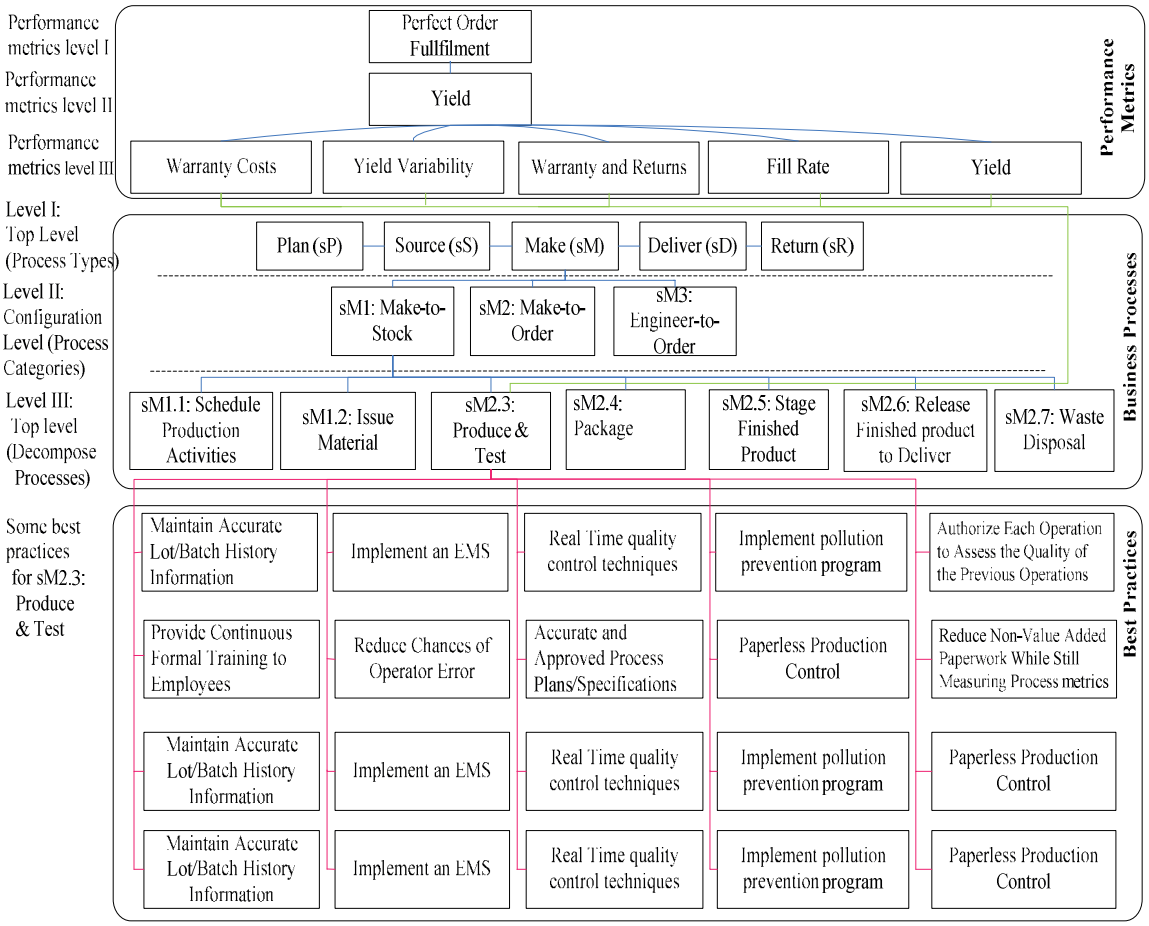

Figure 2-4: SCOR model best practice with performance measures & process element at level 3 for sM2:3 produce and test (SCC, 2010)

Additionally, similar research has also been done by other researchers to adapt and extend the SCOR model to suit the new requirements such as Han et al. (2007) and Lim et al. (2007).

*Adaptation of SCOR model to construction industry***:** One of the industry types that need modeling and improvement tools is the construction industry. In recent papers, the application of a holistic model for measuring logistics performance to improve the construction industry and its supply chains has been identified by Johansson and Persson (2011), and Persson et al. (2009, 2012). In addition, Johansson and Persson (2011) have recommended the use of the SCOR model in the construction industry as a suitable analysis tool. After extensive group research by Johansson and Persson (2011), they reached the conclusion that in the case of the construction industry there is a strong need for a structured analysis tool with predefined metrics and process definitions that support the logistics activities at the construction site. Through long research efforts, it has been proven that the SCOR model can be a useful starting point for further development of the adapted SCOR model for construction. Persson et al. (2009, 2012) also show that the SCOR model probably needs to be adapted to the construction settings. Persson et al. (2009, 2012) in their findings from the case study have proposed for new Deliver and Source sub-processes, changes in current sub-processes, and new metrics. These changes constitute the first version of the Builder's SCOR model (BSCOR).

SCOR model adaptation to service industry: The SCOR model has many limitations when applied to the service industry. Two of the most significant limitations are the semantics and process types. The limiting factor of the semantics and process types is the connotation of the embedded definitions. An example is the definition and use of the "MAKE" process. Semantically the "MAKE" definition in SCOR is the process of manufacturing that adds value to a product (SCC, 2010). James (2006) has adapted the SCOR model for the service sector. The conversion of the SCOR "MAKE" process to service semantics creates a situation that is lost in translation. In fact, the "MAKE" in the service industries does not have a direct translation. Another process that is not in any services setting is the "RETURN" process. One reason is that the physical return of a service is highly improbable. This is because once a service is rendered; the service is consumed, thus invalidating the semantic and process descriptions in relation to services (James, 2006). Ellram et al. (2004) have evaluated the applicability the different models for a Service SC based on three product-based manufacturing models: Global Supply Chain Forum (GSCF) Framework, the SCOR model, and Hewlett Packard's supply chain management model. Xia (2006) has analyzed SCOR limitations for application in Telecom industry. The SCOR has enhanced and proposed a practical roadmap for SCM modeling and implementation and applied this in a case study for Telecom industry. The research paper has also analyzed qualitative and quantitative benefits from the SCOR implementation in Telecom industry. Lange et al. (2007) have presented the conceptual performance

framework for the measurement of operational performance in the domain of industrial service. Baltacioglu et al. (2007) have also developed a new framework built on the existing knowledge derived from the SCOR and Ellram models, with an application in the healthcare industry. The name of the model (IUE-SSCM) is derived from the initials of the affiliated organization of the authors and Service Supply Chain Model. After thorough investigation, they have constructed the IUE-SSCM model to cover three basic units in the chain: the supplier, the service provider, and the customer. The service provider is the focal company in the supply chain that performs the service, and it claims the manufacturer's role in the traditional supply chain literature.

SCOR model adaptation to military industry: Like any other sectors, the military industry has always used knowledge from other sectors for improvement of its activities. The South African National Defense Force (SANDF) has investigated and proposed methods to improve its logistics and inventory accounting capabilities (Bean et. al., 2009). The researchers have decided that supply chain management in conjunction with the SCOR model can be used to improve the SANDF's logistic effectiveness and inventory accounting. The SCOR V.9.0 Model was chosen as a basis for the SANDF's supply chain analysis. Three case studies of increasing complexity were conducted. During these case studies it was ascertained that the SCOR model did not cover the activities with regard to materials in the SANDF supply chain sufficiently. Consequently, the SCOR model has been extended to suit the military environment. The results of an extension analysis have included the introduction of a sixth management process, USE, which describes the use of ammunition and user systems, such as an armor regiment, during training and operational exercises.

SCOR model adaptation to IT & GIS industry: Schmitz (2007) has used the SCOR model to introduce supply chain management into a GIS unit in order to improve the effectiveness and efficiency of the unit when creating a GIS product. The SCOR focuses on the management of the data used by a GIS unit. In the extended version of the SCOR model, GISDataSCOR, the original five management processes are used, and the Make Process is extended to include an extra process category for maintenance (M4: Maintain-to-Stock). Fayez (2005) has explored the intricacies of the SCOR in his research. This research has documented the weaknesses of the SCOR model and developed views of the framework to enhance the capability of the model (Fayez, 2005). Enhancements to the SCOR model include the ability to define interactions using a common ontology at the enterprise and functional unit level, as well as clarifying the complexities involved within the supply chain. One of the conclusions drawn from this research is the need for a variety of views for other sectors outside of manufacturing.

SCOR model adaptation to collaborative network: There was some research also to study the SCOR model adaptation for collaborative networks. Some researchers have adapted and applied the SCOR model specifically to a virtual organization, such as the performance measurement system by Seifert et al. (2008). At the same time, there are some conceptual models based on the SCOR based model (Westphal et al., 2008). The adapted conceptual models can help decision makers to achieve the specifics purposes or strategies or identify new challenges (Francisco et al., 2009). Hieber (2001) has developed integrated model of collaborative performance measurement to support improvements in trans-corporate logistics, as well as to give guidelines for implementation of supply chain management.

The above results have demonstrated the possibility of the SCOR model adaptation to different industrial situations based on the identified requirements. As the expectation of the model intended, the manufacturing industry is the dominant sector for SCOR model adaptation, followed by the service industry. From this review on SCOR model adaptation, it can be concluded that:

i. There are possibilities of the SCOR model adaptation to different scenarios that suit the environment it operates.
ii. Different business processes and working practices of the supply chain can be mapped and compared with the original SCOR model to help determine their applicability and adaptability. This approach would suggest how adaptation can be more suited to the environment supply chains.
iii. Most analysis started with analysis of the business process. Then, the selection and determination of appropriate performance measures have been followed. The dominant adaptation activities were the SCOR model as a performance measurement system.

From the literature review, the researcher has observed and learned about the possibility of SCOR model adaptation to different environments and contexts even far from SCOR model scope area. The firms in developing countries have a better alternative for their organizations' local environments and operating conditions than investing their limited and scarce resources in their efforts, which would not amount to much more than 'reinventing the wheel.' The state-of-the-art techniques and practices currently in operation in developed countries' organizations can undoubtedly be of great benefit to organizations in developing countries.

2.4.1 Research methods employed in previous SCOR model adaptation

After the analysis in section 2.4, the researcher can obtain generic information about the research methods used for SCOR model adaptation. From reviewed papers, case studies and conceptual approaches dominate with fewer researchers undertaking large-scale questionnaire surveys. This result demonstrates the

increasing application of grounded theory approach (GTA) in the supply chain areas in recent years.

Case Study: Case study analysis is usually used for theory development originating in social science and organization management research. Case analysis application in business and engineering is relatively recent. The recent trends in literature study, however, have suggested case analysis as an accepted method of studying engineering processes (Kulonda, 2001). Eisenhardt (1989) and Yin (2003) describe case study research as a powerful methodology for exploring new theories, building theory, testing existing theory and refining existing theory. Traditionally, case research has been used for building new theories in operations management and is one of the most powerful methods for this purpose (Eisenhardt, 1989, Voss et al., 2002, Yin, 2003). Case studies allow the researcher observe a phenomenon in its natural setting, answer the *why, what,* and *how* questions, and explore the unknown variables, phenomena, and their linkages (Meredith, 1998).

James (2006) has selected a case study as his research approach as suggested by Eisenhardt. In the process are the necessary details and methods used to build empirically valid theory from case studies (Eisenhardt, 1989). One downside to case-based analysis is the predisposition to create overly complex theory or the development of narrowly focused theory (Eisenhardt, 1989). The goal of the case study analysis is to create a SC model independent of the constraints of current models. A first step in accomplishing this goal is to understand the characteristics of the service industry operations that contribute to the supply-chain. Persson et al. (2009, 2012) have employed the case study to adapt the SCOR model in order to propose new Deliver and Source sub-processes, changes in current sub-processes, and new metrics. These changes constitute the first version of the Builder's SCOR model (BSCOR). They have thoroughly explained their reasons for choosing case research as a methodology. Through surveys, problems with controlling what answers are given (by the selection of questions) may also result in loss of valuable information, correctable through observations. We want to observe the phenomenon, not control them.

Grounded Theory Methodology (GTM): It is one type of qualitative orientation research strategy. Since being created by Glaser and Strauss in 1967, GTM has attracted not only social and educational fields, but also managers, businessmen, and professionals because of its ability to explain practical phenomenon. The founder of GTM, Glaser and Strauss, define it as: "derived from the study of the phenomenon it represents, that is, discovered, developed, and provisionally verified through systematic data collection and analysis of data pertaining to that phenomenon. Therefore, data collection, analysis and theory should stand in reciprocal relationship with each other. One can begin with a theory and then prove it. Rather one begins with an area of study and what is relevant to that is allowed to

emerge" (Pandit, 1996). By considering the requirements of recent research focal topics, Garosa and Taisch, (2008) decided the Ground Theory Methodology is appropriate. GTM is suitable to those areas of investigations for which insufficient theory has been developed, but where theory should emerge from the data. According to the Gaosa and Taisch (2008), there are three important reasons for selection of GTM as research methods for reference model adaptation. These are: (i) theories are derived from observations, the reference model had to emerge from practice and the practices representing it; (ii) GTM permits the researcher to use his own experience and practical knowledge to generate new theories; (iii) the process of constant comparison assures practice-oriented and long lasting products. With this background, Garosa and Taisch (2008) have demonstrated the applicability of the approach for adapting SCOR model to industrial service situations. Another similar research project is undergone by Schneider et al. (2007) by utilizing GTM and System Engineering approaches to develop the reference processes and the concepts for performance measurement using the SCOR model in the domain of industrial service operations.

Questionnaire Survey: Research by Hwang et al. (2008) was carried out to identify important SCOR sourcing performance metrics by using the stepwise regression method. To further improve the performance of the sourcing process, which is critical to many industries, this research has investigated the sourcing processes and their accompanied performance metrics in the SCOR model version 7.0. The supply chain of thin film transistor-liquid crystal display (TFT-LCD) industry in Taiwan is the subject of this research. In order to build the regression model, the questionnaire is divided into 14 items to measure sourcing correlations. The questionnaire uses the 11-point Likert scale and is divided into two sections: the ratio of the sourcing processes to the total sourcing, and the correlation between performance metrics and the sourcing processes. Using the questionnaire survey to collect empirical information, the regression model was applied to examine the sourcing process of SCOR at level 2 and its performance metrics. The results obtained were further extended for discussion on the sourcing process of level III. Desodt et al. (2007) have also collected information from the industry through an external benchmarking project involving 29 textile garment supply chains in order to achieve modeling of the supply chains of textiles and garments. Then, using these performance data the researchers have identified important variables and investigated the endogenous and exogenous relationships amongst those variables. The SCOR model had to be adapted in this study. The researchers have demonstrated a result of the study by classification of the interactions between the performance measures at both the factory and supply chain levels.

For the development of new models or enhancing or extending the existing process reference models, the literature demonstrates four stages of work. Rosemann and Schütte (1997) suggest five stages for developing a multi-perspective reference model (define project objectives, define reference modeling technique, construct

reference model, evaluate reference model, reference model marketing). Certain elements have been adapted to engineer the reference process model of discourse in a structured way. Deindl et al. (2010) have also explained four distinct stages followed for their adaptation of the reference process modeling for Utility Companies. The researcher has employed this experience to set the approach for the adaptation activities. The adapted four-stage approach has been explained in chapter 5 at the beginning of the section 5-2.

3 CHARACTERISTICS OF MANAUFACTURING INDUSTRY & SUPPLY CHAIN CHALLENGES IN DEVELOPING COUNTRIES

Advancement of technologies and global competition are transforming the way products are sourced, manufactured, and distributed around the world. A new way of integrating businesses with the help of global supply chains has evolved, providing unique opportunities and challenges to different countries. Businesses and activities need to be properly integrated with their procurement, production, and distribution activities to remain in competitive positions. Firms in developed countries are well aware of the competitive advantage that different nations have to offer. The various value-adding activities of a SC can be strategically dispersed among various countries and need to be coordinated to take optimal advantage of their competitive strategies. As globalization becomes the new business model, and different activities become spread around the world, firms in developing countries are increasingly participating as members of these operations.

Therefore, manufacturing firms in developing countries are becoming more and more parts of global supply chains in different industries such as textile, garment, leather, and agriculture processing due to an increase in demand for exotic products by Western consumers. Concerns of Western consumers regarding food safety, environmental issues, and social aspects such as wages, working conditions, etc, bring about new demands for producers in developing countries supply chains. Consequently, for firms to compete in the World market, the developing countries must adapt to stringent quality, safety standards, and regulations in these Western markets. Although exports from this sector have been in a declining trend, manufacturing still earns a fifth of Africa's total foreign exchange, making it the third most important sector after agriculture and tourism. Moreover, it is the manufacturing sector that provides a reliable platform for innovation and harnessing modern technologies to increase production output. This chapter discusses the characteristics of the manufacturing industry in developing countries, and the challenges they have faced so far for their SC integration efforts. Firstly, it introduces the role of developing countries in the global supply chain. The general trend of manufacturing industry in developing countries is explained in the second part. The third section presents supply chain challenges in the developing countries' scenarios. Finally, the composition and type of the manufacturing industry in Ethiopia were discussed.

3.1 Global supply chain & developing countries

Currently, new research results and practical experience in the global supply chain are increasing, and including developing countries as players (UNCTAD, 2011; Trienekens, 2011; Ivarsson et al., 2005; Humphrey, 2004; Fleury et al., 2001). Global supply chains have increasingly gained importance in linking developing

countries to international markets. For a long time, operations were limited to only a few selected economic sectors, and were largely confined to developed countries. Until recently, participation of developing countries in GSCs was minor, and was limited to the role of suppliers of primary raw material. Recent changes in the global business and improvements in supply chain management have allowed GSCs to further integrate developing countries into production activities (UNCTAD, 2011).

Changing global supply chain concepts in global business have created different perspectives and forms in production, logistics, organizational relationships, and technological transfer activities. There were many success stories from literature about the global supply chain in agribusiness (Trienekens, 2011; Dolan, 2004; The Conference Board, 2009), in production industries (Ivarsson et al., 2005; Fleury et al., 2001), and others. A typical global supply chain example is the textile and garment industry. Firms in developed countries are trying to make maximum use of global supply chains and utilize “low-cost countries” as global source countries (Hwang and Seruga et al., 2011). Another example from Brazil shows how transfer of technology and standards led to changing structures and upgrading of its plastics industry (Fleury et al., 2001). The above examples also show how developed countries' technological standards, systems guides, control processes, and flows of goods and information such as HACCP (Hazard Analysis of Critical Control Points) are increasingly being used by developing-country producers who participate in these supply chains (Trienekens, 2011).

The manufacturing firms in developing country are actively participating with a substantial share of GSCs’ production processes. However, GSCs offer both opportunities and challenges for developing countries’ enterprises. Even though the global supply chain creates access to markets, it demands greater efficiency and competence from suppliers. It is therefore important for firms in developing countries to implement more advanced techniques and enhance their competitiveness to improve their supply chain performance. Presently, developing countries enjoy preferential market access to developed countries. Still, the participation of manufacturing firms in developing countries in global supply chains is limited to being the suppliers of raw material. Unfortunately, most of the developing countries have not developed their capacity to compete in many manufactured value-added products. Product quality, productivity, and deliver time are often the major letdowns. The World Bank, UNIDO, ILO and various research forums have explored some of these problems and come away with the conclusion that the sector suffers from a shortage of managerial skill and a scarcity of technological input. This lack of managerial skill as well as a fragile technological base have demonstrated themselves in an invariably high enterprise mortality rate in all developing countries investigated. However, one of the important challenges

for the majority of developing country manufacturers is how to enter these supply chains and how to improve their capability to be able to compete in these new markets. Even so, most developing countries are likely to be exporting raw materials or basic and high value agricultural produce for some time to come. Developing countries should learn a lesson and prepare to compete with others because such opportunities will not continue forever (UNCTAD, 2011).

3.2 Characteristics of major manufacturing industry in developing country

The manufacturing industry in developing countries paves its way for participation due to its global sourcing and manufacturing activities. It should be noted, however, that there is a high degree of heterogeneity across developing countries and so manufacturing performance will vary across countries. The type, number, and distribution of the manufacturing industries in developing countries vary. To this effect their participation also varies in global supply chains that mainly depend on their available resource types. However, there are general trends that can be observed; the majority have participated in export of semi-processed raw material and basic consumer products from their mining and agro-processing industries. The research done by Todero (2009) has demonstrated the existing export share between developed and developing countries in relation to the production activities of primary commodities and manufacture products. Figure 3-1 shows the variation in composition of world exports between developing and developed countries. The firms in developing countries were exporting the majority of their resources in the form of primary commodities (72%), compared to (19%) in developed countries. In the contrary, the firms in developed countries were exporting 81% manufactured products, compared to 28% for the firms in developing countries. The data describes the characteristics of the level of manufacturing firms in developing countries. In addition, it shows the contribution of the manufacturing firms in developing countries. It demonstrates the dominant contribution of production of primary commodities. This result will help to determine the characteristics of the manufacturing industries in developing country.

There is a wide variation among developing nations in the relative importance of manufacturing industries. Because of longer history of independence and earlier integration, most Latin American countries have a better industrial experience and participation than African or Asian countries. After the 1970s and 1980s, Asian countries like Taiwan, South Korea, Hong Kong, and Singapore have increased their participation level in manufacturing output and are rapidly becoming industrialized states. Still, African countries lag behind most developing countries in Asia and Latin America. Most of the developing countries have specialized in the production and export of a few primary commodities, but their manufacturing sectors have been isolated from the rest of the economy and sales markets mainly focus locally. These distinctive features of the economic structures in developing

countries have hampered a full realization of the sectors' potential (Todaro et al., 2009).

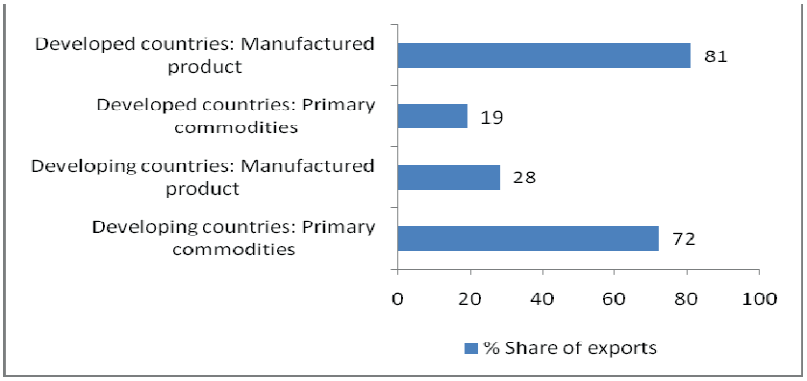

Figure 3-1: Composition of world exports (Source: Todaro, 2009)

Three main characteristic trends are formulated for the development of exports of manufactured and semi-manufactured goods from developing countries as a whole. Firstly, exports of manufactured and semi-manufactured goods remain at a very low level; secondly, they have been expanding at a rapid rate, particularly since 1959; and thirdly, growing major export commodities were light manufactured goods as textiles, leather, wood, and paper products. In most of the least developed and low-income countries, primary products that incorporate low levels of processing continue to account for the larger share of both national production and exports. By considering the changing structure of global supply chains, their contribution has not increased as expected. Most of the countries that have participated little in global integration are primary commodity-dependent countries with relatively small and highly inefficient manufacturing sectors such as African Countries (COMTD, 1996).

Different studies about the potential areas for comparative advantages of developing countries are related to their agricultural raw materials because of their present situations that make them particularly suitable (Trienekens, 2011, UNCTAD, 2011, Wilkinson, 2006, FAO, 1997). They have better advantages in these raw materials because their products have a large proportion of total costs that can often offset disadvantages such as lack of infrastructure or skilled labor. According to the traditional classification of the UN International Standard Industrial Classification of All Economic Activities (ISIC), "agro-industrial production is present in many manufacturing sectors: Manufacture of Food, Beverages, and Tobacco; Textile, Wearing Apparel, and Leather Industries; Manufacture of Wood and Wood Products, including Furniture; Manufacture of Paper and Paper products, Printing and Publishing; Manufacture of rubber products." Figure 3-2 shows the composition of agro processing industries. The

potential for agro-industrial development in developing countries is largely linked to the relative abundance of agricultural raw materials and low-cost labor.

The Textile & Clothing (T&C) industries are very typical examples to show the dominance of agricultural processing in developing countries. These are true for a handful of countries, in terms of trade, GDP, and employment opportunity significance. The T&C industries provide opportunities for export diversification and expansion of manufactured exports for low-income countries that can exploit their labor cost advantages and fill emerging niches and meet buyer demands. The contribution of T&C production to GDP differs by country but is up to 5% in Sri Lanka, 12% in Cambodia, and 15% in Pakistan. T&C are the dominant sources of exports and foreign exchange in several countries. Developing countries such as Cambodia, Bangladesh, Pakistan, and Sri Lanka depend on T&C exports for more than 50% of total manufacturing exports (e.g. 80% in Cambodia, 83.5% in Bangladesh) (Keane et al. 2008, Hossain, 2012).

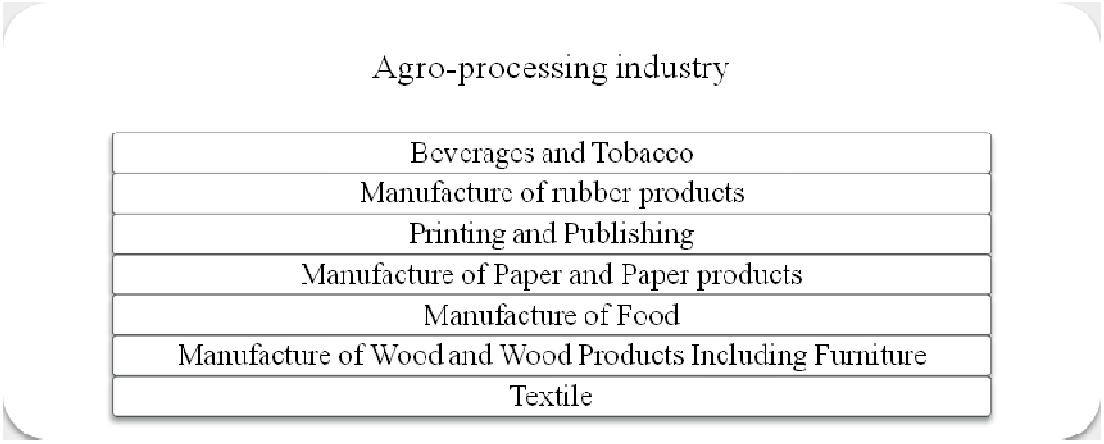

Figure 3-2: The composition of agro processing industries

3.3 Supply chain challenges in developing countries

In the last decades, the trends for adopting different modern management techniques have been introduced to developing countries from developed countries. These attempts at adoption and implementation of modern management techniques and philosophies in developing countries have faced different challenges. Some of these efforts have failed to achieve the expected results. However, these efforts might potentially have proved to be failures for different reasons, which may not be experienced in developed countries. Different practical researches and experiences with models and best practices that have shown success in the developed world may fail in developing countries (Sinkovic et al. 2011; Ohemeng 2010; Kureshi 2010; Han et al. 2009; Rutkowski 2009; Walsham et al. 1999). Their investigations have resulted in and paved a way to start new research based on experience and frameworks for further adaptation works. Thus, in order

to make successful technology transfer and implementation of the model, careful analysis for the adaptation activity, structural changes, and changes in the actual training, are necessary (Walsham & Sahay 1999). Manufacturing firms in developing countries have also been eager to implement and reap the benefits. However, they have faced different challenges on the SCM concept implementation than those faced in developed countries. Different scholars have investigated such challenges. This section presents the review of the literature and the developed framework on the factors and forces that influence our adaptation activities.

Recently, there is an increasing tendency of research to identify the supply chain challenges and barriers in developing countries. The following sample of research papers has discussed the barriers and the challenges of the Developing countries in the SCM implementation. Khalifa et al. (2008) has investigated the challenges and issues faced by Egyptian manufacturing industries. Based on supply chain deficiency stages, a framework has developed. The proposed framework has indicated supply chain challenges in developing countries in general, and in Egypt in particular. It demonstrates that most manufacturing industries' supply chains in Egypt are suffering from poor supply chain design. The other research paper by Easton et al. (2002) focuses on issues related to supply chain planning and design. This study has emphasized the importance of planning activities and their role in SCM. These activities are considered the basis for other supply chain activities. Sinkovic et al. (2010) have researched the problems encountered when a performance management system such as the BSC is implemented in the culture of a developing country. They have advised that managers need to be aware of the problems if they are to be successful in implementing modern management techniques in the developing country. National and organizational cultures influence the degree of difficulty of implementing performance measurement systems such as the Balanced Scorecard.

The other done by Kureshi (2010) investigated & discussed the concept of supply chain integration for its great potential to improve the competitiveness of both large and small businesses in Pakistan. The Motorola Five-Stage Model of Customer/Supplier Partnership Development can be benchmarked by large buyers in Pakistan's manufacturing industry to develop a more "culturally competent" model that could work in the Pakistani business environment. Finally, Kureshi proposed a modification of the Motorola Five-Stage Model of Customer/Supplier Partnership Development in manufacturing sectors of developing economies. By exploring the challenges & constraints of supply chain practices of the MIDC, this part of the research helps the researcher to better understand how and why the forcing factors affect the SCOR model adaptation. The overall process of SCM implementation comprises many challenges and barriers for its successful

operation. Various researches have been conducted to identify the characteristics of the barriers and challenges SCM. Kim (2007) found that top managers' recognition and support, level of information sharing, information technology, level of communication, trust level of integration, strategy of supply chain, cooperation and collaboration, value-added products/services, and organizational bottleneck are critical factors for successful SCM implementation. In other research done by Hwang and Seruga et al. (2011), critical success factors for SCM implementation have been classified into four categories such as environmental factors, organizational factors, information systems, and partnership factors. Environmental factors include efforts for the expansion of SCM and change in recognition of SCM, while organizational factors consist of top managers' recognition and support change in employees' attitude for SCM, and education. The information system factor includes the level of development of the internal information systems and standardization while the partnership factor identifies the critical link between supply chain members. People and business processes are also needed to undertake significant change in adaptation of IT. In their recent work, Hwang and Seruga et al. (2011) have assessed and classified critical success factors of textile SCM. These factors are classified into four categories such as environmental, management, information technology, and collaborative relationship factors.

The author has reviewed different research papers on potential supply chain challenges and barriers. For this thesis, based on the literature the barriers and challenges of SCM are identified and classified. The barriers and challenges are classified into four categories such as technical and information technology, organizational & managerial, national infrastructure, and supply chain relationship factor. Based on the literature review, for the purpose of this thesis, the supply chain challenges and barriers in developing countries fall into four principal capability areas. Table 3-3 summarizes the challenges and barriers accordingly.

- Technical & IT: Implementation of information technology & company's ability to react to different market segments with their technological & operational capabilities.
- Supply chain relationship: Ability to adopt partnership or alliance-based relationships, which promote communication & information sharing.
- National infrastructure: This segment consists of infrastructure & resource factors, cultural variations, arbitrage and leverage opportunities, government incentives and regulations.
- Organizational & managerial: The ability of companies to handle challenges related to management style & model, organizational culture, and skilled & professional man power. Table 3-1 shows the summary of the identified challenges and barriers in the firms of developing countries.

Table 3-1: Summary of the challenges and barriers for SCM implementation

Type of capabilities	Challenges & Barriers	Sources
Technical & IT	• Different production standards & manual production operation • Lack of QM concepts and documentation • Time delay and logistics problems • Lack of needed competencies/skilled • State of technology in use: Outdated technology • Lack of integrated computerized system to links with supplier	Gargeya et al. 2005, Khalifa 2008, Swaminathan 2007, Flores et al 2008, Msimangira 2009, Easton et al 2002, Hamisi 2011, Darroch 2010, Barbbar 2008, Hernandez 2007, Kureshi et al. 2010, Ruteri 2009, Holmes et al. 2006, Razzaque 1997, Babbar 2008; Stewart et al. 2002; Han et al. 2002; Al Falah et al. 2003
Supply chain relationship	• Lack of commitment, willingness & ability to invest into chain • Lack of willingness to work together • Lack of mutual trust & mutual dependence • Equitable sharing of risks & rewards • Industry is reluctant to adopt partnership & alliance-based relationships • Difficult to find local suppliers	
National infrastructure	• ICT & physical infrastructure like road, rail • Complexities associated with global sourcing • High transportation and logistics costs • Low research & development works • Lack of financial resource, process equipment & technologies • Cultural barriers, political instability & corruption	
Organizational & managerial	• Lack of compatible goal& strategy • Obsolete functional-based model • Working cultural difference • Centralization of operational decision • Poor management practices on documentation and data & information handling • Ignorance for level inventory at the supply chain	

From the literature review, the researcher has learned methods of other researchers in framework development for the analysis of different models. The works of Kurnia & Peng (1999) have assessed the electronic-commerce readiness in developing countries with special emphasis on Chinese grocery. They have developed an e-commerce readiness framework. Consequently, e-commerce readiness has three dimensions: organizational readiness, industrial readiness, and national readiness. With their research, they have addressed e-commerce readiness at all the three levels forming the basic condition of e-commerce adoption by any organization. Upping & Oliver (2011) have developed a contingency model to adapt and investigate accounting changes in Thai Public Universities. It consists of

four components: (1). External pressures for change; (2). Internal pressure for change. (3). Barriers to change; (4). Facilitators of change, which capture the varieties identified in previous studies like Luder (1992).

Waggoner et al. (1999) have developed a framework and identified four generic categories of forces that can be said to shape the evolution and change of organizational performance measurement systems. These categories are: (i) internal influences, e.g. power relationships and dominant coalition interests; (ii) external influences, e.g. legislation and market volatility; (iii) process issues, e.g. manner of implementation and management of political processes; and (iv) transformational issues, e.g. degree of top-level support and risk of gain and loss for change. Munir et al. (2009) have developed a framework for change in performance measurement systems for the banking sector. A framework for changes in performance measurement system is influenced by a number of macro-level factors (e.g. economic, technological, socio and political), which in turn place pressure on organizations in various forms (mimetic, coercive and normative). The framework has proposed examination factors that stimulate change in performance measurement systems in the organization, and the strategic responses to change efforts. From the above research experience, the researcher has integrated the challenges and barriers with the framework of forces. Therefore, the previously identified capabilities can be designed within a framework to better understand the influences on supply chain management implementation. Figure 3-3 demonstrates the established framework of factors.

3.4 The manufacturing industries in Africa and Ethiopia

Despite a decade of rapid economic growth, Africa's industrial sector remains small and under-developed. John Page (2009) highlighted that Africa has actually de-industrialized over the last 3-4 decades. Manufacturing industries in Sub-Saharan Africa have generally been stagnant or shrinking for the last three decades (Bigsten and Söderbom, 2005). From the viewpoint of poverty reduction, this is worrisome because industrial development is expected to offer plenty of employment opportunities to the poor. Collier and Gunning (1999), Fafchamps (2004), and many others have argued that the industrial development in Africa has been hindered by many problems ranging from high transportation costs and high transaction costs to highly risky business and political environments. Moreover, both the provision of public services and the development of grass-roots institutions and social capital are considered to be insufficient to cope with such problems in Africa. Unless this trend can be reversed, Africa is likely to remain overly dependent on agriculture and the extraction of natural resources in the foreseeable future. Improving the investment climate is often argued to be important for stimulating growth in Africa´s private sector. The idea that better logistics, more sensible regulations, better courts, etc. should help attract investors certainly has some intuitive appeal. However, judging by the Doing Business indicators published by the World Bank, many African countries have achieved

significant improvements in the investment climate over the last decade. However, the manufacturing production has not taken off. Recent thinking on industrialization and structural change revolves around the idea that what a country produces matters crucially for its economic development. Hausmann and Klinger (2007), for example, have argued that poor countries export "poor-country goods" that are associated with low added value, while rich countries export "rich-country goods", associated with high added value.

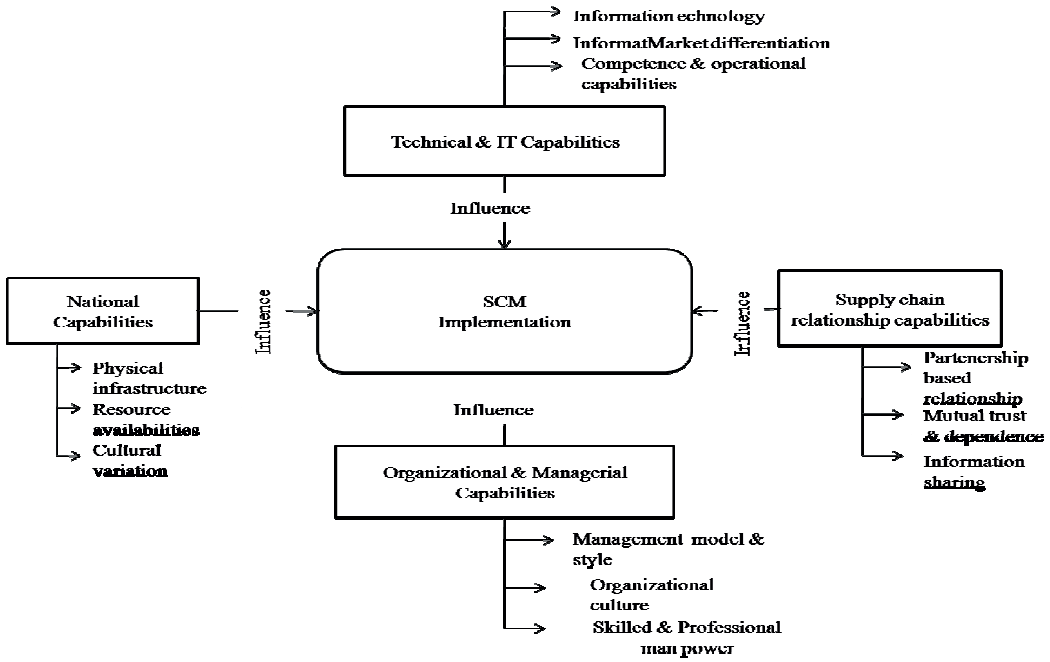

Figure 3-3: Framework of factors influencing the supply chain management implementation

The Ethiopian Central Statistics Authority (ECSA) for the purpose of its annual survey has set a definition on small scale manufacturing industries and medium and large scale manufacturing industries. This definition is adopted by ECSA for the different sub-sectors are: “Medium and Large Scale Manufacturing is defined as establishments engaging 10 or more persons and using power driven machines in performing their main manufacturing activities”. According to the 2010 annual Large and Medium Scale Manufacturing industries survey, the total number of large and medium scale manufacturing establishments for the country as a whole stood at 1,737. It has shown an increase of 33 establishments and 3.1% compared to the year before in absolute and relative terms, respectively. For the country as a whole, establishments classified under manufacture of food products and beverages industrial group constituted the largest share accounting for 29.9% of the total. Appendix 9-6 tabulates the distribution of the main manufacturing industries in Ethiopia. The output by these industries among others include: flour,

bread, edible oil, soft drinks, beer and alcohol drinks. Manufacture of furniture and manufacture of non-metallic mineral products, which represented 16.2 and 12.2% of the total, were in second and third position respectively. (ECSA, 2010). In a similar note to the above, Absence of market demand and shortage of supply of raw materials emerged as the first and second major causes for under utilization of capacity. Generally, a number of inter-related problems affected the growth and dynamism of the local manufacturing industries. Some of the common problems that most industries would share are: market deficiency, shortage of raw material, large in-process inventory, high material handling cost, poor product quality, obsolete technology and machinery (ECSA, 2010).

4 FIELD RESEARCH DESIGN AND RESULTS

It is important to assess current practices in order to obtain a better understanding of the current situations and challenges the organizations have experienced in relation to SCM concepts implementation. In this thesis current supply chain business processes practices means established procedures, methods, and approaches adopted by firms in their day to day production activities. The overall goal of the these field studies is to assess and analyze current supply chain business processes, performance measurement, best practices, enablers, and challenges of the supply chain implementation from Ethiopian manufacturing industries. The results of the questionnaire survey and semi-structured interview are aimed at assessing the current supply chain practices from Ethiopia. The data is collected through self-completion questionnaires and semi-structured interview in the selected firms. The outcomes of these field studies are used to focus on the overall research and create a better understanding of the characteristics of supply chains to facilitate adaptation activities. The research method is a way to systemize observation, describing ways of collecting evidence and indicating the type of tools and techniques to be used during data collection (Cavage, 1996). The research method includes the research design, data collection, and analysis procedures. This chapter presents the field research design and outcomes of the field studies. The section is organized into three sections. The first section introduces the research design for the field research, with the first part depicting and justifying the research methodology. The second section explains the findings of the two field studies conducted in Ethiopia. The field studies findings discuss the results of the questionnaire survey and results of the semi-structured interviews, combined together. The last section discusses the identified general characteristics of the supply chain in detail based on the results of field studies.

4.1 Research design

The research methodology presented here is the overall guide that the researcher employed in order to produce research results and contribute to the body of knowledge. Research design describes the structure of research and defines concisely how all the elements in a research project hold together. The research design is the program that guides the investigator in the process of collecting, analyzing, and interpreting the findings (Trochim, 2006). The elements of the research design described in this section include the purpose of research and research location. The research design for this study consists of a mixed methods approach, utilizing both quantitative research in the form of a questionnaire, and qualitative research in the form of semi-structured interview. The questionnaire and interviews make up the primary research. Recent research done by Susan et al. (2012) explains the advantages of a balanced research approach for success in the area of logistics and supply chain management. The analysis of secondary sources

and field study results are performed in sequential order. According to Creswell (2003) this procedure allows the researcher to "elaborate on or expand the findings of one method with another method." The inductive logic of research was followed in the first phase of the research, which is the analysis of secondary sources.

In order to answer the central research question and to achieve the research objective a set of immediate research questions were formulated for field studies. The immediate questions are: (a) what are current practices and characteristics of the manufacturing industry supply chain in developing countries? (b) What are the differences between supply chains' characteristics in developing countries and developed countries that affect supply chain measurement & improvement activities? (c) What type of performance indicators and best practices are available currently in developing countries' manufacturing industry supply chains?; (d) What type of key performance indicators and best practices are applicable for developing countries' future manufacturing industry supply chains according to different market maturity conditions and scenarios? The overall purpose of this research was explanatory and descriptive, i.e. to explain the characteristics of supply chains in businesses processes activities in developing counties and provide support for adaptation processes. The choice of research location depends on the purpose of research (research question) and methodological considerations. This research identifies the characteristics of business processes that provide corresponding performance measures and best practices. Furthermore, as this research aims in adapting the SCOR model for the manufacturing industry in developing countries, data collection activities were carried out in a developing country (Ethiopia). A developing country like Ethiopia makes an excellent place for assessing the characteristics of supply chains so as to provide more insight into the limitations of the model.

4.1.1 Factors of framework influencing the adaptation works

Since this research aims to adapt the SCOR model to the MIDC, it would facilitate the research analysis if these challenges were formulated systematically. For this effect and a fruitful analysis, a framework was developed that forms the basis for the previous research experience in addressing the challenges & barriers of the supply chain. In chapter 3.3, many supply chain challenges and barriers that can impact the adaptation of SCOR model were examined. Significantly, the synthesis of the literature has yielded a framework of factors influencing SCOR model adaptation in Figure 3-4. The literature has demonstrated that successful evaluation & selection of SCM models remains problematic (Sinkovic et al., 2011; Waal, 2007 and Davidson, 2007). The theoretical contribution of this framework is to explain how an adaptation of the SCOR model in a MIDC can be performed by considering both internal and external operating conditions. It is believed that the proposed framework is useful in two ways. First, it is a step toward a more prudent explanation of how SCOR model adaptation can be performed in the MIDC. The

frameworks of factors indicate that the four capabilities (Technical & IT, Supply Chain Relationship, National Infrastructure, and Organizational & Managerial) play important roles in the adaptation of the model in the context of the developing world. The SCOR model is inadequate because it does not incorporate or consider the existing four capabilities of the MIDC satisfactorily. Second, it highlights many important factors for SCOR model adaptation in Developing countries context, which may enable a researcher to identify explanation and find a possible way to facilitate adaptation work more thoroughly. Figure 4-1 demonstrates the established framework of factors for adaptation activities.

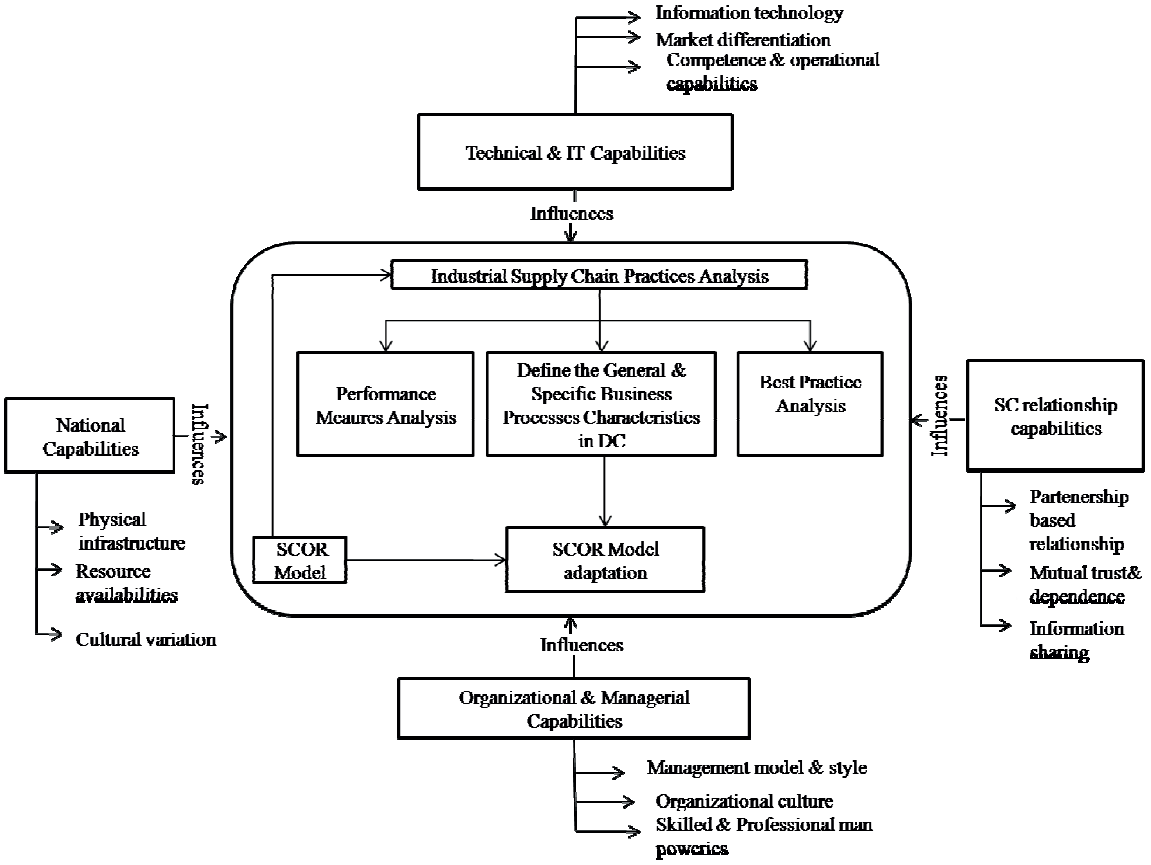

Figure 4-1: Framework of forces for SCOR model adaptation

For this research, there are three phases of analysis as shown in the framework. It involves the analysis of the SCOR model with the barriers and challenges of the manufacturing industry environment. The first step provides the input information about the general characteristics of the MIDC supply chains in relation to the SCOR model. The second phase involves the analysis of the current business process practices in all five SCOR model processes (see section 2.3) and compares the results with the current SCOR model. This analysis provides the input characteristics to the development of the adapted SCOR model business processes. The third phase uses the characteristics of the adapted business model to develop

and implement a new adapted SCOR model with the respective performance measures and best practices. To determine the common characteristics, the research must analyze the MIDC as generally as possible. Generalization allows for assessment of multiple scenarios occurring cross-industry, insuring that the identified characteristics are general operations shared by the industry and not specific industry functions. Finally, the result of customization is the establishment of business process elements for the manufacturing industry in developing countries. At the same time, each business process element included suitable performance metrics to evaluate supply chain performance.

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4.1.2 Data collection method

Data collection activities can be done via different mechanisms for a survey research strategy, for example self-administered questionnaires with postal or web base, interviews, data archives, and structured observations. This study collected data through the administration of self-completion questionnaires and semi-structured interviews.

The questionnaire survey approach was adopted to provide wide access to geographically dispersed samples at low cost. In addition, questionnaires provide a high degree of anonymity, which can encourage openness when sensitive areas are involved. However, the major criticism against questionnaires is the low response rate (Trochim, 2006). However, there are various strategies to overcome the difficulty of securing an acceptable response rate to postal questionnaires. The strategies followed in this study include:

- Cover letter convincing the respondents to fill out the questionnaire. It should identify place and university of study and the sponsor of the study, explain its purpose, tell the respondents why it is important and assure them that answers will be held in strict confidence (see appendix 2).
- The arrangements of the statements and questions should be considered seriously.
- Definitions of important concepts were given at the end of the questionnaire for securing a good response rate.
- A follow-up letter explaining the importance of the study and the value of the respondents' participation.

Similarly, the guide for the semi-structured interview questions was developed. The invitation request letter was also sent to senior managers along with the package of the interview documents (see appendix 3). It is also divided into five sections. In the introduction section, the questions are focused on the information on the background and size of the respondent's organization. The first section was designed to collect information about the supply chain relationships practices. The second part is aimed at collecting data on different performance measurements and measures by Ethiopian manufacturing companies. In the third section, the firms' supply chain business process practices were assessed using the SCOR model's five processes: Plan, Source, Make, Deliver, and Return processes. In the fourth section, respondents were asked questions about their best practices implementation level. The last section focused on information on the enablers and existing challenges faced for smooth implementation of these advanced technologies. In particular, the respondents are requested to describe a type of specialized software or system to support their supply chain operations. Most of the interviewed participants were involved in the strategic decision-making process, so that they could provide us with in-depth answers regarding how the company deals with their supply chain issues in practice. The interviews lasted from one to two hours and were tape recorded and then transcribed. Interviews were supplemented with documentary evidence. However, the advantage of using multiple sources of evidence is the development of converging lines of inquiry, a process of triangulation (Yin, 2003). The findings of a study are likely to be much more convincing and accurate if it is based on several different firms. A number of strategies were employed to deal with the challenges during interviews and increase the quality of data collection activities in this study. The interview was conducted in an informal and relaxed atmosphere. A semi-structured interview was adopted because it provided insight into the phenomena being studied and was amenable to interpretation. Semi-structured interviews provide respondents with considerable liberty to express their views. Long questions, double-barreled questions, leading questions, and biased questions were avoided.

4.1.3 Survey questions development and pilot testing

An extensive survey of relevant literature was undertaken to understand different research-based adaptations to the SCOR model and identify supply chain challenges in Developing countries in order ensure content validity. The questionnaire was pilot tested with five industry practitioners with extensive experience from Ethiopian manufacturing industries to give comments for improving the questionnaire. Using the pre-testing and pilot study feedback results, some questions were further modified to improve responses. The most significant modifications were the removal of superfluous questions and the use of 4-point scaled response questions. The final questionnaire is attached as appendix 2. An interview guideline was developed and used to provide guidance in data collection procedures. The preparation of the protocol involved extensive review of technical literature, definition of research questions, and definition of construct and field procedures. The definition of research questions assisted in refining the research focus, while the definition of construct and field procedures helped to sharpen the construct validity of the research. Before the final firms' visit and interview activities, the guide was tested with three experienced managers in the Ethiopian manufacturing industries. This organization was also selected because of its close proximity to the researcher's working location and willingness of the respondents. The field experts assisted in validating the interview guideline. The final interview guideline is attached as appendix 3.

4.1.4 Sampling and data analysis procedures

It is impractical and expensive to include the entire population in a survey and the researcher used sampling to select respondents to be included in the study. Considering the expected questionnaire response rate and the number of organizations with relevant advanced management experience, a sample of 200 Ethiopian manufacturers was selected for the survey from a population of 1737 medium- and large-sized Ethiopian manufacturing companies from Ethiopian Central Statistical Authority annual publications (ECSA, 2010). This contains the name of the firm, its address, products, telephone, and postal addresses. Selection criteria were based on ownership structures: private & public sectors, producers for local and export markets, industry's sizes, and industry groups. The manufacturing industry in developing countries is composed of many different sectors. In the Ethiopian case, the major manufacturing sectors are food, textile and garment, leather and leather products, beverages, chemicals, construction material, and forest industries (ECSA, 2010).

The data collected were coded and entered for analysis. The mean values were calculated to measure the level of agreement of the statements. Unlike the mode or median, the mean takes into account all the values in the distribution, making it sensitive to extreme values (Nachmias and Nachmias, 1996). The standard

deviation was used to measure the extent of variation from the central value (Nachmias and Nachmias, 1996). The mean and standard deviation together were used as a standard to compare the relative importance of the supply chain and the practices.

4.2 Results of field studies

The second field study using semi-structured interview was aimed at identifying characteristics of business processes, performance measures, best practices, and challenges of supply chain implementation. The field studies provided detailed investigation of the supply chain practices in relation to supply chain relationship, performance measurement, business processes, best practices, enablers, and challenges for supply chain concepts implementation in the twelve case study companies in Ethiopia. These supply chain practices were identified discusses the details of the supply chain performance based on the four building blocks concepts from the SCOR model i.e. business processes, performance measures, best practices, and enablers. The results are mainly drawn from interviews with twelve different types of organizations to represent the main supply chain processes and to cover the whole supply chain system of each participating company. There were different respondents ranging from general managers to line managers of different departments. These provided a chance to analyze the relationship between suppliers, customers, and the respondents from production departments. The personal observations and company documents also provided additional relevant information about the topic. Additionally, the analysis of the data relates to the question themes in appendix 3. As a result, the insights from the cases helped the researcher understand current supply chain practices in Ethiopian manufacturing companies.

Survey packages each containing a survey questionnaire and a covering letter (see appendices 2 and 5) were sent to 200 Ethiopian manufacturing industries. A total of 42 responses were received, 36 of which were usable, giving a response rate of 16%. Two questionnaires mailed to the director of manufacturing were returned as a result of having incorrect addresses. The sample population is fairly evenly distributed between those producing for export market firms (30%) and those producing for local market firms (70%). The respondents' production for export or local markets provided an opportunity to examine whether world-class management techniques are prevalent in organizations. Non-response bias can result from a low response rate and/or missing responses affecting the conclusions about the variables being examined in the study.

The demographic data were analyzed and presented with frequency distributions. The respondents were asked to indicate their company's information (types of industry, number of employees, and annual turnover). The respondents were spread over a range of industry groupings with the majority being in industries such as

beverages, chemicals, and food industries (22%, 19% and 19% respectively). The next largest industry was construction materials & leather and leather products & industries (13, 12% each), closely followed by metal and metal products industry (9%). On the other hand, printing industries (3%) and textile and apparel (3%) represented the minority (see Figure 4-2).

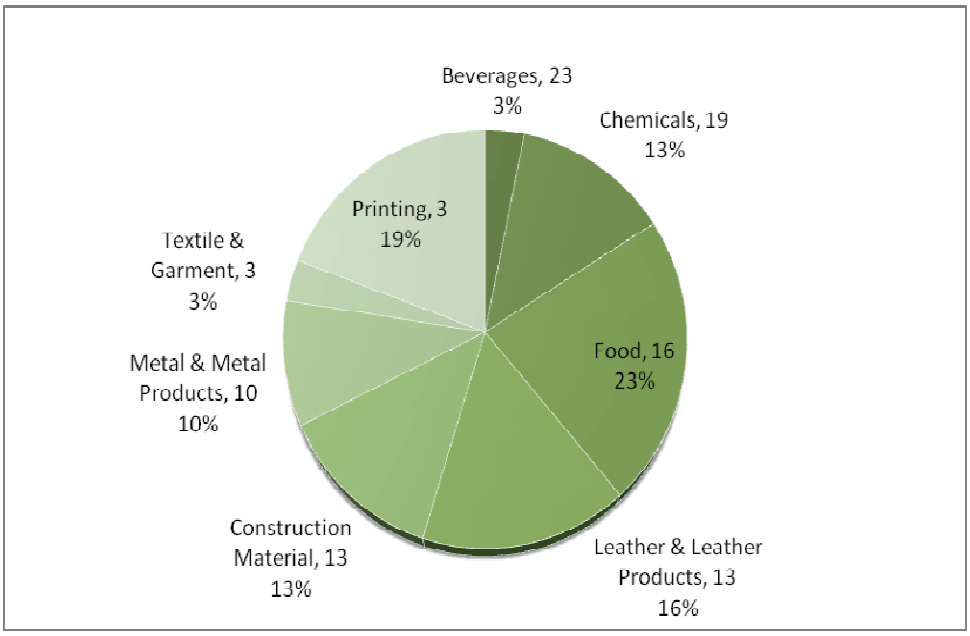

Figure 4-2: Types and composition of industries

The size of the companies varied greatly, from less than 50 to 2000 employees, but the majority of companies were in the range of 50 to 500 employees. The majority of the organizations indicated that their annual turnover range was between birr 5 million to birr 500 million (Note: 1 USA dollar is approximately 18 birr, 2013). It is interesting to note that none of the organizations from Ethiopia indicated a turnover of greater than birr 1billion. The next section presents the results of descriptive statistics used in the study to investigate the current supply chain business processes practices, performance measures and measurement, best practices, enablers, and challenges associated with them. The data collection was conducted via semi-structured interviews along with the industrial visit with top managers in the their respective organizations. The respondent companies' composition was similarly like our literature review dominant in the developing countries. These were foods, printing, leather and leather products, chemicals, and wood construction material industries. The experiences of these companies were appropriate feedbacks for the model adaptation processes.

The results of the field study are presented by combining the questionnaire survey and semi-structured interview question findings. Both the results of the survey questionnaires and the semi-structured interviews are discussed in five thematic areas according to the organization of the survey questionnaire and interview

questions. The first part presents the supply chain relationship level in the surveyed firms. The issues related to performance measures and measurements are explained in the second part of this section. The third section focuses on the business process with the five SCOR model processes: Plan, Source, Make, Deliver, and Return. Later, the level of the best practices implementation results is summarized. Lastly, enablers and challenges for supply chain implementation are discussed.

4.2.1 Supply chain relationship

The purpose of this investigation was to identify and evaluate the level of integration and current practices of global supply chain integration. The first part presents the results of the questionnaire survey and then the results of the semi-structured interview questions. Finally, the section concludes by discussing the results. The first part of this section presents the survey findings related to the supply chain relationship which focused on the level of firms' integration and coordination activities in their business environment. The respondents were asked to rate their organization's level of integration with suppliers, internally, and with customers. The questionnaire consisted of scaled response from 1 to 4 such that 1 = very poor, 2 = poor, 3 = high and 4 = very high. One additional column also was given to those who think that techniques were not applicable. The mean and standard deviation (S.D.) were evaluated to compare the level of integration in the firms. Table 4-1 shows the respondent firms' level of integration with their suppliers, customers, and within the firms themselves.

The overall level of integration was generally in poor condition. Cross-functional teams' information exchange and information exchange with suppliers through internet or web-based technologies were at a better level of integration than others. Stable procurement through networking, online integration between production and sales functions, and online tracking were at a very poor level of supply chain integration.

Currently, the company's supply chain relationship and its integration with its supplier and customers are becoming the basis for success. For this research, the companies have investigated relationships with their customers, suppliers, and internally. To further investigate this integration, the information exchange activities were also examined along with encountered challenges. In this interview questions part, the main raw material sources for the companies were mainly agricultural products. However, most of companies' production activities are still dependent on imported machineries and chemicals inputs such as plastics and beverages industries. For production companies, the main customers were a mixture of local and international markets. Those companies targeting international markets were predominantly in the textile and leather industries. The means of communication and interaction inside and outside companies were mainly

dependent on mainly paper (letters), telephone, and fax machines. Some of the companies have started using e-mail communication for their international purchase activities. The main challenges encountered in their relationships were inconsistency in raw material quality, late delivery, loyalty, and price fluctuations.

Table 4-1: Respondents level of supply chain integration

Supplychainrelationship	Mean	S.D.
WithSuppliers		
Information exchange with suppliers through internet or web-based technologies	2.45	1.10
Participate level of suppliers in the design stage	2.35	0.87
Level of strategic partnership with suppliers	2.32	0.89
Participation level of suppliers in the process of procurement and production	2.29	0.81
Establishment of quick ordering system	2.16	1.00
Stable procurement through network (e.g. electronic data interchange)	1.68	0.80
Withinthe Company		
Cross functional teams information exchange	2.53	0.79
Real time inventory management	2.30	0.86
Data integration in production processes	2.29	0.73
Real time access to logistics-related information	2.17	0.78
Data integration among internal functions through network	2.04	0.84
Online integrations between production and sales functions	1.93	0.74
With Customers		
Follow up with customers for feedback	2.28	0.72
Speed of order processing	2.24	0.86
After sales service support	2.03	0.85
Integrated demandforecasting	1.76	0.76
Online ordertaking	2.31	0.81

The supply chain relationship results manifested the different levels of integration and coordination activities with the supplier and customers, and within the company's daily operations. Generally, from the tabulated results, the levels of integration and coordination activities in all levels were at very poor positions. However, the integration and coordination within companies' operations and with their suppliers were in better positions than customer's handlings. The main reasons for such practices were the push-type of manufacturing strategies and lower level of competition in firms in developing countries.

4.2.2 Performance measurement & performance measures

The other aim of the field research was to assess types of performance measurement and performance measures used by Ethiopian manufacturers. Using the two approaches for assessing current practices, the researcher found some interesting results in both studies. First, the questionnaire survey results. 22% of the respondents were using a balanced scorecard and an activity-based costing approach. 13% of the respondents use an integrated performance measurement system. 6% used the ISO 9000-based performance measurement system. The other approaches were specified as being only 3% economic value analysis. The remainder (34%) did not state what types of approach they used so far. Based on the answers, it is possible to observe that the most common answer was that the firms did not use any types of performance measurement system. The most commonly used approaches were the Balanced Scorecard in original versions and Activity Based Costing. The third most commonly used approach was the Integrated Performance Management System. No one company responded about SCOR model implementation in the survey (Figure 4-3).

Performance measures: A list of the performance measures, rated on frequency of use, is composed of fifteen performance measures. The performance measures were grouped into four categories: financial, productivity, revenue, and customer satisfaction. Respondents were asked to state the frequency of use of each measure using scaled responses from one to four, one being never and four being always used. The mean results from this section were then tabulated. Table 4-2 presents the extent to which organizations used the fifteen performance measures. They are dominated by productivity measures and followed by financial measures.

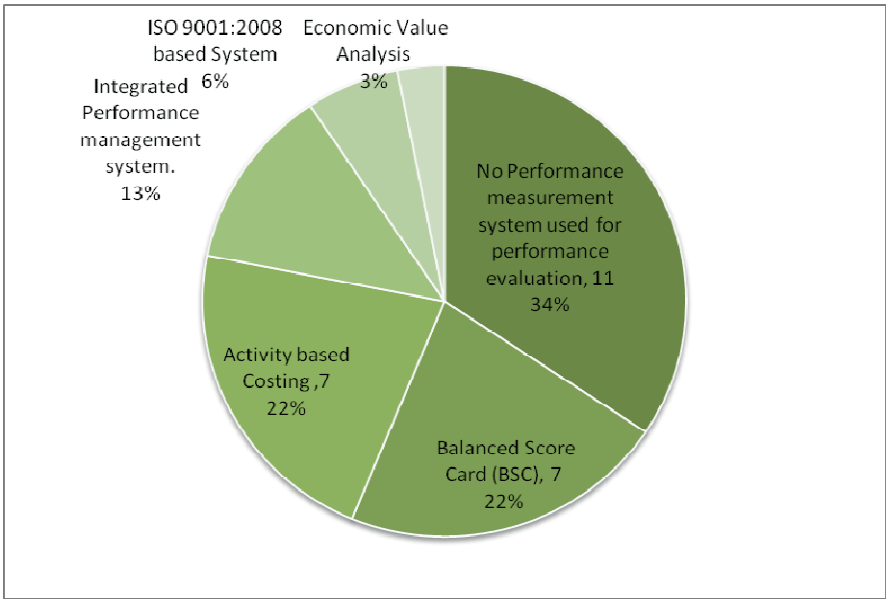

Figure 4-3: Current state of performance measurement systems

Table 4-2: Types of performance measures used in practice

Performance measures	Mean	S.D.
Costof goods sold	3.67	0.75
Gross profit margin	3.47	0.76
Number of units produced	3.37	0.91
Amount of finished goods inventory	3.33	0.98
Total sales revenue	3.27	1.06
Amount of material inventory	3.27	0.96
Rate of incidence of production defects	3.10	0.87
Number of customer orders completed	3.10	0.98
Order accuracy / fill-rate	2.80	0.98
In-stock rates / stock-outs	2.75	1.06
Numberofworkerinjuries	2.67	0.94
Compliance	2.60	1.02
Damages	2.46	1.05
Backlog in the delivery schedule	2.41	1.16
On-time delivery	2.37	0.91

The second observation was the results of interviews. Based on the interview results, it was possible to analyze the current situation regarding the performance measurement systems and performance metrics used in manufacturing industries. The current state within the defined areas is summarized in the following table 4-3.

The above results on performance measurement system and performance measures can help to better understand the real phenomenon in the firms. Even though a considerable number of respondents (34%) did not implement any type of performance measurement, there were some initiatives to adopt some of the existing PMSs. It was interesting to observe that BSC, activity based costing, and integrated performance management systems have already been started for pilot implementation. However, PMSs were not getting full commitment and support from top management as best practices for their company improvement actions. These implementation activities are concentrated in the government owned manufacturing industries controlled by Central Authority. The major problem was lack of full commitment at different level. The performance measures within the industries were dominantly financially-oriented measures such cost, profit, revenue, and productivity measures such as number of units produced and inventory. The customer-focused performance measures were given less attention for time conscious measures such as on-time delivery, or backlog in the delivery schedule.

Table 4-3: Summary of the current state of performance measurement

Area	Current State
Performance measurement systems	- In most companies performance measurement is based on experience and common sense, not from a well defined approach or model. - The performance measurement efforts are limited to measuring manufacturing operations and processes within the company. - The measurement is mostly used for control purpose and not actively used for improvement purposes within company and with their respective suppliers.
Performance measures	- The performance measures mainly focus on finanace and operations, and do not provide a comprehensive overview of all important areas of the company. - In most firms performance measures focus on productivity and profit.
key Performance Indicators (KPI)	- Generally, most companies' key performance indicators have not yet defined company-wide perspectives and relations with suppliers and customers.
Enabling Technologies	- The performance measures data are to a large extent manually gathered. - E-mail and telephone are fequently used tools for information exchange within and outside the company. - Not all companies used enterprise resource planning (ERP) software. However, some companies have started some activities to develop local software that can be applicable in different departments.
Challenges & Barriers	- Lack of point of sales & operation information. - Wrong perception about performance measurement by employees that makes the companies focus on financial measures. - No serious evaluation for adopting the different performance measurement models and no follow-up and evaluation for failure from practices and challenges for implementation

4.2.3 Supply chain processes

The third part in both the survey questionnaire and the semi-structured interview were the business processes. This section can provide one of the most important inputs for adapting the business processes. The proper business process adaptation would be the base for further action for integration of the supply chain members. The first part deals with the questionnaire survey results. The questions are designed to understand the use of supply chain practices with their respective SCOR model's five supply chain processes (Plan, Source, Make, Deliver, and Return). The questionnaire consisted of scaled response from 1 to 4 such that 1 = Never, 2 = Poorly, 3 = Well and 4 = Extensively. This section presents the results regarding

the business processes from raw material sourcing up to the final product delivery. Similarly, close investigations of supply chain process in some companies are conducted using the SCOR model's five business processes in semi-structured interview. The experience of twelve manufacturing companies are collected, tabulated, and analyzed in tabular forms.

Plan process: This section presents the first business process: plan process. It addresses how firms in Ethiopia are planning their activities in comparison with the standard SCOR model plan process. Similar to the above discussion, this section contains results both from the questionnaire survey and the semi-structured interview questions. The first part of this section discusses the results of the questionnaire survey. The plan process in supply chain highly relies on forecast data using the information as inputs for its sourcing, making, inventory management, and deliver activities in a supply chain (Chae, 2009). Table 4-4 indicates firms' supply chain planning process practices within the survey. It has been found that firms often relied on **"**What-if" analyses implemented for supply/demand balancing (mean = 3.00). The companies used historical data in the development of forecasts. Also important, the companies used information systems in their forecasting activities (mean = 2.90). The activities that are implemented to a lesser extent are those relating to the balancing of product lines on a daily basis (mean = 2.87), the demand management process driven by customer information (mean = 2.76), cross- functional team help planning departmental activities such as production, and sales (mean = 2.55). Meanwhile, the buying firm hardly adopts activities; such performance indicators have been defined for their department (mean = 2.29), and the company frequently contacts retailers to get information about market demand (mean = 2.29). However, the high standard deviation scores found in many of the categories imply inconsistencies in the respondents' answers.

Table 4-4: Supply chain planning process practices

Planningpractice	Mean	S.D.
"What-if" analysis has been implemented for supply/demand balancing	3.00	0.95
The use of historical data in the development of forecasts	2.92	1.06
The company use information system in their forecasting activities	2.90	0.96
The balancing of product lines on a daily basis	2.87	0.81
The demand management process is driven by customer information	2.76	0.96
Cross functional team help planning departmental activities such as production and sales	2.55	0.86
Performance indicators have been defined for your department	2.29	1.04
Your company frequently contacts retailers to get information about market demand	2.29	0.93

The second section explains the results from the semi-structured interviews. Demand forecasting usually takes demand data from sales people who receive

sales and demand information from customers. It appears that the two most important factors that companies considered when preparing forecasts were based on the past two or three years' sales historical data, capacity, and the prevailing economic conditions in the country. Use of computers in forecasting activities was very minimal. Most of the respondents rely heavily on past experience in preparing forecasts. The extensive reliance on past experience, the minimal reliance on computers, and the high average forecasting error percentage point out that forecasting is not a developed activity within manufacturing companies in Ethiopia. Other factors considered were forecasts, customer order backlog, and the amount of previous sales.

The plan process respondent companies followed a traditional forecasting procedure dominantly based on previous two or three years' sales historical data. They used no direct feedback data from customers or users. Poor performance was observed in information collection activities from final users and retailers. The respondent companies did not define the performance indicators to check their planning process level. Team based cross-functional planning was at the lowest level of practices due to low level of collaboration activities between different departments.

Source process: The source process is one of the important strategic areas to further improve firms' competitiveness and success (Tate et al., 2010). The main reason is position as a starting activity for the flow of raw materials into the final product within the company (Carter et al., 1998; Porter and Van der Linde, 1995). Sourcing is one of the strategic business processes in the current competitive markets. Similarly two approaches are employed to identify the current practices in the firms under study.

The respondents have also shown the different levels at which companies use variety policies when initiating purchase orders. A variety of policies are used, the most frequent ones being purchasing orders being initiated according to the production plan and current inventory levels. Also used is a periodic interval policy. Even though only small proportion of the respondents relied on actual customers' initiates purchase orders, the firms mainly used MTS/MTO strategies. These results indicate that companies were perhaps holding large amounts of imported raw materials to protect against higher future prices because of the high rate of inflation, and also to ensure timely deliveries. Ethiopian companies have a very high cost of holding proportion of their inventories in raw materials due to raw material scarcity in the economy. In Ethiopia, economic forces, rather than market forces, dictate the relatively high percentages of inventory held as finished goods. Companies have not used optimal inventory policy and warehouse utilization. Inventory managements were done and analyzed manually by low skilled labor.

The first section discusses the results of the questionnaire survey. The questions are designed to measure the use of supply chain practices with respective SCOR model source process and to rate their level of agreement to statements related to the above business process. The questionnaire consisted of scaled response from 1 to 4 such that 1 = Never, 2 = Poorly, 3 = Well and 4 = Extensively. Table 4-5 indicates supply chain source process practices. The firms have often relied on long-term relationships with strategic suppliers (mean = 2.78), as well as imported raw materials are always available for manufacturing companies (mean = 2.34). Frequent performance feedback to suppliers (mean = 2.22) also achieved higher value. The use of performance measurement and availability of imported raw materials locally were at lower levels of implementation.

The next section presents the results of the semi-structured interviews. All respondent companies have practiced raw material sourcing from local and foreign supplies. Depending on their production operations and their dependency on local and imported raw material, their procurement activities follow different purchases strategies. One of the challenging practices was supplier selection. Supplier selection process refers to the process of selecting reliable suppliers including selection criteria and negotiation. Most of the respondent companies used price negotiation for local material purchase from wholesaler. The textile, leather, and food industries raw material collecting was done through different collectors by identifying potential suppliers. For international purchases, companies should follow the National Bank procedure for their bidding and procurement activities. There was a standard procedure in place especially for international purchases. The companies have imported from different countries and also exported their products to various countries, and each country has a different standard. Procurement department officers directly participating in purchasing cannot follow all rules because the marketing situations are highly variable and dynamic especially with changing raw material prices. Most companies have prepared a standard contract for all suppliers.

Table 4-5: Supply chain sourcing process practices

Sourcing practice	**Mean**	**S.D.**
Long-term relationships with strategic suppliers	2.78	0.96
Imported raw materials are always available for manufacturing companies	2.34	0.79
Frequent performance feedback to suppliers	2.22	0.76
Reduction in the number of suppliers	2.18	1.00
The company use of information system in procurement process	2.13	0.81
Just-in-time delivery from suppliers	2.08	0.78
Performance indicators have been defined for your suppliers	1.97	0.81
Frequent measurement of suppliers' performance	1.97	0.85
Imported raw materials are always available locally with affordable prices	1.88	0.83

Generally, the companies used different supplier selection criteria such as the quality of material, price, delivery time, previous performance, and reliability of suppliers. There was a standard procedure in place especially for international purchase. The companies have imported from different countries and also exported products to various countries and each country has a variety of standard. Although the companies have to set rules for effective negotiation procedure, procurement department and officers who were directly participating in purchasing cannot follow all rules because the marketing situations are highly variable and dynamic especially with raw material price. Most companies have prepared a standard contract for all suppliers. However, it was common practice to ignore the contract and go to new buyers if prices were advantageous. Usually, the procurement process started when the procurement department received a purchase requirement from customers; i.e. the production department sending this requirement to the purchasing department.

Manufacturing industries have faced many challenges in their sourcing process. The sourcing process challenges were generally grouped into two categories: one related to imported raw material, and other related to local raw material purchase. In relation to the foreign purchase, the main challenges were: lack of foreign currency, inconsistency of quality raw material during final delivery, unavailability of local suppliers for imported items, and long processing and delivery time due to lengthy bureaucratic purchase procedure. The local sourcing was also challenged by the following factors: high price fluctuation, lack of long term-relationship commitment, and loyalty from supplier. The latter factor was manifested by the interest of the supplier in even smaller financial benefits, and less consciousness for raw material quality and handling. Important challenges are associated with the seasonality and occasional sensitive availability of raw material, such as agricultural resources. The manufacturers are challenged to find reliable and consistent-quality suppliers for imported raw material, and as a consequence stock large inventories. The responses from companies were interesting particularly in their sourcing process for imported raw material. They have faced difficulty in finding reliable and cheap suppliers for imported raw materials, and stock large inventories in their warehouse to anticipate these challenges. They have shown lack of experience in evaluating suppliers and giving feedback for their strategic suppliers. Additionally, there was a low level of information technology application in sourcing activities of the respondents.

Make process: Manufacturing industries are trying to satisfy their customers with the help of available sales information and forecasts of demand. Knowledge about the current production strategies and practices needs to be collected and analyzed to properly improve the supply chain. Industrial data are collected by using two collection methods for the make process. The first field results focuses on production activities. ‘Planning procedures and processes related to material and capacity

planning have been rated by cross functional teams' and 'the outcomes of planning procedures and processes related to material and capacity planning are aligned with actual demand' have been rated as the most frequent manufacturing practices. Meanwhile, the existing processes are met with material or capacity and internal and external customers' needs. The last activities, 'deliver schedules' and 'material requirement planning for external customers are integrated with your department's activities aspects' have been rated at lesser degrees of importance. Detailed data about respondents in making process has shown in Table 4-6.

Table 4-6: Supply chain making process practices

Making practice	**Mean**	**S.D.**
Planning procedures and processes related to material and capacity planning is being done by cross functional teams	2.70	0.95
The outcomes of planning procedures and processes related to material and capacity planning is aligned with actual demand	2.70	0.85
Delivery times are extremely important for the department planning processes	2.61	0.89
Material requirement methods are used by your departments planning processes	2.48	0.85
Internal and external customers' needs for material or capacity are met with the existing processes	2.39	0.70
Delivery schedules and material requirement planning for external customers are integrated with your department's activities	2.39	0.74

Inventory management practices were also assessed. Table 4-7 shows the level of inventory management practices. The two most frequent inventory management practices were 'company-wide coordination and management of inventory' (2.59) and 'keeping a safety inventory as a consequence of sales variability' (2.30). 'Just-in-time delivery' inventory management practices showed lower levels of use. Inventory management practices used in the supply chain, such as 'vendor managed inventory at production sites,' and 'joint inventory by suppliers and manufacturer' show even lower levels of use.

The following section discusses the results of the semi-structured interview questions. Depending on their data and types of products they produced, respondents set different production strategies. Most of the respondents in the interview used push-type production strategy for their products, and therefore used Make-to-Stock (MTS) strategies in their operations. However, some companies used Make-to-order (MTO) in their production activities. Leather, garment, and textile-based companies frequently used this strategy. Manufacturers who were trying to penetrate the export market were more sensitive to customer demand and additional requirements such as packaging and other standards. The involvement of supplier and customers varied depending on the production strategies that the firms practiced. Generally, a lesser involvement of customers and suppliers were

observed in MTS than MTO strategies. In the MTO strategy, firms were in more frequent contact with their customers than suppliers. Their collaborations started in the design stage and completed after final product approval, such garment companies producing products for customers in the USA. In the MTS companies, the customers' involvements were observed in the introduction of new products to the market. The same collaboration strategies were also observed with suppliers; they were involved in production activities for testing of new raw materials. Collection of customers' comments and complaints was mostly manually done with the help of a data logbook. The most important challenges were lack of local and imported raw materials, high competition, lack of hard currency, fluctuation of price for raw material, out-dated machinery, lack of skilled labor for advanced and automated machinery, and inconsistent quality of imported raw material.

Table 4-7: Inventory management best practices

Type of Inventory Practices	Mean	S.D.
Company-wide coordination and management of inventory	2.59	0.78
Keeping a safety inventory as a consequence of sales variability	2.30	0.97
Regional distribution centers for product distribution	2.25	0.99
Lowestinventorydrivencosts	2.21	0.86
Automatedwarehousemanagement	2.19	1.26
Just-in-time (JIT) delivery	2.04	0.79
Vendor managed inventory (VMI) at production sites	1.71	0.84
Joint inventory management by suppliers and manufacturer	1.54	0.63

The make process was investigated focusing on the material requirement, inventory management, and capacity planning in relation to delivery times and customer service. From the responses, the companies had lower practices in their consideration of customer deliver schedule with their material requirement and capacity planning activities. The existing making process did not meet the requirement of internal and external customers. The companies did not have experience in modern material techniques with help of computers and software. They still used traditional paperwork in their material requirement and capacity planning activities.

Delivery process: Nowadays, product delivery time and customer service are one of the focal areas for company competitiveness. A better understanding of these practices is important for successful adaptation works. The first section discusses the survey results and then follows the interview results. The following Table 4-9 presents the results of the questionnaire survey on the delivery process in the respondent company. The general results of the survey were somewhat poor in the deliver processes. However, companies' response to their customers' needs has shown a better result than others. The practice of order consolidation activities with

help of different members showed a better performance. The use of performance measures and use of automatic identification for distribution process were poorly rated.

Table 4-8: Supply chain delivery process practices

Delivery practice	Mean	S.D.
We respond to our major customer's needs quickly	2.84	0.79
We consolidate orders by customers, sources carriers, and etc	2.70	0.82
We maintain the capacities to respond to unplanned orders	2.60	0.84
We have a single point of contact for all order inquiries	2.53	0.85
We deliver products to our major customer on a just-in-time basis	2.46	0.98
Our company use third party logistics for product delivery	2.43	1.02
Our company always delivers orders within lead time	2.28	0.66
We have real time visibilities of order tracking	2.17	0.90
Performance indicators are determined for distribution processes	2.14	0.87
We use automatic identification during the delivery process to track order status	1.93	0.77

This part of the section explains the results of the interview activities. Customer order processing and delivery aim to provide the requested products with a short lead-time (Persson and Olhager, 2002). Generally, the respond companies used four different strategies for distributing their final products. Firms used different distribution channels such as own outlets, wholesalers, and retailers' markets. The wholesale distribution strategy was the dominant one. Sometimes this wholesaler played an important role as supplier of local raw material, sometimes with help from their collectors. So, they have played dual role in the developing countries. Most of the respondent companies were using their transport facilities to transport and distribute their final products. Some of the companies have started using third party logistics (3PL) providers for their distribution functions. Different challenges were observed in the distribution activities such as lack of Ethiopian access to the sea (Land-locked country), and backward transport infrastructure. Due to this the deliver process was expensive and challenging. This hinders Ethiopian firms' competitiveness. The companies have shown better delivery practices in handling customer orders and responding to major customers' orders quickly. The respondent companies' situations in the use of the modern way of order tracking and automatic identification in deliver process were at very low level of performance. Also, performance indicators are not determined for the distribution process.

Return process: The last part in this section is the return process. Similar to the above analysis, this process was also analyzed using the data collected by two approaches. The first section discusses the results of questionnaire survey. Almost

one fourth of the respondent companies have shown their lack of experience about the return process activities by responding in the "Not applicable" column. However, in the case of claims and emergency returns, companies have responded at a higher level of prepared specification or criteria for returned products. Table 4-9 shows the results of the survey. Reverse logistics and document on return process have shown poor performance levels in the respondent companies.

Table 4-9: Supply chain returning process practices

Return practice	Mean	S.D.
We have a set of specifications to verify the quality of returned products	2.84	0.79
We allocate resources for our product returns during the planning stage	2.53	0.85
We have dedicated personnel, equipment & facilities to process returned products	2.46	0.98
We have accurate forecasts of our product return rate	2.43	1.02
Our product return process is easy for our major customer to follow	2.28	0.66
Our company managers have practiced reverse logistics	2.17	0.90
We have documentation describing our product return process	2.14	0.87

Similar results have been observed during the interview activities. Companies under investigation have no planning at all for the return process. However, they have some mechanism to handle customer complaints on an ad hoc basis. According to the respondents, the customers' complaints were handled with fast responses. In most cases the complaint analysis was done after a fast response to the customer. For this analysis members were mainly from production, quality, and market departments. Most companies have used the final results for improvement activities. The existing manufacturing industries were basic products manufacturers such as food, garments, textiles, leather, etc. which had practiced for a long time with push-type production strategies. The companies' response about return process was generally at a lower level of performance. Companies have a better set of specifications to verify the quality of the return products. However, reverse logistics and detail documentation about return process was at lower level of practices.

4.2.3 Best practices

This section's results showed similar trends. The first part discusses the questionnaire survey results. The interview results follow. In order to further verify the extent of best practices implementation in Ethiopian manufacturing industries, the respondent companies were asked to rate the level of adoption of selected best practices from the SCOR model. The questions were set up on a four-point scale to measure the extent of implementation described by each of the items. The scale range from 1 to 4, with 1 = never implemented, 2 = poorly implemented, 3 = well implemented, and 4 = extensively implemented. Table 4-11 illustrates the distribu-

tion of best practice mean scores. Most of the surveyed companies have indicated that they have started to use some of the best practices. Among all of the best practices, Total Quality Management was found to be the leading best practice, with a mean score of 2.48. Other best practices which have shown high levels were Benchmarking (2.39) and Available to Promise (2.35). However, the least practiced best practices are the Electronic Data Interchange and Bar Coding/Automatic Identification Practice. Those best practices which need an ICT infrastructure were represented at a lesser extent than others.

The interviewed companies have also stated the following as the major best practices implemented so far: Business Process Reengineering, ISO 9001:2008, Environmental Management System, Total Quality Management, Kaizen, Benchmarking, Balanced Scorecard, Food Quality & Safety Standard, Outsourcing, and other products related to specific manufacturing techniques from different sources. However, some companies were not much interested in observing world-class practices. The government companies were generally in a better position than private companies to adapt some best practices. Table 4-11 summarizes the respondents' list of best practices from the interviewed firms' experiences. Lack of professional expertise, high employee turnover, lack of management commitment, lack of research training, and research institution were the most important challenges.

Table 4-10: The implementation level of best practices

Type of Best Practices	**Mean**	**S.D.**
Total Quality Management	2.48	0.98
Benchmarking	2.39	0.97
AvailabletoPromise	2.35	1.04
Carrier Agreements	2.31	1.02
Outsourcing	2.23	0.92
Supplier Performance Assessment System	2.03	1.00
Lean Production	2.00	0.86
Co-locatedProcurement	1.96	0.96
Cross-Docking	1.92	1.04
Postponement	1.89	0.94
Collaborative Planning, Forecasting and Replenishment (CPFR)	1.61	0.75
Six Sigma	1.56	0.79
VendorManagedInventory	1.56	0.87
Bar coding/automaticidentification	1.54	0.84
Electronic Data Interchange(EDI)	1.54	0.73

Based on these findings, the existing best practices were identified. They were mainly focused on productivity and quality improvement programs such Total Quality Management and Benchmarking. Other types of best practices highly

dependent on information technologies were at very poor level of implementation. Considerable number of respondents did not have any interest in practicing these. The inventory management practices were also at a low level of implementation. Companies were still using traditional methods of higher stock safety and central warehouse control mechanisms.

Table 4-11: Types of best practices & challenges

Firm	Types of best practice	Challenges
1	TQM, BPR, Benchmarking, ISO 9001:2008, Environmental management system	Lack of expertise & commitment, Ideas come and change without critical thinking about the use of the best practice
2	Special product related technologies and organizational working culture from Korea	Different working culture and high employee turnover
3	No formal best practice implemented	Management only involved in routine production operation
4	TQM, BPR, Benchmarking, Quality management system	However not for long time & committed for successful implementation
5	Food quality & safety standard best practice	No much attention given for other best practice
6	No formal best practice implemented	Management only involved in routine production operation, no responsible person for research & development activities
7	Manufacturing technologies related to company product & how to work closely with supplier, customer requirements handling	Lack of awareness
8	Kaizen, Green park, outsourcing	Lack of support from top management
9	Benchmarking, ISO 9001:2008	Financial constraints and low level of acceptance & resistance for new ideas
10	Benchmarking, ISO 9001:2008	Lack of practical training & support form academic & research institutions
11	BSC, Benchmarking, BPR, ISO 9001(not finished)	After privatized owners do not interested in the introduction of the new technologies and ICT
12	BSC, TQM, BPR and other ceramics technologies	No continuity & follow-up for introduced best practices

4.2.4 Enablers and challenges

Implementing supply chain concepts in manufacturing systems is a challenging task. In the literature, researchers have pointed out a number of challenges or obstacles for implementing best practices to situations in developing countries (discussed in chapter 3). For any change in an organization to take hold and be successful, the challenges or barriers need to be identified and understood. The questions were set up on a four-point scaled range to measure the extent of challenges described by each of the items. The scaled range from 1 to 4, with 1 = no challenge, 2 = small challenge, 3 = challenge, and 4 = strong challenge. The supply chain concept barriers are analyzed based on the status of supply chains' implementation by the respondent companies (indicated in the previous section). The three main barriers in the firms were (1) the existing models' specificity to the developed countries' operating environment; (2) quality of skilled workforce; and (3) lack of ICT infrastructure. Table 4-12 shows the ratings of the most significant challenges or obstacles for implementing supply chain management concepts according to the respondents.

Table 4-12: The challenges of supply chain concepts implementation

Types of Enablers	**Mean**	**S.D.**
The existing model specificity to the developed countries operating environment	2.97	0.76
Quality of skilled and cost-effective workforce	2.94	0.84
Lack of ICT infrastructure	2.93	0.78
Difficulty in implementing the models & handling for practical operations	2.79	0.89
Non-systematic approach to measuring customer requirements	2.78	0.74
Management practices and organizational working culture	2.77	0.91
Difficult to establish relationships based on shared risks & rewards	2.68	0.86
Lack of employee loyalty/motivation/empowerment	2.57	0.88
Lack of physical infrastructure	2.45	0.91

Table 4-13 exemplifies the use of information and communication technologies as enablers, including both hardware and software in the firms. The questions were set up also on a four-point scale to measure the level of the enablers' status of each of the items. The scale ranged from 1 to 4, with 1 = poor performance, 2 = fair performance, 3 = good performance, and 4 = excellent performance. The Electronic mail service was the dominant enabler available in the respondent companies. The use of new technologies and software, such as forecast/demand management software, transport/warehouse software and e-procurement, and bar coding/automatic identification system are at poor performance levels. Almost half of the respondent companies did not have such types of enablers at all. However, most companies were interested in adopting such types of enablers in the future. Some firms have already started programs to implement local software for use.

Similar observations and results were obtained from interviewed companies. During foreign sourcing processes, most companies use telephone and e-mail to contact suppliers, and send purchasing orders (PO) via fax to confirm the order. However, simple communication systems such as telephone, fax, and email are used for communicating with suppliers. State-of-the-art electronic business (e-Business) has not started yet in Ethiopia. Few companies have company websites, even with primary information about the company or its products. Three companies out of twelve have a plan to use ERP systems in the future to create e-Business via the internet. Furthermore, the present information technology systems waste paper and space in keeping order records, because there are many paper copies of purchase orders for each order. Most companies plan to develop a paperless system by working on computers and linking departments' processes via local networks and the internet. Thus, the use of information technology (IT) between the companies and suppliers is improved. Therefore, IT system is a key enabler of fast and reliable interaction with suppliers and customers for those manufacturing industries trying to penetrate the export. In summary, IT system is a very important part of contemporary business in order to gain competitive advantage in planning, sourcing, production, and distribution processes. The main constraint or obstacle for developing countries in implementing supply chain concepts is the lack of a model that specifies the existing local scenarios. They have responded that the existing model was designed to fit situations of developed countries' companies. Lack of ICT infrastructure and trained professionals were also bigger challenges for the investigated developing country's companies.

Table 4-13: The level enablers for supply chain implementation success

Types of Enablers	Mean	S.D.
Electronic mail system	2.80	1.06
Automated material handling system (hardware)	2.05	0.95
Enterprise Resource Planning systems (ERP) system	1.78	0.85
Advanced planning and scheduling software	1.74	0.91
Electronic data interchange (EDI) capability	1.74	0.91
Bar coding/automatic identification system	1.50	0.71
E-procurement system	1.50	0.74
Transportation/warehouse management software	1.28	0.65
Forecast/demand-management software	1.22	0.53

4.3 The identified supply chain characteristics

The results of the field study have improved understanding of the existing supply chain relationships, business processes, performance measurement, best practices, enablers, and challenges associated with supply chains. Furthermore, a better understanding of the technological constraints that face Ethiopia was obtained.

This result lead to knowledge of how the SCOR model can provide better information to manufacturing industries' in their modeling, evaluating, and effective improvement of their performance. Therefore, the result from this survey assisted in later SCOR model adaptation in order to apply to developing countries' scenarios. The study also helped to identify and contact organizations that would participate in further semi-structured interview activities. The survey also identified specific characteristics of developing countries' supply chains from Ethiopia. For example, there were different inputs regarding what to include and exclude in their adaptation activities. As a result of this survey, the researcher has a better understanding of how the current practices can provide support to further model adaptation. This survey brought out a number of challenges associated with supply chain implementations. In particular, the challenges related to existing advanced innovative management techniques and their adoption to local processes practices were highlighted.

The previous section introduced the results of the questionnaire survey and semi-structured interview data. The purpose is to provide an overview of the existing supply chain practices, enablers, and challenges that influenced successful implementation. Analysis of the data and difficulties encountered were also discussed. This section summarizes the results of the field study, and identifies main characteristics of supply chain in the developing countries. Reasons for the inclusion of the results are provided with respect to the literature, research data and the researcher's own professional experience. To go further for the main adaptation works, it was important to revise the results and compare the findings of the two field studies. In summary, all of the five focal areas of the two field studies were presented as inputs for further adaptation activities. The semi-structured interview results have given more detailed data that focuses with the help of the results of the first field study. This confirmed the finding of the questionnaire-based survey.

4.3.1 Supply chain relationship

Some factors were especially unique in the supply chain relationship of the studied companies. For example, their sourcing functions from local and international suppliers, supplier selection, and price decision issues in the chain. Based on the interviewed companies, configuration and coordination aspects of each Ethiopian firms supply chains have been investigated. The first issue to be addressed was the identification of elements in the supply chain and allocation of functions among the elements. These aspects are depicted in Figures 4-4, 4-5, 4-6, 4-7, and 4-8. The figures also show the line of coordination, which in this case refers to the presence of formal orders, information exchange, and standard procedures. Looking at Figure 4-4, 4-5, 4-6, 4-7, and 4-8, it can be seen that each industry's supply chain consists of different elements. For the garment supply chain, the other members in the chain are wholesalers that act as their direct customers, and agents which distribute the products to the end customers. Sometimes, agents can deal directly

with companies without the presence of wholesaler. In the garment and leather supply chain, both consist of their parent company or the groups' headquarters. However, the garment's supply chain has an additional member with the presence of sister companies that act as their 'direct' customer. The important major differences were in sourcing and delivery processes and their supply chain members' participation in such activities. For example, the wholesaler and small retailers actively participated in both the sourcing and delivery processes to the suppliers and final customers in Ethiopian context manufacturers. This makes the delivery process more challenging and unique in the developing world. Figures 4-4, 4-5, 4-6, 4-7, and 4-8 show the typical supply chain configurations in garment and leather industries in the case studies.

Figure 4-4 shows the supply chain characteristics of the garment industry in Ethiopia. The company sources its major raw material from a Chinese fabric manufacturer and delivers their ready-made garments to the market in the USA. In this supply chain, their geographical location and distance between customers, producers, and suppliers creates its own unique features and challenges as a global supply chain. The main challenges were information exchange and planning activities to fulfill the appropriate lead time. From the challenges of on-time delivery the company lost a large amount of money. The product quality was another big challenge to the company because the end customers are far from the manufacturing area.

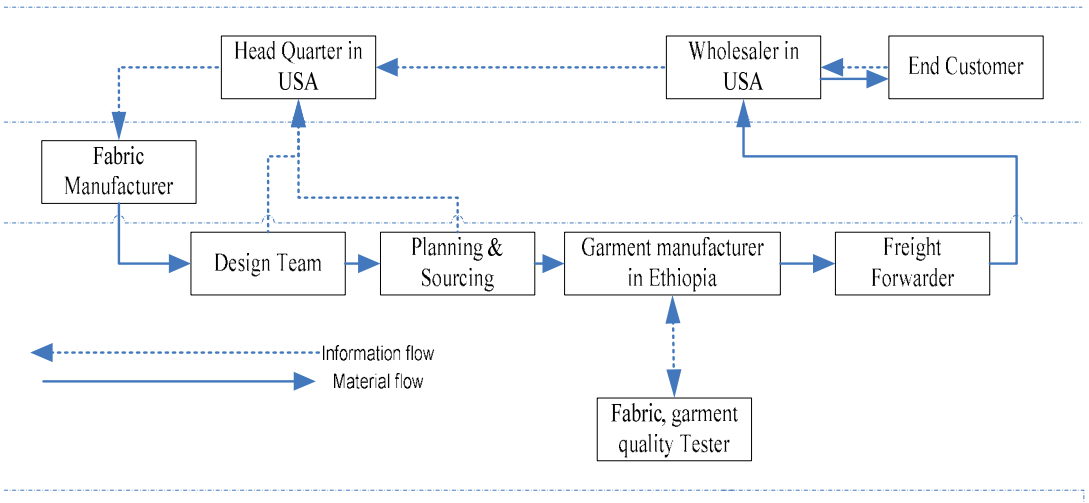

Figure 4-4: Garment industry supply chain

Another other potential area for the developing countries is the leather industry. From their large livestock potential and promising market for leather products currently, the industry is trying to gain an advantage in the sector (Figure 4-5). However, the industry is highly fragmented. The presence of different chain participants was creating high price fluctuations and an unstable market. The collection of raw

skins and hides, and price negotiations were large challenges. Long-term relationships were challenged by external interventions on local manufacturers especially by Chinese leather manufacturers.

Figure 4-6 presents the textile supply chain. The textile industry was one of the potential areas for present and future development and job opportunities in developing countries. Because of the large agricultural land for production of cotton as the raw material source, the developing countries should take advantage of further processing their raw materials to finished product garments. The main challenges in this industry were lack of technology knowledge and high competition from global markets. The companies need to upgrade their capacity to compete in the global supply chain. A firm manufactures textiles mostly for local markets, and operate as a textile mill. A company has around 1000 employees. It uses local wool producer from local supply. However, its production activities still depend on imported chemicals and spare parts.

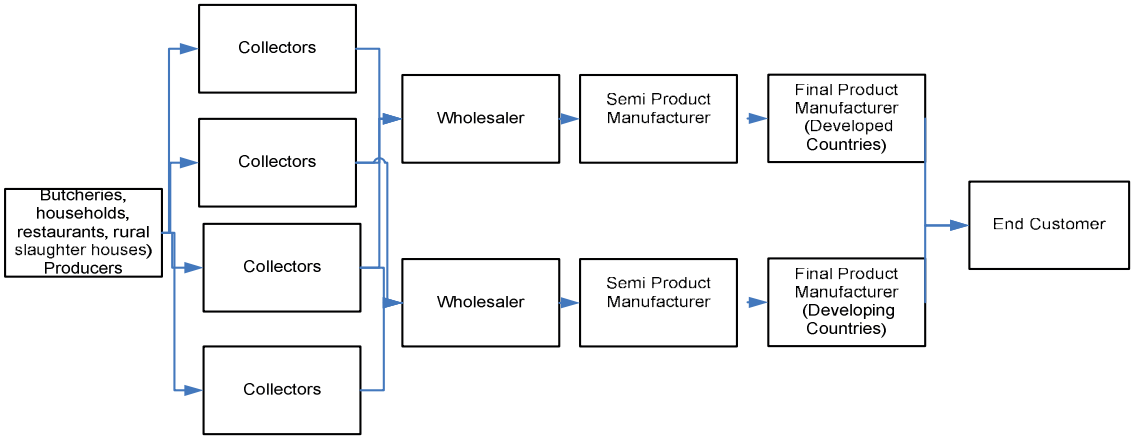

Figure 4-5: Leather industry supply chain

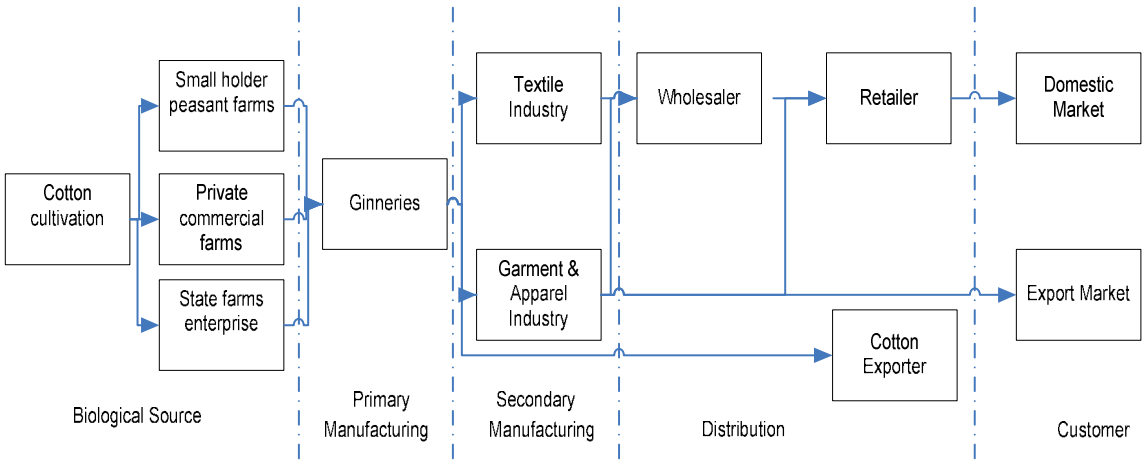

Figure 4-6: Textile industry supply chain

Figure 4-7 illustrates another example of the steps in a supply chain for the wood products manufacturing industry. This process begins with logging operations, and logs are then sent to the mill where crushing woods are sent to the wood products manufacturer (wood processing operations). Lastly, once chip woods are manufactured, they are reduced to appropriate sizes and sent to the sales department of a wholesaler, or directly to the final customer. The factory lies in an area of 69,000 square meters with an integrated forestry development on 985 hectares of woodland.

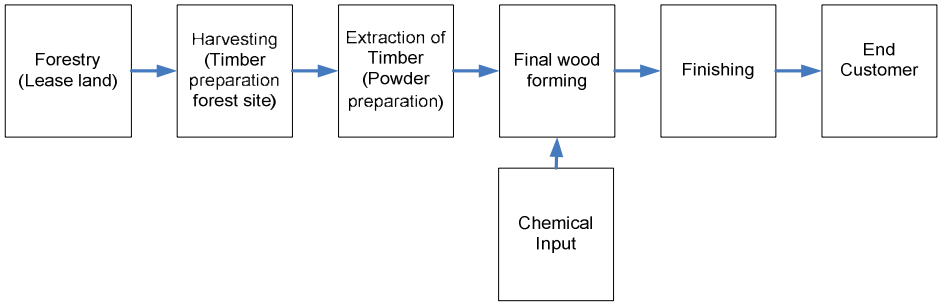

Figure 4-7: Wood industry supply chain

The food processing firm is a pioneer of the food processing industry in Ethiopia. The current capacity has reached 21,600 MT/annum. The factory had been re-established as a share company in 1999 by transforming the previous public enterprise with a total capital of birr 38,594,000. It had also undergone rigorous expansion and innovation works to satisfy the ever growing demand of society, and currently the capital has grown to birr 48,710,752. The company also has implemented an integrated food safety and quality management system (ISO 22000-2005), certified by the Republic of South company called SABS. Figure 4-8 shows the supply chain of the food processing company.

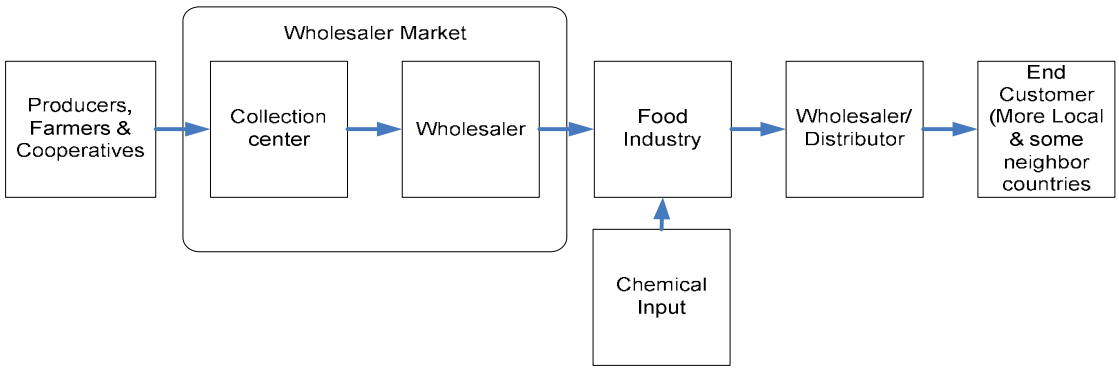

Figure 4-8: Food industry supply chain

4.3.2 Performance measurement

The reviewed literature has suggested that firms should put more emphasis on non-financial measures in comparison to financial measures in their performance measurement system. In addition, recently there has been a shift in the new development of performance measures to include supply chain performance measures. However, the findings from the interviews and questionnaires show that levels of performance measures not only focus on financial measures but also are restricted to organizational boundaries. Even the performance measures used inside the companies were the focus in departmental performance measures. Figure 4-9 demonstrates the summary of the existing performance measures and industrial practices at three levels: strategic, tactical, and operational performance measures. The existing performance measures still lack the recent influential measures in current businesses such as time, customer satisfaction, flexibility, and reliability measures.

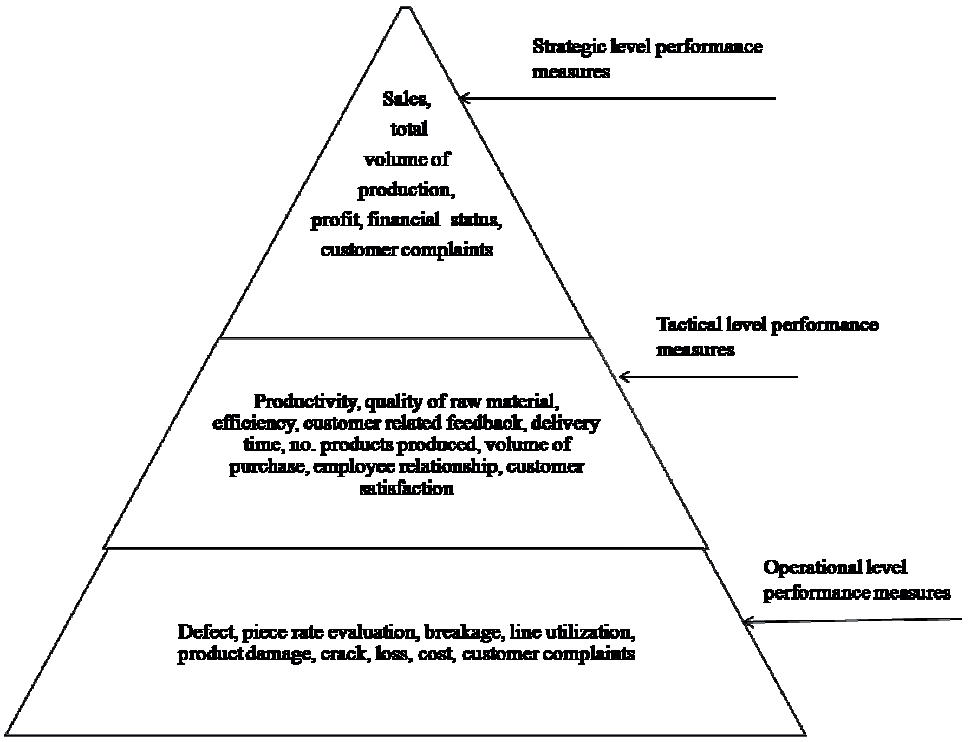

Figure 4-9: Performance measures in three levels

The study also sought to find out what performance measurement approaches were commonly adopted by Ethiopian manufacturers. Over thirty percent of the manufacturing industries have not implemented any performance measurement systems. Next, twenty-five and around twenty-two percent use contemporary systems; respectively, the balanced scorecard and activity based costing. No clear trends were evident in the results showing that these modern PM approaches used non-financial measures to a greater extent than financial. The Balanced Scorecard literature implies that if this system is implemented correctly, non-financial measures should be

foremost. Results from this study showed little or no difference between approaches. Interestingly, no organization that participated in the survey was planning to adopt a new performance approach in the foreseeable future. However, from case studies of companies, only two out of twelve manufacturing industries have tried the balanced scorecard implementation. Eighty-four percent of the respondents did not implement any performance measurement system. Table 4-14 shows the summary of the performance measurement system and performance measures characteristics found in the research.

Table 4-14: Performance measurementcharacteristics

Key characteristics
There are some PMSs have initiatives by the government to adopt the modern performance measurement system. However, they have started without careful selection and after some trial for implementation; they have stopped and just jumped to another new one.
Less attention is given for time and customer satisfaction
Recently productivity and finances have gained more attention
Employees fear performance evaluation and feel insecure
Only functional based measures leads reinforced functional silos
Manual data collection
Mangers think that it was additional challenge and work burden to implement the performance evaluation and keep records
People are not open to discuss with each other and feedback directly about performance

4.3.3 Business processes

From analysis of the field results, the researcher has found the basic characteristics of the five business processes in manufacturing firms in Ethiopia:

Plan process: Planning processes are present more or less in all companies. The existing planning systems correspond to maximum stock levels established especially for raw material inputs from foreign companies' supplies due to high uncertainties in the companies' basic operation. As a result of lack of point on sale information, planning process has initiated its demand plan from previous years such as last three to five years of sales experience. Most of the companies did not do well at cross-functional and cross-company planning. Due to departmental silos, the investigated companies have shown a lack of a coordinated planning process between marketing and procurement operations compared to the world's best practice. The main reasons for this gap are their poor forecasting standards and models used in their planning operations. In most Ethiopian companies, forecasting is followed by prediction of total volume growth by X percent (mostly 10%) across all departments. While Ethiopian top managers tend to focus on marketing and sales functions for their planning process, they generally have limited understanding of

its implications for supply chain planning. However, planning in a specific industry of the chain or covering the whole chain relies on the company's basic marketing or sales functions, its relationships with suppliers and customers, and its existing support obtained by technological tools. The table 4-15 shows the general characteristics of planning Processes. The current data collection and information exchange with suppliers and customers were limited and used traditional channels. Because of data constraints, high uncertainty of raw material supplies, and volatile market price fluctuation, firms have faced difficulty in managing their supply chains within firm boundaries.

Source process: Generally, the companies in question procure material especially to stock foreign and seasonal raw materials such as agricultural product inputs. Processes associated with companies' purchases are defined by the type of raw material inputs and the location of the source. If the input sourcing is from international suppliers, the procurement procedures are determined by the Central Bank of Ethiopia's bidding procedure due to foreign-currency needs. Due to lack of currency, distant foreign markets, complex custom procedures, and other uncertainties, high stocking levels up to 6-12 months are always practiced as the safe model. With respect to the local purchase, price fluctuation and supplier loyalty were bigger challenges. Table 4-16 shows the main characteristics found in the source process.

Table 4-15: General characteristics of planning process

Key characteristics
Lack of visibility of sales at the end customers
Data are collected manually in papers which makes planning activities difficult
Use of computers in planning and forecasting is very minimal
Process more of a push strategy primary driven by sales targets
No formal forecasting techniques used, uses only historical data for demand planning
Marketing department are responsible for initial demand plan
Production planning follows marketing department demand plan to make it realistic and achievable with current capacity
Planning activities are not considered as part of serious function but as part of additional task on the main department function

Make process: Most of the companies studied have implemented Make-to-Stock strategy, while other companies such as those in the textile and garment industries have their reported production according to the customer's specifications with make to order strategy. Due to high uncertainties in supply, companies outsourcings practice are underdeveloped. The manufacturing industries are highly fragmented, dependent on foreign technology, and of low level infrastructure in ICT, power, and water supply. The general characteristics of making process are summarized on table 4-17.

Table 4-16: General characteristics of sourcing process

Key characteristics
Suppliers lack critical elements of service namely quality, delivery reliability, and value added services
Companies depends on local and international sourcing for their production activities
Delivery times of suppliers show a huge variance due to road conditions, traffic and distance of the suppliers
Delay on time delivery and poor quality of raw material from international suppliers
Suppliers lack major capabilities to design products and services
Suppliers are fragmented and mostly rural in nature which makes procurement difficult
Long delays in customs and port handling as well as complex tariff for imported items often made it very hard for firms to operate under a lean inventory system
The supplier evaluation is largely based on minimum cost
Price fluctuation and negotiation are frequent practice in local purchase
Contract breakdown & supplier apathy

Table 4-17: General characteristics of make process

Key characteristics
A push strategy dominates for make-to-stock production
High production costs and lead time
Low outsourcing because of high uncertainty in suppliers
Some production Machineries have become obsolete, 25 to 30 years
Spare parts are usually imported and sometimes produced locally by small work shops
Companies measure productivity in terms of variation between sales/costs budget and real values
Production schedules aren't practiced well
Industries are fragmented into small and medium firms
Limited or lack of adequate infrastructural support like frequent power outages, inadequate water supply and poor road connections
Packaging material and quantity of products in the package should be with minimum costs to be affordable to larger poor customers

Deliver process: The existing model to deliver products uses three methods: (1) through wholesalers or agents to local and export markets; (2) manufacturers by its own shops; (3) directly delivered through retailers. Some manufacturers directly visited retailers and delivered information on demand to wholesalers. Recently, supermarkets have been introduced one option of delivery in some big cities. Table 4-18 summarizes the general characteristics of delivering process.

Table 4-18: General characteristics of deliver process

Key characteristics
Poor customers and smaller markets are distributed throughout the country with limited physical infrastructure
Different retailer, old fashioned street markets, emerging new supermarkets
Manufacturer, wholesaler, and retailers are involved on delivery process
For outsourced delivery process, wholesaler is in charge of routes optimization
The purchasing and marketing are characterized with cash-based system
Time of delivery has variation depends on location and type of the customers
No third party logistics provider is available (either own truck fleet or customers' trucks)
The distribution system is heavily regulated with burdensome and bureaucratic public sectors

Return process: Returns from wholesalers and retailers are managed in two stages: first, the order is assumed complete if the customer doesn't send any complaint within specific date limits after its receipt; the second stage considers the subsequent real verification of products, and for this most suppliers have a period of time for complaints and returns. Manufacturing companies are handling the return issues on ad hoc basis when the request appears.

Table 4-19: General characteristics of return process

Key characteristics
Companies do not have a plan for return processes but treated on ad hoc basis when claims appear
Most of companies do not have direct contact with final customers
Returns on foreign imported goods are more complicated
Price compensation is used as strategy for claims than return

The return activities from the international customers and suppliers were especially big challenges. Regarding local suppliers, returns are physical whereas for international suppliers and customers it is through negotiations for next orders. Regarding external suppliers however, due to the cost implication in the return, the product loss is assumed by the producers or distributors importing the products. When Ethiopian manufacturing companies had direct and permanent relationships with their external suppliers, information on defective products generated actions and reviews in the supplier, even when there was no physical return of the products. Table 4-19 shows the summarized characteristics of return process.

4.3.4 Best practices

This analysis is based on the most frequently identified best practices from the SCOR model and other research. The research focused on answering the question: to what extent have the following SCOR model best practices been implemented in

the respondent companies? Most of the surveyed companies indicate that they use some of the best practices. The most common best practices are: Total Quality Management, and Benchmarking. The least common practices in the surveyed companies were: Electronic Data Interchange (EDI), Bar Coding/Automatic Identification, Vendor Managed Inventory (VMI), Six Sigma, and Collaborative Planning, Forecasting and Replenishment (CPFR). The results show that most of the respondent firms have started to adopt best practices up to a certain extent. The firms should be aware and understand the best practices and purposes because the main barriers to these firms are the lack of real understanding of best practices manufacturing concepts and employees' attitudes. Some of the best practices will better facilitate the efforts of the developing countries toward supply chain integrations with their partners in developed countries, and benefit the overall improvement of supply chains.

4.3.5 Enablers

The other outcomes of the field research were gathered data on the organization's information and communication technologies level. Most companies have practiced a manual type of data collection for the performance measures. The data collection was not supported by information and communication technologies. However, financial measures were collected with better accuracy. Financial data was well supported while operational performance data collection was poorly supported. These results indicate a deficiency in current information systems. Most communication within companies happens through paperwork. Some companies have started to use computer and internet facilities to support information sharing inside organizational boundaries. Use of internet supported company-wide activities were rare. Most companies use the internet for international purchases and communication with foreign suppliers. Table 4-20 lists the major enablers for communications and data collection.

Table 4-20: Type of enablers for communication and information collection

Key characteristics
E-mail used mostly in communicating with foreign suppliers
Mail, fax, mobile, & fixed phone for local connection widely used communication techniques
Face to Face (F2F) communication for local purchases
No Electronic Data exchange (EDI), No Internet based B2B tools
No planning & scheduling software such as MRP I&II used. However some companies are planning Enterprise Resource Planning (ERP)
Some locally-made functional based software is used such as Inventory (Warehouse) Management, Budget, & Finance management software

5 ADAPTATION OF THE SCOR MODEL FOR INDUSTRIES IN DEVELOPING COUNTRIES

The previous chapter discussed the results of the two field study findings. This chapter aims to present the adapted SCOR model for manufacturing industries in developing countries. The adapted SCOR model is named d-SCOR (developing countries Supply Chain Operations Reference). It is based on the SCOR model but incorporates new processes, key performance metrics, and best practices suited for the manufacturing industry. Keeping the original SCOR version intact is crucial. The new processes and performance metrics are denoted with a lower case letter 'd.' for a supplier of raw material for manufacturing firms in developed countries, the current SCOR model cannot be taken as a sufficient instrument since most of the existing situations and prevalent environment in the developing country are different from the initial SCOR model assumptions. The results of the literature review (chapters 2 & 3) and field results (chapter 4) have discussed these differences in detail. The manufacturing industry in developing countries needs new and adapted processes, metrics, and best practices that suit their operating scenarios and the challenges discussed in chapters 2, 3, and 4. Figure 5-1 demonstrates the typical supply chain involving a developing country. The figure also clearly shows the areas of application for adapted model.

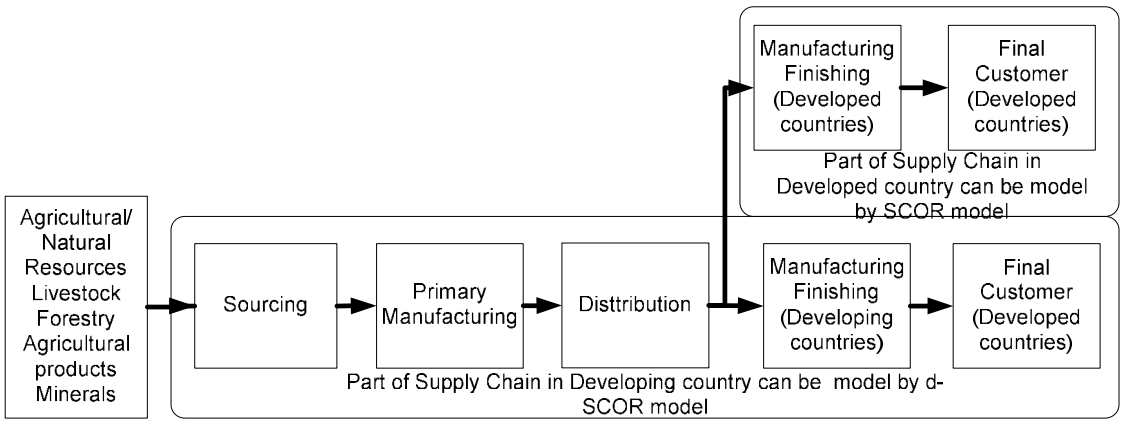

Figure 5-1: Typical supply chain involving firms in developing countries

The current chapter presents the SCOR model adaptation to suit these new scenarios. Section 5.1 describes the general and specific requirements for the adapted SCOR model. Section 5.2 explains works related to an adapted new business processes. This is then followed by a description of the adapted key performance indicators to suit the characteristics of the manufacturing industry in developing countries, based on the findings from the field study and literature review. The best practices adaptation is explained in section 5.3. Finally, the two models (SCOR and d-SCOR) interface and integration are discussed in section 5.4.

5.1 Requirements for adapting the SCOR model to suit manufacturing firms in developing countries

For this research, the researcher has modified the Deindl (2010) four-stage reference models to fit the adaptation scenario. These stages are depicted and explained in Figure 5-2. In the first stage, preliminary analysis has been made through literature review and field study in selected companies in manufacturing industries. The first stage results have been discussed in previous chapters. In this chapter, requirement analysis and adaptation results are presented in this section and the next section consecutively. The results of the literature review and field results have been used to elicit and define the specific and general requirement of the adapted model. In order to effectively measure, analyze, control, and finally integrate the entire supply chain players in business processes and underlying ICT infrastructures, a new reference framework for manufacturing industry is required. To validate the industry need, an extensive literature review and field study were carried out to define the industry requirements needed for the reference model.

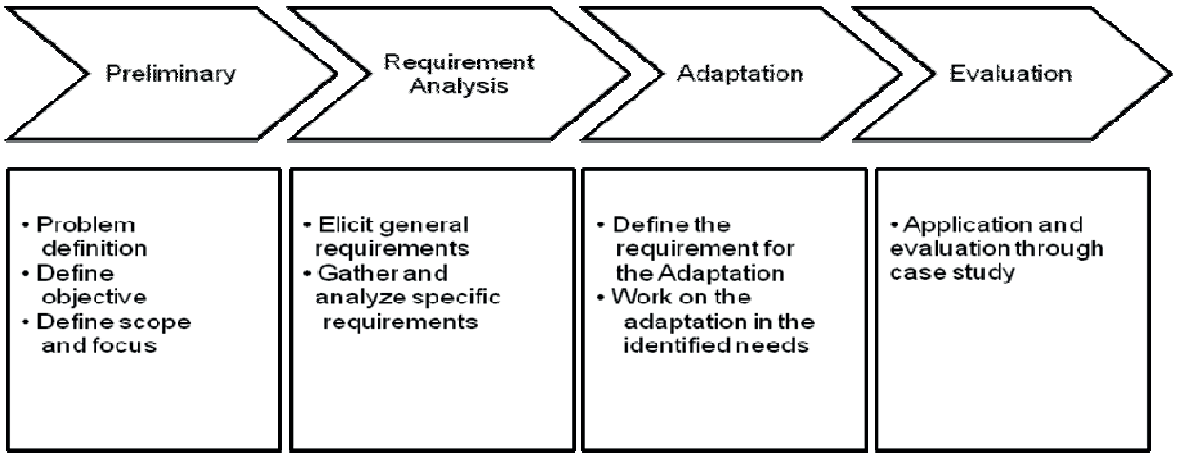

Figure 5-2: An approach for designing the reference model (Deindl, 2010)

The process-oriented reference models can be extended and adapted to suit different situations where the models have to be successful. From the results of the literature review and field results, the supply chain characteristics of the firms in developing countries are defined. This analysis leads to the definitions of the requirements for the new situations. The information collected by the questionnaire and the semi-structured interview questions provided insight into the ability of the current operations reference models to handle the new situations and analyze the useful information to determine characteristics of the supply chain. The identified gaps from such field study have provided the data necessary to determine the requirements. This section explains how the requirement can be answered from the

following questions satisfactorily. These are: why adaptation is more important than using the original version of SCOR model? What are the existing situations that differ from the original model assumptions? Which part of the model remains untouched after adaptation? Which parts need to be changed, removed, or modified? What types of new processes need to be added?

The SCOR model has many limitations when applied to firms in developing countries. Four of the most significant limitations of the SCOR model are the process types, performance measures, best practices, and enabling technologies. Within the next section, the general requirements and necessities of an adapted SCOR model are defined from the literature review and field results for firms in developing countries. The adapted performance measures are presented in the third section. The fourth section explains how the existing SCOR model best practices are better utilized to suit the new situations. Finally, the existing enablers and future potential for development are discussed.

5.1.1 General requirement

The trend of new business and competition requires a new form of collaboration and integration of entire supply chains. To remain in competitive position, companies are trying to integrate their entire supply chains to include firms in developing countries. To facilitate this effort, tools for modelling, evaluating, and ultimately improving the entire supply chain are becoming important. This leads to recent interest by academics and practitioners in global supply chain integration, and need for such models that help such initiatives. The data collected from practical industrial experience can help to further specify the goals and contents of the adapted reference model. The focus of such a reference model is to define, analyze, and evaluate business processes in supply chains; to define common intra- and inter-enterprise languages; to measure actual performance against benchmarks or set targets; to describe disconnects and conflicting targets and develop project portfolios for improvement. The scope of an adapted SCOR model is to integrate the entire supply chain. Whereas a reference model supports companies in measuring, analyzing, and controlling what they do in a standardized way, a reference framework offers recommendations for how to manage and execute different improvement efforts.

The firms in developing countries are actively participating with a substantial share of global supply chains' production processes, leading to opportunities and challenges in the same enterprises. Even though the global supply chain creates greater access to markets, it demands greater competence from suppliers. It is therefore important for developing countries to implement more advanced techniques focused on improving the supply chain to enhance their competitiveness. The developing countries have enjoyed preferential market access

to developed countries up to the present time. However, the business situations are changing dynamically and at some point it would be impossible to get such preferential treatment at all. As long term business strategies, the manufacturing firms need to integrate their business processes and improve their activities in order to obtain better benefits. Therefore, the manufacturing industry in developing countries needs a tool for such modelling and improvement actions.

5.1.2 Simplicity and reduction of complexity

This section presents how various identified challenges and barriers can affect the implementation of the model. The firms in developing countries are operating in a challenging environment with constraints. An overview of the building blocks of the model, which require simplification and reduction of the complexity of the supply chain model, is shown in Table 5.1. Due to these challenges the building blocks of the model need to be simplified to decrease the complexity of the model for smooth operation. The results of the literature review and field studies have demonstrated the effect of the challenges in operating behaviour and capabilities. The content and the complex nature of the model can affect the success of its implementation because of technical difficulties in understanding, collecting, management, and exchange of information. The lack of professional expertise and knowledge also limit the complexity of supply chain model. As a consequence of financial constraints, sophisticated equipment will be unavailable. Limited financial as well as human resources also necessitate limiting the model complexity. The existing physical and ICT infrastructure challenge the assumption of the model to design business processes. The observed existing practices in organizational and managerial capabilities also limit the model's applicability in its current form.

5.1.3 Specific requirements

The identified supply chain characteristics in chapter 4.3 are employed for defining the requirements of the new situations. This section focuses on the building blocks: business processes, performance measures, best practices, and enablers. The first part discusses the business processes focusing on the five business processes. The performance measures requirement is presented in section two. In the third section the best practices requirement is explained. In the final part the technology enablers' requirements are demonstrated.

Business processes: The business processes are an important part of the reference model. They need careful analysis and configuration for the adaptation tasks. The companies under investigation have shown a unique configuration of the supply chain, especially on some business process such as sourcing activities from local or international suppliers, supplier selection, and price decision issues in the supply

chain. The business processes in the adapted model have followed a similar level of arrangement as the original, having a smooth interface. The business processes in level I remain untouched except for return source from agricultural resources. It is excluded from the adapted model. Business processes in level II are highly affected by the environmental conditions and factors. Therefore, the business processes need appropriate modification by adding, removing, and modifying the processes. The following paragraph discusses some of the requirements for different business processes.

Planning process existed more or less in all companies. However, the planning process suffered due to lack of data, information, and methods of forecasting. Computer application is at a low level for planning activities. As a result of lack of point on sale information, plan process has initiated its demand plan from previous years such as the last three to five years of sales experience. The main gaps in the planning process are poor forecasting standards and the models used in their planning operations. In most Ethiopian companies, forecasting is followed predicting a total volume growth by X percent (mostly 10%) across all departments. However, planning in a specific industry of the chain or covering the whole chain relies on the company's basic marketing or sales functions, its relationships with suppliers and customers, and its existing support obtained by technological tools. This reality needs to be understood and taken in the subsequent activities of adaptation.

The important major differences were in sourcing and delivery processes and their participation in such activities. In developing countries, manufacturers, wholesalers, and small retailers actively participated in the delivery process to the final customer. This makes the delivery process more challenging and unique in the developing world. Generally, the companies in question procured material to stock, especially imported raw material and seasonal raw materials such as agricultural products. Processes associated with companies' purchases are defined by the type of raw material inputs and location of sources. If the raw materials input sources are from international suppliers, the procurement procedures will be determined by the Ethiopian Central Bank bidding procedure due to foreign-currency needs. Because of lack of currency, distant foreign markets, complex customs procedures, and other uncertainties, high stocking levels up to 6-12 months is always practiced as the safe model. With respect to local purchases, price fluctuations and supplier loyalty were bigger challenges. The adaptation works should consider this unique situation for successful implementation.

The researcher has also considered the make process as another characteristic. Most of the companies studied used a make-to-stock strategy. Some of the companies such as textile and garment industries report production according to the customer's specifications. Due to high uncertainties in supply, companies practice outsourcings were underdeveloped. The manufacturing industries were

highly fragmented, dependent on foreign technology, and had a low level of infrastructure in ICT, power, and water supply. The product quality is a challenging problem frequently faced by production activities. The main reason of such a problem arises from raw material suppliers, both from local and foreign companies. In addition to the raw material, the manufacturing process has also experienced product quality problems. The existing manufacturing practices are also the source for environmental pollution. Therefore, the make process shall be adjusted to accommodate these challenges.

The other characteristic that needs due attention is the inventory management practice. Firms in developing countries have different inventory management problems compared to problems in the developed countries. The manufacturing industries in developing countries are highly dependent on imported raw materials and machineries for their production activities. This in turn influences and consequently delays obtaining materials. Most production managers usually plan production on available and anticipated stock levels. This task is further complicated by the government's restriction on foreign currency and bureaucratic delays in international bidding procedures. In more developed countries, due to the well established business infrastructures and business communications, the efficiency of the inventory ordering process was generally taken for granted. In developing countries' situations, the monopoly in manufacturing business has been enjoyed by many industries, and there are no major pressures to reduce inventory costs. The existing situation of heavy dependency on imported raw materials and parts and lack of foreign exchange makes the task of ensuring a regular supply of raw materials a difficult one. As such, the efficiency objective in inventory control should be given more prominence than the cost objective for the inventory management goals in developing countries. This peculiar condition needs to be considered as another requirement in the adaptation works.

The last requirement analysis is focused in the return process. In the existing practices, returns from wholesalers and retailers are managed in two stages: first, the order is assumed complete if the customer does not within specific time limits after its receipt; the second stage considers the subsequent real verification of products, and for this most suppliers have a period of time for complaints and returns. Manufacturing companies are handling the return issues on ad hoc basis when the request appears. The return activities from the international customers and suppliers were especially big challenges. Regarding local suppliers, returns are physical whereas for international suppliers and customers it is through negotiations for next orders. However, regarding external suppliers due to the cost implied by the return, the product loss is assumed by producers or distributors that returned the products. When Ethiopian manufacturing companies have direct and permanent relationships with their external suppliers, information on defective

products can generated actions and reviews on the supplier, even when there was no physical return of the products. The adapted model needs to include these specific needs.

Performance measures: The reviewed literature has suggested that firms should put more emphasis on non-financial measures in their performance measurement system. In addition, there has recently been a shift in the new development of performance measures to include supply chain performance. However, the results from the interviews and questionnaires show that the level of performance measures not only focus on financial measures but are also confined to organizational boundaries. Even the performance measures used inside the companies focused on departmental performance measures. The existing performance measures still lack the recent influential measures in current businesses such as time, customer satisfaction, flexibility, and reliability.

The existing performance measures have shown that the interests of the local manufacturers with respect to their market segments were mainly targeted. There was a large gap in the selection and implementation of the performance measures. Companies targeting the export market were more sensitive to delivery time and quality than those serving the local market only. It was clear that there were some differences in the general trend of performance measures. Based on research objectives for modeling and improvement to the whole supply chain, and current trends of global supply chain business process integration for better competitiveness, there is a great need to integrate the existing experiences with the SCOR model. In order to define a set of key performance indicators (KPI) for the manufacturing firms in developing countries, it is important to state the dimensions for these indicators.

Best practices: The firms should be aware of and understand the best practices and their purposes, because the main barriers to these firms are the lack of real understanding of best practices concept and employees' attitudes. Some of the best practices facilitate the efforts of developing countries in supply chain integrations with their partners in developed countries and the overall improvements of supply chains. This finding has implications for firms as it provides a means to help them to search, select, adapt, and apply the best practices that suit the existing conditions and factors affecting the process. Managers should understand and emphasize the importance in overcoming challenges for the successful implementation of best practices in their firms. The issue of applicability of the best practices to developing countries should be settled on the basis of the outcomes of such implementation. The search for best practices in developing countries requires an appropriate selection, adaptation, application, and evaluation of the results.

A major requirement in the future will be addressing the environmental factors and conditions that hinder the implementation of the best practices to developing

countries' situations. This will require new kinds of adaptation mechanisms for best practices that suit the existing situations. The field survey and literature review provides the following key insights and lessons: (a) future best practices adaptation should be flexible enough to respond to dynamic manufacturing scenarios and markets; (b) best practices adaptation should favour approaches that provide a number of different technologies and management practices which firms can search, select, adapt, implement, and evaluate so that they fit; (c) the gap between those practices observed in the field and those reported in the literature should be closed; and (d) some ICT based best practices require a conducive industrial environment and enhanced linkages with supply chain members to enhance beneficial returns.

Table 5-1: Simplicity and reduction of complexity

Factors that affect the acaptation			Business processes									
			Plan	Source	Make	Inventory management	Deliver	Return	Performance Measures	Best practices	Enablers, ICT	Supply chain relationship
Objective		Integration & coordination with other manufacturing firms	●	●	●	●	●		●	●	●	●
Capabilities and constraints	Technical and IT capabilities	Competence & operational capabilities	●	●	●	●	●		●	●	●	●
		Market differentiation	●	●	●	●	●			●	●	●
		Poor telecommunications infrastructure	●	●		●	●	●	●	●	●	●
	National capabilities	Cultural variation	●	●	●	●	●	●	●	●	●	●
		Resource availabilities	●	●	●	●			●			
		Physical infrastructure	●	●	●	●	●	●			●	●
	Relationship capabilities	Partnership based relationship	●	●	●	●	●		●		●	●
		Mutual trust and dependency	●	●	●	●	●		●		●	●
		Information sharing	●	●	●	●	●		●	●	●	●
	Organizational and managerial capabilities	Management model & style	●	●	●	●	●		●	●		●
		Organizational culture	●	●	●	●	●		●			●
		Skilled & Professional man power	●	●	●	●	●	●	●	●		●
Manufacturing		Types & characteristics	●	●	●	●	●	●	●	●		●
		Manufactured goods	●	●	●	●	●	●		●	●	●
		Source of raw material	●	●	●	●	●	●		●	●	●

Enabling technologies: Another outcome of the research was the data gathered on the organizations' information and communication technologies capabilities. Most of the companies have practiced a manual type of data collection. Business processes data collection was not supported by information and communication technologies. However, financial measures were collected with methods of better accuracy. Financial data collection was well supported while operational

performance data collection was poorly supported. These results indicate a deficiency in current information systems. Most of the communication within the companies was done through paperwork. Some companies have started to use computer and internet facilities to support information sharing inside the organization boundaries. The use of internet supported company-wide activities was rare. Most companies used the internet for international purchases and communication with foreign suppliers. The existing reality in relation to ICT requires due attention when adaptation works are performed.

The researcher has also considered the make process as other characteristic. Most of the companies studied used make-to-stock strategy. Some of the companies such as textile and garment industries report production according to the customer's specifications. Due to high uncertainties in the suppliers, companies practice outsourcings were underdeveloped. The manufacturing industries were highly fragmented, dependent on foreign technology and low level of infrastructure in ICT, power and water supply. The product quality is a challenging problem which frequently happens in the production activities. The main reason of such problem arises from raw material suppliers, both from local and foreign companies. In addition to the raw material, the manufacturing process has also experienced product quality problem. The existing manufacturing practices are also the source for environmental pollution. Therefore, the make process shall to be adjusted to accommodate this challenges.

The other characteristic that needs due attention is the inventory management practice. Firms in developing countries have different inventory management problems compared to problems in the developed countries. The manufacturing industries in developing countries are highly dependent on imported raw materials and machineries for their production activities. This in turn makes influences and the consequently delays in obtaining materials. Most production managers usually plan production on available and anticipated stock levels. This task is further complicated by the government’s restriction on foreign currency and bureaucratic delays in international bidding procedure. In the more developed countries, due to the well established business infrastructures and business communications, the efficiency of the inventory ordering process was generally taken for granted. In developing countries situations the monopoly in manufacturing business has been enjoyed by many industries and there are no major pressures to reduce inventory costs. In the existing situations heavy dependency on imported raw materials and parts and lack of foreign exchange makes the task of ensuring a regular supply of raw materials a difficult one. As such, the efficiency objective in inventory control should be given more prominence than the cost objective, in the inventory management goals in developing countries. This peculiar condition needs to be considered as other requirement in the adaptation works also.

The last requirement analysis is focused in the return process. In the existing practices, returns from wholesalers and retailers are managed in two stages: in the first one, the order is assumed complete if the customer doesn't send any complaint within specific date limits after its receipt; the second stage considers the subsequent real verification of products and, to do it, most suppliers have a period of time for complaints and returns. Manufacturing companies are handling the return issues on ad hoc basis when the request appears. Especially, the return from the international customers and suppliers are bigger challenges. Regarding local suppliers, returns are physical whereas for international suppliers and customers, returns are through negotiations for next orders. However, regarding external suppliers due to the cost implied by the return, the product loss is assumed by producers or distributors that returned the products. When Ethiopian manufacturing companies have direct and permanent relationships with their external suppliers, information on defective products generates actions and reviews on the supplier, even when there isn't physical return of the products. The adapted model needs to include these specific needs.

Performance measures: The reviewed literatures have suggested that firms shall put more emphasis on non-financial measures in their performance measurement system. In addition, recently there has been a shift in the new development of performance measures to include supply chain performance too. However, the findings from the interviews and questionnaires shows that level of performance measures not only focus on financial measures but also confined to organizational boundaries. Even the performance measures used inside the companies focused on departmental performance measures. The existing performance measures still lacks the recent influential measures in current businesses such as time, customer satisfaction, flexibility and reliability measures.

The existing performance measures have shown that mainly the interests of the local manufacturers with respect to their market segments were targeted. There was a large gap in the selection and implementation of the performance measures. Companies' targets for the export market were more sensitive for delivery time and quality than those running for the local market only. It was clear that there were some differences in the general trend of performance measures. Based on research objective for modeling and improvement to the whole supply chain and current trend of global supply chain business process integration for better competitiveness, there is a high need to integrate the existing experiences and the SCOR model. In order to define a set of key performance indicators (KPI) for the manufacturing firms in developing country, it is important to state the dimensions for these indicators.

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understanding of best practices concept and employees' attitude. Some of the best practices facilitate more in the efforts of the developing countries towards supply chain integrations with their partners in developed countries and the overall improvements of supply chains. This finding has implication for the firms as it provide a means to help them to search, select, adapt and apply best practices that suit the existing conditions and factors affecting the process. The managements should understand and emphasize the importance to overcome challenges for the successful implementation of best practices in their firms. The issue of the applicability of the best practices to developing countries should be settled on the basis of the outcomes of such implementation. The search for best practices in developing countries requires an appropriate selection, adaptation, application and evaluation of the results.

The major requirement in the future shall be addressing the environmental factors and conditions that hinder the implementation of the best practices to developing countries' situations. This will require new kinds of adaptation mechanisms for best practices that suit the existing situations. The field survey and literature review provides the following key insights and lessons: (a) future best practices adaptation should be flexible enough to respond to dynamic manufacturing scenarios and markets; (b) best practices adaptation should favour approaches that provide a number of different technologies and management practices, which firms can search, select, adapt, implement, and evaluate so that they can fit; (c) helps to closing the gap between those practices observed in the field and those reported in the literature; and (d) some ICT based best practices requires a conducive industrial environment and enhance linkages with supply chain members to enhance the returns to be beneficial.

Enabling technologies: The other outcomes of the research were gathered data on the organization's information and communication technologies level. Most of the companies have practiced the manual type of data collection. The business processes data collections were not supported by information and communication technologies. However, financial measures were collected with better accuracy ones. Financial data collections are well supported while operational performance data collection was poorly supported. These results indicate a deficiency in current information systems. Most of the communications within the companies were done through paper works. Some companies have started to use computer and internet facilities to support information sharing inside the organization boundaries. The usage of the internet supported company-wide activities was rare. Most companies use the internet for international purchases and communication with foreign suppliers. The existing reality in relation to ICT requires due attention when adaptation works are performed.

5.2 Adapting the business processes to developing country scenarios

The research has explored the supply chain processes of manufacturing industry in developing countries based on the SCOR model's five processes, best practices, and existing enabling technology. From literature review and field studies, the researcher has found that although there are quite a number of similarities in SCOR model business processes, there is still a large difference due to existing environmental scenarios. After identifying the general characteristics of a supply chain business process, the research proposed a business process for developing a SCOR (d-SCOR) model, which is used to model the supply chain operations in developing countries. It helps companies to model, evaluate, compare, and benchmark the key areas which can help them to maintain their pace and speed their success in integration efforts.

As discussed in the previous section, firms in developing countries are operating in challenging environments with constraints. Due to these challenges the building blocks of the model need to be simplified and decrease in complexity for smooth operations in the new situations. The results of the literature review and field studies have demonstrated the effect of the challenges in operating behaviour and capabilities. The content and complex nature of the model can affect the success of its implementation because of technical difficulties in understanding, collecting, management, and exchange of information. The lack of professional expertise also limits the complexity of supply chain model. As a consequence of financial constraints, sophisticated equipment will be unavailable. The existing physical and ICT infrastructure is also hinders the implementation of the model. The observed existing practice in organizational and managerial capabilities are also limits the model applicability.

From the field study results and personal observations, the SCOR model does not take the developing countries' conditions and prevailing circumstances into consideration. The researcher concludes that the existing SCOR V.10 model is not able to provide the answer to the research question. Therefore, the findings represent an adaptation of the SCOR model by examining how circumstances unique to developing countries can affect the given performance indicators and processes. This increases the model's relevance for global supply chain integration. The field results reveal the differences in the internal and external circumstances of firms in developed countries. The existing internal conditions include poor logistics and information communication infrastructure. The external transport or country-specific conditions need attention, and the model adaptation activities need to act accordingly to suit to the situation of the research question. From the results of the field assessment and examination, the effects of internal and external conditions can be adapted. According to the new requirements, the processes will have to be revised and adapted.

Like SCOR, d-SCOR has three main levels of details described in the specification. Secondary levels, such as Level 4, are for description of processes specific to the implementing organization. The Supply Chain Council (SCC) uses the term "level" to describe the hierarchical association of processes. For example, Level 1 is the top level describing types of processes. Level 2 is the configuration level and categorizes the processes, while Level 3 is the decomposition of the processes at the elemental level. While an organization can use the existing Level 3 processes, further decomposition into Level 4 enhances the framework's usefulness. Level 4 describes the implementation of performance measures specific to the implementing organization. From a process point of view, Level 4 also describes the workflow of the organization using standard flowcharting techniques. The d-SCOR is also a business process reference model that links process elements, performance measures, best practices, and execution features associated with a business activity. The Figure 5-3 demonstrates structure of the adapted SCOR model.

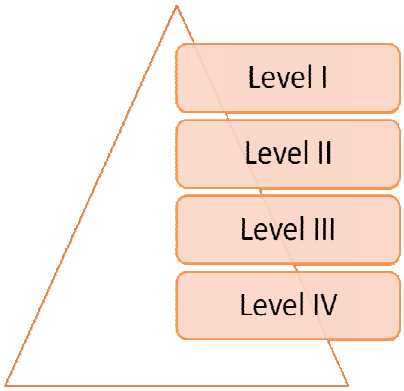

Figure 5-3: Structure of the adapted SCOR model

5.2.1 Level I Business Processes

From the field results and personal observations the processes and performance measures were adapted. From the previous chapters' literature review and field results, the researcher has proposed modification of the business processes at different levels. As discussed in the previous section, the SCOR model has three-level business processes for the modeling activities, as does the modified SCOR model. At the current stage of manufacturing practices and types of products distributed to customers, the Return Process is not an urgent and critical part of the model. In this section, the developing country's SCOR (d-SCOR) model is presented based on the requirement definition shown in section 5.1. We denote the new processes and metrics with a lower-case "s" to distinguish them from SCOR processes and metrics. In level 1, the d-SCOR is made up of the following processes: Deliver Agricultural and Imported Items to the manufacturer (dD), Source to Agricultural and Imported Items (dS), Make to Stock Product (dM), Deliver MTS/MTO to Local and Export Market (dD), Return MTS Product (dR),

and Plan (dP). Return Process are excluded from the adapted model since the feedback from industrial practitioners and literature review have shown a low level of maturity of the Return process in developing countries. From the mentioned arguments, the Return Process has been excluded from sourcing process. Figure 5-4 illustrates the general representation of the level I business processes of the d-SCOR model. The research analysis focuses initially on the raw material delivery processes (mainly for natural resource and agricultural products), then on the manufacturing processes, and finally on delivery to the customer. The next sections present the new additions to the SCOR model regarding level II and III processes to suit the new situations.

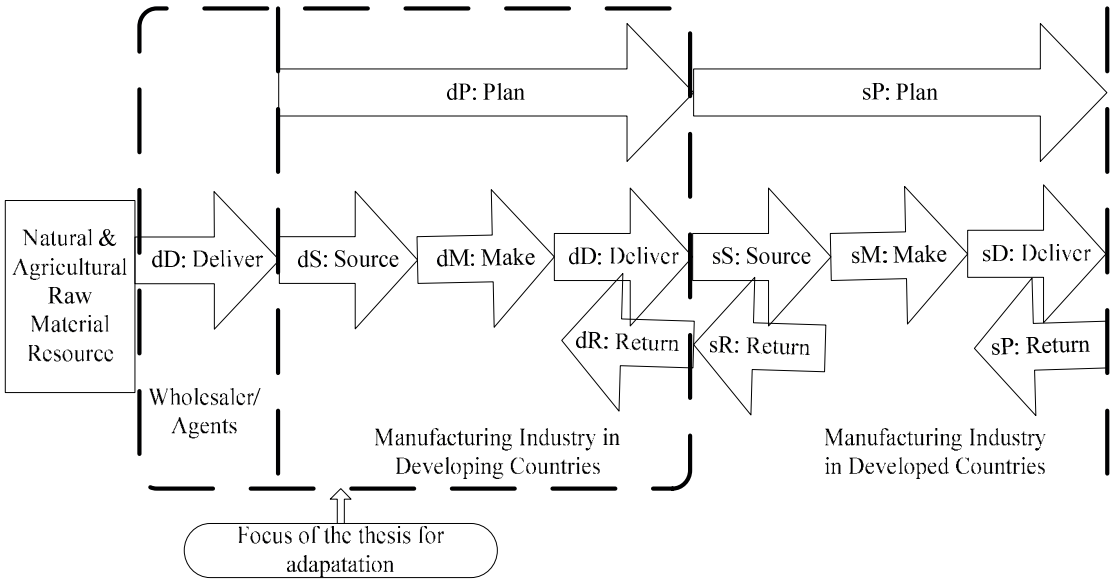

Figure 5-4: Adapted level I business processes

5.2.2 Level II Business Processes

The business process adaptations in level II are also done accordingly. The results of the level I business processes adaptation are used as starting point for the level II adaptation work.

Plan Process: Lack of point-of-sale information and software were the main hindrances in collecting data. At present, due to the low level of integration and information exchange, it would be difficult to prepare the supply chain plan that integrates the different actors in the developing countries' scenarios. The firms' plan practices and capacity cannot handle supply chain plan process. Therefore, the Plan Process is modified with Annual Plan, Plan Source, Plan Make, and Plan Deliver. Figure 5-5 demonstrates the adapted Plan Process in level II in the d-SCOR model.

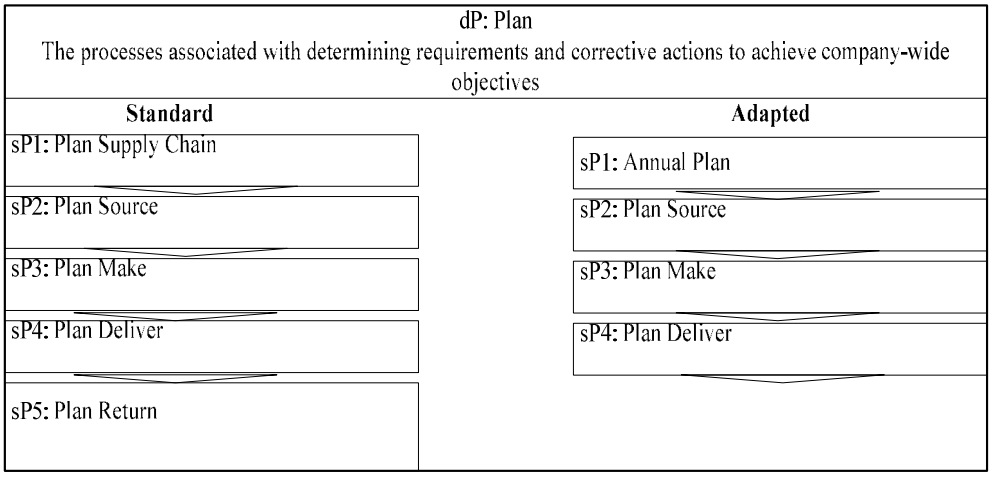

Figure 5-5: Adapted level II plan process

Deliver & Source Processes: One of the important functions of manufacturing activities is raw material sourcing. The field studies and observations showed that the raw material sourcing processes need attention for the adapted model. The main local raw material sourcing are natural resources and agricultural products from fragmented markets collected by wholesaler or firm agents. The imported raw material also experienced different delivery strategies compared to locally sourced material. The identified gaps from this field study have provided the data necessary to determine the new model requirement. The goal of the adapted SCOR model is to integrate the entire supply chain including the DEVELOPING COUNTRY.

During the field study, observations supported the original SCOR model's basis of delivery and sourcing of agricultural and imported materials on the level 2 processes sD1 (Deliver Make to Stock Products) and sS1 (Source Make to Stock Products). The delivery and sourcing of all materials on updated sD1 and sS1 processes are built on the ability of sS1 to handle products that are MTS and MTO. The processes dD1 and dS1 (Deliver and Source Raw Materials) is based on sS1 and contain all metrics and best practices from the original SCOR process. Due to special conditions in the agricultural and imported raw materials sectors for the manufacturing industry, the predefined order of sub-processes in sS1 does not conform to the delivery and sourcing activities of raw materials. The processes sD1, sD2, and sD3 are Deliver processes in the SCOR model. The Deliver process is defined as order handling at the supplier and all the activities that are related to a delivery. In d-SCOR, the Deliver process is changed according to the changes in dS1. Deliver in d-SCOR is therefore defined as the following two level 2 processes where the changes in all three processes are the same: dD1 – Deliver Make-to-Stock Agricultural and Natural Materials, dD2 – Deliver Make-to-Stock Imported Raw Materials. Therefore, generally, the deliver process can be categorized for local and imported materials. Figure 5-6 and Figure 5-7 demonstrate the two types of deliver and source processes.

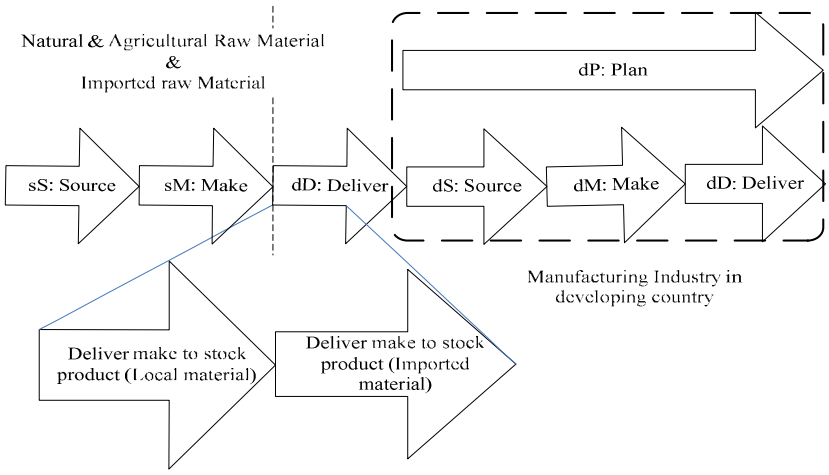

Figure 5-6: Adapted level II deliver process (raw material delivery)

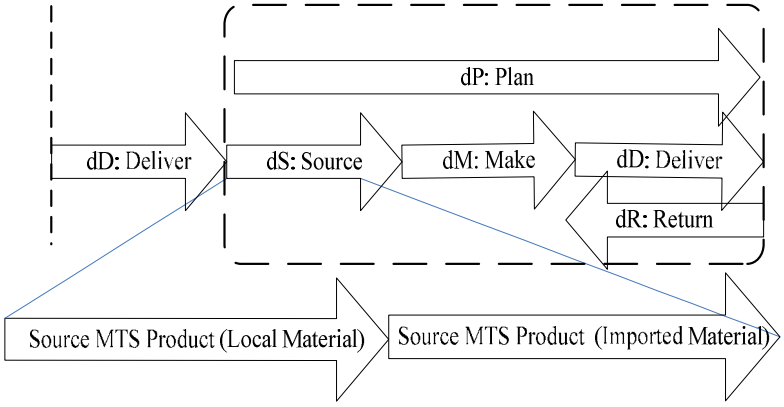

Figure 5-7: Adapted level II source process (raw material sourcing)

Due to the nature of the production activities and products, the dominant industries were producers of consumer products from agricultural resources. The make-to-stock production strategy is dominant in developing countries even though make-to-order is also practiced in many companies trying to fulfill their customers' requirements. Make-to-engineer production was rarely practiced by studied companies. The result was as expected due to the level of development of the manufacturing industries and the nature of the products they are producing. Therefore, the SCOR model level II Make process is modified by excluding the make-to-engineer as shown in Figure 5-8. Accordingly, the source and deliver processes are modified for the two production strategies by excluding the make to engineer strategy.

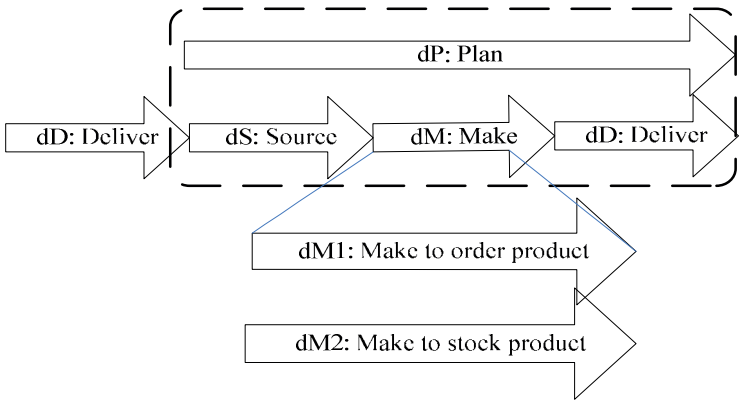

Figure 5-8: Adapted level II make process

The field results revealed differences between internal and external circumstances from firms in developed countries. The existing internal conditions are poor logistics and information communication infrastructure. The external transport or country-specific conditions require attention, and the model adaptation activities need to act accordingly and have to suit the situation of the research question. From the results of the field assessment and examination, the effects of internal and external conditions can be adapted. According to new requirements, the processes will have to be revised and adapted. If the prevailing conditions present no obstacles to the planned procedure, one can go ahead and establish the future distribution structure. In addition, inventory management requires attention due to poor physical infrastructure. This applies for both raw material sourcing and delivery activities if warehouses are established along the raw material collection and delivery route. Every additional storage step will make it possible to store available stocks closer to the customer. This benefits customer supply by increasing the speed of deliveries and availability of stocks throughout the year. More warehouses initially reduce transport costs since it is possible to achieve more comprehensive bundling effects when supplying warehouses. In addition, the internal and external conditions are important criteria in the design of the distribution structure. If the efficiency of the planned distribution system corresponds to the requirements of the delivery service in question and its associated costs, the planned scenario can be deemed effective. The distribution strategy can be further optimized by incremental changes to individual components and variations in the degree of delivery services. The processes sD1, sD2, and Sd3 are Deliver processes in the SCOR model. In the d-SCOR model, the Deliver process is adjusted accordingly to the changes in Deliver to become dD. Therefore, in the d-SCOR model, the Deliver process is defined as the following four level II processes where the changes in all four processes are: dD1- Deliver MTS product to export, dD2- Deliver MTS product by wholesaler, and dD3- Deliver MTS product by retailer. Figure 5-9 presents the SCOR model level II deliver process.

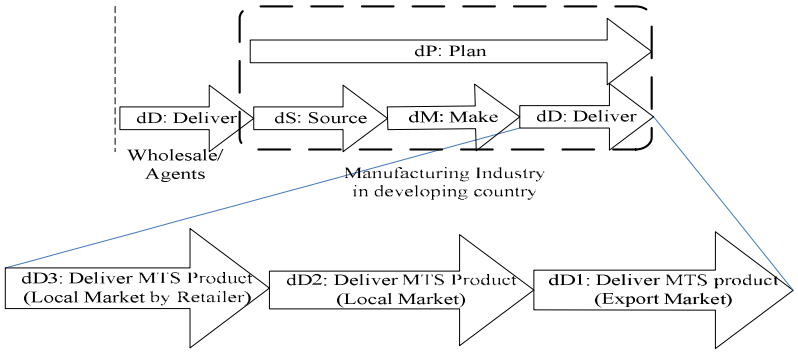

Figure 5-9: Adapted level II deliver process

5.2.3 Level III Business Processes

All level II business processes were changed appropriately in level III sub processes. Except the Plan process, all level III sub processes done for Make to Stock. The same modifications are applied to Make- to-Order product business processes.

Plan process: From previous analysis of plan process, the planning activities are highly suffered with shortage of recent up-to-date information. Because of this information shortage and low capabilities in collecting and analyzing the data, it would be difficult to do planning activities at the supply chain level in developing countries scenarios. The supply chain plan process is modified as demonstrated in Figure 5-10 below.

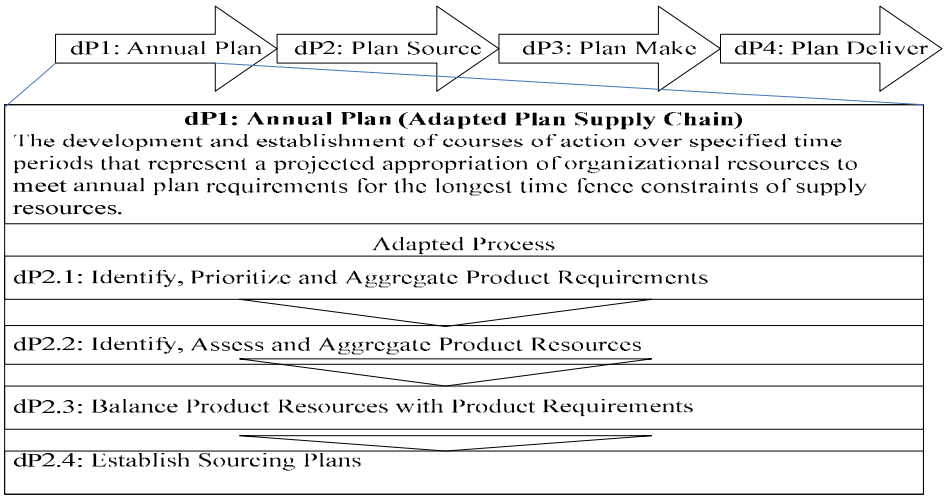

Figure 5-10: dP1: Adapted annual plan process

Deliver process (Raw Material): The raw materials deliver processes dDrm1 and dDrm2 were modified according to their subsequent level III sub processes. These

processes were more challenging because of the fragmented and rural nature of suppliers for local material. Figure 5-11 demonstrates the adapted deliver processes for sourcing local and imported raw material. Due to the nature of the raw materials, some of the processes were deleted. Most of the local raw materials were directly delivered to the manufacturers' premises. As such, the route shipments and select carrier were removed.

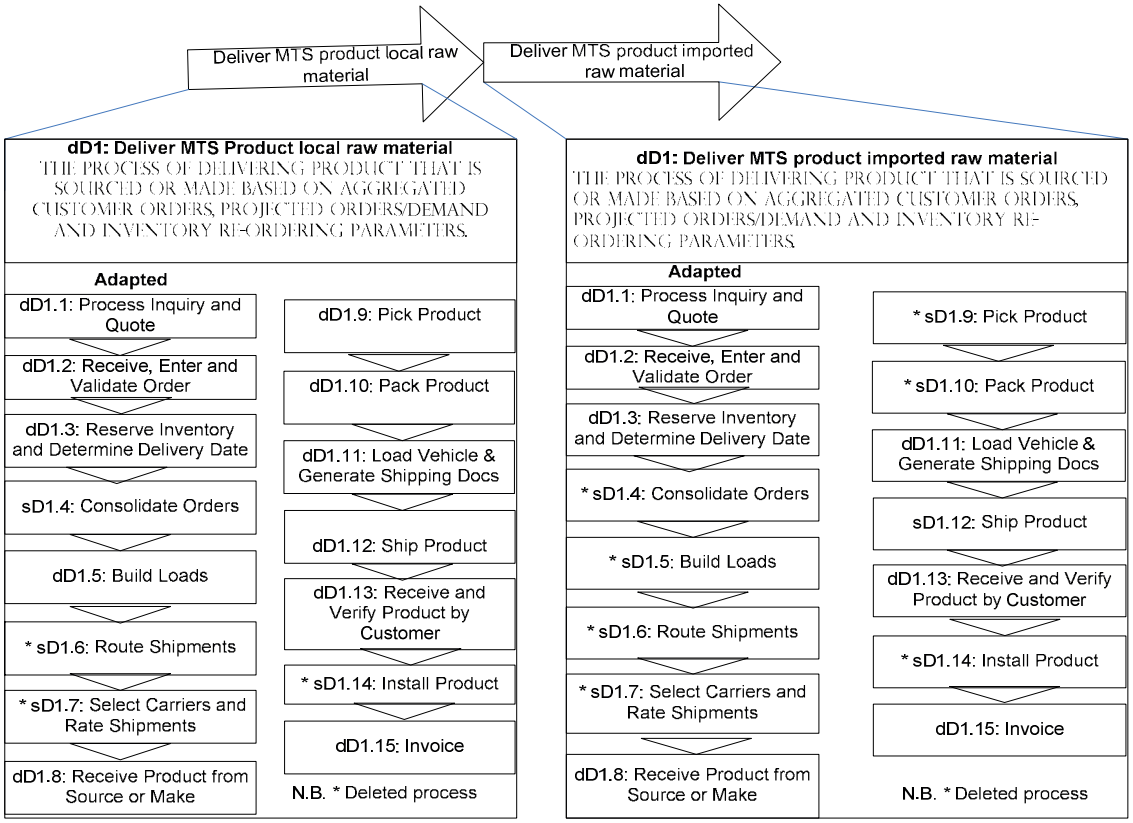

Figure 5-11: $dD_{rm}1$: Adapted deliver process for local & imported material

Source process: The sourcing process in developing countries faces different challenges when interacting with suppliers, especially in their availability and selection procedure. Because low supplier base and supply disruption causes the supply chain to choose an alternative, suppliers and new relationship must be formed frequently. In dS1, the sub-processes that verify the delivered product by quality assessment and verification need to operate before the dD1.4 Receive product process. The sub-process dS3.5 (Verify Product) contains verification of the delivery in dS1. This process is carried out before the supplier is paid. This is in line with commercial terms for the agro-industry, which states that a delivery should not be received before quality check up on the company premises. It is only then possible to really verify the delivery. The level 3 sub-processes are mostly identical to the corresponding sub-process in sS1 SCOR, except for dS1.1, dS1.2. and dS1.4, as the latter has no equivalent in SCOR. This includes the level 3 sub-

processes dS1.1 and dS1.2, whereas the dS1.4 process is deleted from the model. Thus, for the proposed adapted model to be used in developing countries, the source stocked product and source to make product activities will be required, adding two additional level III elements: Identify source of supply, select supplier, quote, negotiate, and set price for both local and international purchases. The dS2 level process is also depicted in Figure 5-12.

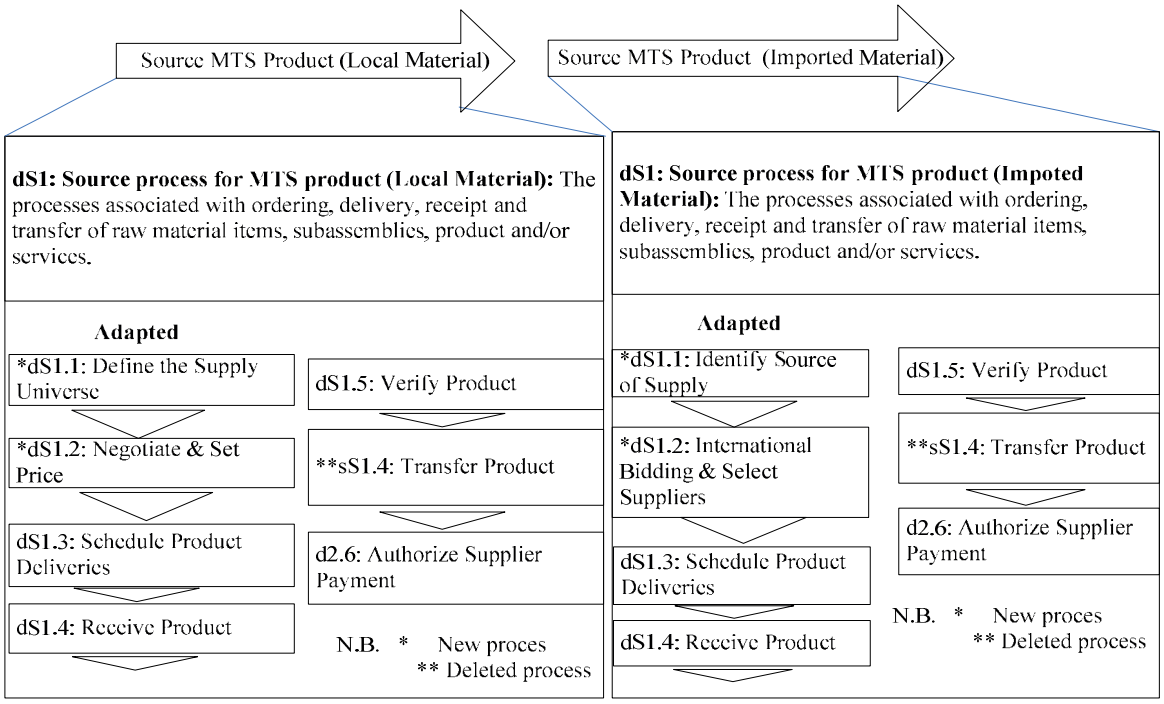

Figure 5-12: dS: Adapted source stocked product for local & imported purchase

Make process: The existing manufacturing activities are mainly non-automatic and production activities are labour intensive. The production planning and schedule are initiated by the marketing department. The quality control department is mainly responsible for quality issues in the organization. Therefore, product quality assurance should be incorporated in the making process with produce and test activities. Other activities that need attention are the recycling activities of by-products and defective products. In most companies, recycling of waste and by-products were common practices. So, in the last activities of the make process, recycle activity is added. Figure 5-13 demonstrates the make–to-order process that suits the developing countries' environment.

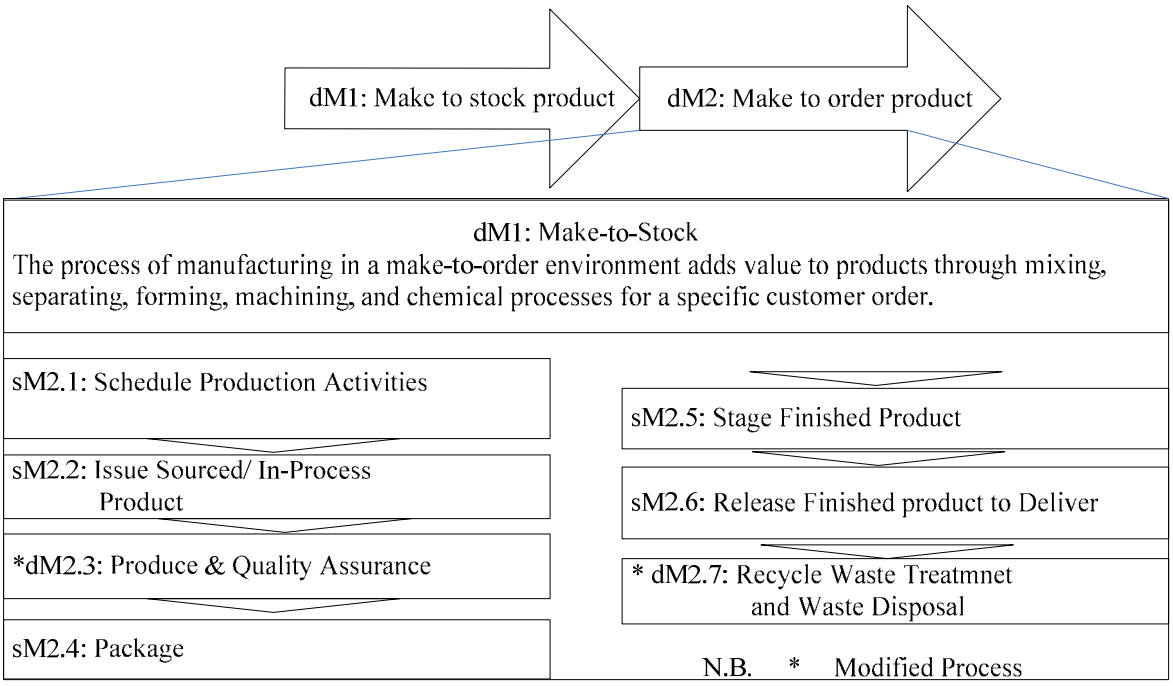

Figure 5-12: dM2: Adapted make to stock product process

Source process: The sourcing process in developing countries is facing different challenges when they interact with their supplier especially their availability and selection procedure. Because of low supplier base and supply disruption causes the supply chain to choose an alternative suppliers and new relationship must be formed frequently. In dS1, the sub-processes that verify the delivered product by quality assessment and verification need to conduct before the dD1.4 Receive product process. The sub-process dS3.5 (Verify Product) contains verification of the delivery in dS1. This process is carried out before that the supplier is paid. This is in line with commercial terms for the agro-industry, which states that a delivery should not be received before quality check up in the company premises. It is only then possible to really verify the delivery. The level 3 sub-processes are mostly identical to the corresponding sub-process in sS1, SCOR, except for dS1.1, dS1.2 and dS1.4, the latter has no equivalent in SCOR. The inclusion of the level 3 sub-processes dS1.1 and dS1.2, whereas dS1.4 process is deleted from the model.

Deliver process: In the field study, there were mainly four different types of deliver processes to end customers, which included delivery by manufacturer, wholesaler, small retailer, and new emerging supermarkets. The new Western-style supermarket outlets have recently become part of the distribution system in Ethiopia. We can observe two main characteristics of the Ethiopian distribution system; (1) the system is mainly owned and controlled by manufacturers, and (2) the Ethiopian market is still a seller's market. In their discussion of supply chain strategists, Han et al. (2002) have defined two familiar traditional models; Model 1 where goods and services flow from manufacturers to the consumers via

distribution centers and warehouses, and Model 2 describing a typical Dell business model where goods are directly transferred to the consumer. In Model 1 and Model 2, ownership of the manufacturer is usually separated from that of retailers. However, in Ethiopia, the owner of the manufacturer also owns the distribution, warehousing, and even retail outlets.

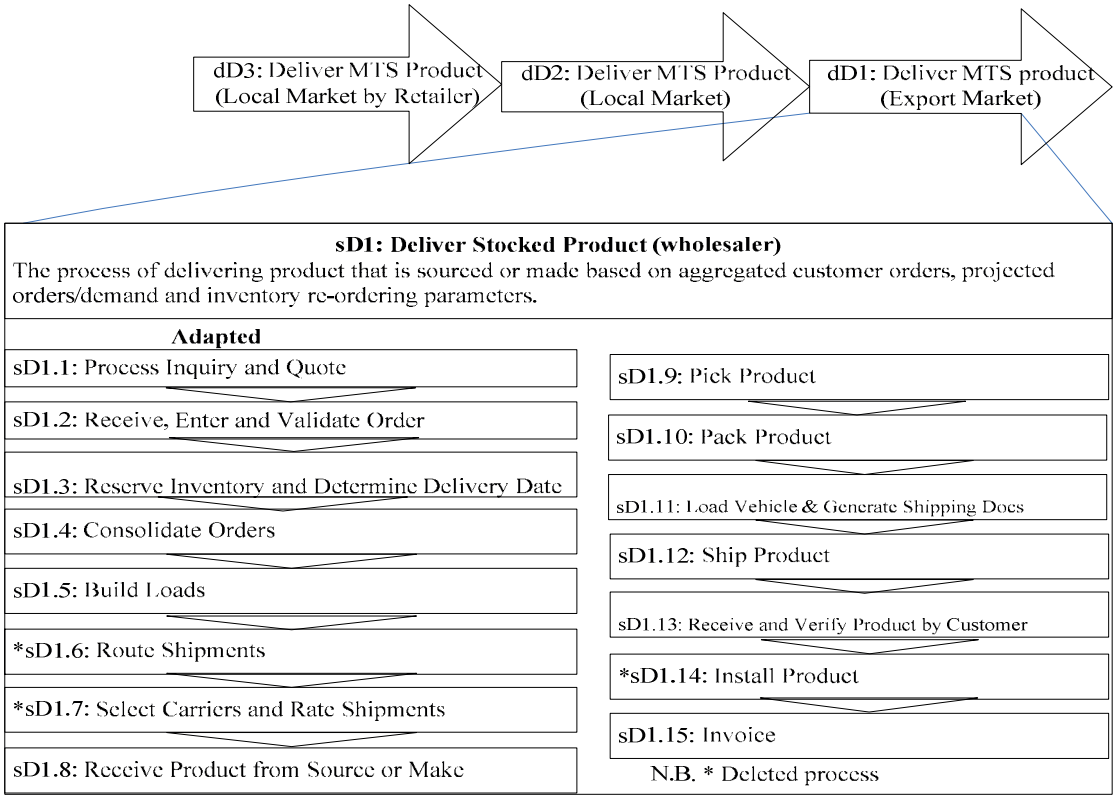

Figure 5-14: dD1: Deliver stocked product (local market)

As already discussed in the previous section, the second level of the d-SCOR model identifies four different types of delivery services. From the above arguments, the delivery processes need to configure with planning process to ensure appropriate mechanisms of delivery of the products to the customer. At the planning stage (Plan for deliver MTO products) of the distribution structure, the question arises whether or not a product is suitable for interim storage. At this stage, it is possible to distinguish between the configuration of processes and planning of storage stages which, during the course of the research, leads to a synthesis of process sD1, sD2, Sd3, and sD4. The agro-processing industries no not operate on the engineer-to-order product process (sD3), therefore, the research focus is on delivery times and delivery efficiency. The distribution process sD4 is an extension of the process sD1 for branch-specific elements not further considered within the scope of our examination. The administrative, transport, and

transshipment processes can only take place once an order has been placed. When planning such distribution structures, it makes sense to use the precedence diagram method showing all steps of the procedure in a process-orientated sequence, and the delivery in an appropriate timeframe. This allows the effects on delivery times and costs for alternative operations (for example, transport via airfreight instead of sea freight) to be evaluated. Here we have modified two activities from the original SCOR model. The check out process was deleted, and the last process modified to deliver without install from the level three business process. A new process called 'deliver stocked product to end customer' is proposed for distribution activities by the manufacturer. Figure 5-14 shows the modified business process with its constituent activities. In most firms the export distribution is handled through a wholesaler.

5.3 Adaptation of key performance indicators for developing countries

The current trend of global sourcing and manufacturing has created both opportunities and challenges. These challenges are more complex when it comes to the scenarios of a developing country. The manufacturing industries in the developing country are trying to take the opportunity and get rid of the challenges. One of the strategies is to model, evaluate and improve its performance dynamically. To this effect, an organization in developing countries must select, adapt and practice world quasi-industrial standard such as SCOR model and its key performance indicators. Through the performance measurement of the supply chain it is possible to understand the company's performance through which it is easier for a firm to fulfill the customers' requirements, to better understand the supply chain dynamics. This helps to find bottlenecks all along the chain, and have a diagnosis tool for the business processes with respect to their competitors and the industry leaders, which helps to develop new strategies and to become more competitive.

The findings reported in the previous chapter 4, insights gained from literature review of other adaptation studies and characteristics of the manufacturing industry in developing countries are utilized for the adaptation of the SCOR model performance measures to developing country scenarios. In this section, a proposed key indicator is presented, considering the four SCOR supply chain business processes (plan, source, make, and deliver). This KPI metrics was classified into three levels, which can asses a strategic, tactical and operational performance. For the development of the key performance indicators, there was different important information to be collected for making the task successful. These are the objectives and types of the organizations, the characteristics of manufacturing industries and its products and the existing enables for information collection and analysis. From the field study results and literature review, there are identified characteristics of the dominant industries in developing country and existing performance measurement and measure.

5 ADAPTATION OF THE SCOR MODEL FOR INDUSTRIES IN DEVELOPING COUNTRIES

The existing performance measures have shown mainly the interest of the local manufacturers with respect to their market segments which they were targeting. There were a large gap in the selection and implementation of the performance measures. Those companies which were targeting for the export market more sensitive for delivery time and quality than those running for the local market only. Generally, we can see the summary of the important and dominant measures from the two field study in Table 5-2. It was clear that there were some differences in the general trend of performance measures. Based on research objective for modeling and improvement to the whole supply chain and current trend of global supply chain business process integration for better competitiveness, there is a high need to integrate the existing experiences and the SCOR model.

In order to define a set of key performance indicators (KPI) for the manufacturing firms in developing country, it is important to state the dimensions for these indicators. The SCOR model defines a single classification dimension for metrics: performance attributes. In this work, following the approach described by SCOR model (SCC, 2010) two classification dimensions, namely the performance attributes and the business processes are applied throughout the research. Both attributes and processes are guiding to apply the relevant performance indicators for a particular situation, since they group performance metrics. The SCOR model advocates hundreds of performance metrics used in conjunction with five performance attributes: reliability, responsiveness, flexibility, cost, and asset metrics. Note that quality is excluded here. Hausman (2004) explained that in modern SCM, quality is taken as a given and that factors in quality management and improvement are somewhat separate from those in SCM development.

Table 5-2: Summary of the existing performance measures

Results from Questionnaire survey	**Results from semi-structured survey**	**Comparison**
• Cost of goods sold • Gross profit margin • Number of units produced • Amount of finished goods inventory • On-time delivery • Backlog in the delivery schedule • Damages • Compliance	• Sales • Defect • Customer feedback with market survey • Productivity • Profit • Quality • Inventory • Delivery time • Cost of production	• Sales and profit dominant one • Productivity is second priority • Customer feedback based on survey was started in some companies • Time and quality are in lower practice level but quality is becoming more important for export oriented firms • Customer focused performance measures less in practice

5.3.1 Performance attributes

The SCOR model (SCC, 2010) defines five performance attributes: reliability, responsiveness, agility, costs, and assets management. This thesis adapted four of these categories for defining the following five performance attributes by adopting one new and one related to business processes in the manufacturing industry. The attributes are Responsiveness, Reliability, Quality, Cost, and Asset Management. Quality is related to both process and product quality along the supply chain. Measuring the quality performance of business processes and products is the way to improve these processes while ensuring the customer's satisfaction level. Reliability is related to the response time of the supply chain in satisfying the customer's requirement. Cost is related to financial performance, and Asset Management is related to efficiency of resource use.

5.3.2 Business processes

Performance is measured along business processes. Based on the processes activities defined by the SCOR model, the following four business processes were selected: Plan, Source, Make, and Deliver. For the four business processes, the SCOR model definition was adopted as stated in chapter two.

5.3.3 Key performance indicators hierarchy

In the literature review chapter, the challenges and characteristics of the manufacturing industries in developing countries were discussed to facilitate the adaptation process. In order to make the SCOR model manageable, the proposed key performance indicators are structured in a hierarchy of three levels which are similar to the original SCOR model by considering the complexity and challenges of the developing countries' supply chain, the available enabling infrastructure, and the vast option of performance measure from model. Except the one additional attribute, all the four are the same, with the specific metrics defined on each level. The idea of including several aggregation levels was adapted from the SCOR model (Supply Chain Council, 2010).

Level I: The first level contains indicators that reflect the performance of the manufacturing industry supply chain in developing countries. These first level indicators will show the result of the efficiency of several activities performed along the supply chain by different members, and they represent high-level aggregated results. The combined use of these indicators will help to further understand the overall performance of the enterprise while taking into account reliability, responsiveness, costs, asset management, and quality.

For the supply chain measurement and improvement, the proposed adapted model uses all seven SCOR level I key performance indicators and one additional quality

performance measure. For practical purposes, companies can typically select among four to six measures to focus on (Huang et al., 2005). The SCOR model's five performance attributes consider both internal and external viewpoints. Next, one needs to prioritize performance attributes and measures to align with one's adopted strategy since it is not possible for a SC to achieve excellent performance in all aspects. Since the majority of manufacturing industries in developing countries have inefficient supply chains, they should not excessively emphasize flexibility and responsiveness metrics. Doing so could deviate from a company's strategy and overly accentuate cost factors. Hence, the manufacturing industry in developing countries follow a strategy that creates products at low-cost, and then the relevant key performance indicators could focus on costs, capacity utilization, labor productivity, and quality (Hausman, 2004). Table 5-3 shows the key performance indicators for the adapted SCOR model for level I.

Table 5-3: Key performance indicators for an adapted SCOR level I

	Performance attribute	KPI Level I	KPI definition
Customer-facing	Supply Chain reliability	Perfect order fulfilment	The performance of the supply chain in delivering the correct product, to the correct place, at the correct time,
	Responsiveness	Order fulfilment lead times	Speed at which a supply chain provides services to a customer.
Internal-facing	Costs	Total Supply Chain Management Cost	The sum of the costs associated with the SCOR Level 2 processes to Plan, Source, Deliver, and Return
		Cost of goods sold	Costs associated with operating the supply chain.
	Asset Management	Cash-to-Cash Cycle Time	The time it takes for an investment made to flow back into a company after it has been spent for raw materials
		Return on working capital	Return on working capital is a measurement which assesses the magnitude of investment relative to a company's working capital posi-
		Return on supply chain fixed assets	Return on Supply Chain Fixed Assets measures the return an organization receives on its in-vested capital in supply chain fixed assets
	Quality	Right quality of raw material prod-uct & process	Quality is related to raw material, product, and process quality along the supply chain

Level II: As we go down through the hierarchy, the number of indicators at each level grows, thus providing more detailed measures for each combination of performance attribute and business processes. The second level contains indicators to measure performance of the enterprise for the same performance attributes and business processes previously described, but the KPI is shown in more detail than it is in the first level. Figure 5-15 shows adapted KPIs for selected and different processes for level II. The key performance indicators presented in level II for Plan process includes the following processes: Annual Plan, Plan Source, Plan Make, and Plan Deliver. In this part the only modification done is reducing the number of KPIs in the processes for easy handling & manipulation of the collected data.

The other major changes in level II KPIs are done for three processes: Source, Make, and Deliver only for make-to-stock product manufacturing strategy. In this level also all the five attributes were included as per the previous discussion. Customer satisfaction surveys and customer complaints KPIs were included in reliability and responsiveness attributes respectively. In all the three processes (Source, Make, and Deliver) quality KPIs were included, namely: claims of quality fails (raw materials), product unit perfectly produced (product), and claims of product quality fails (deliver).

Level III: The key performance indicators for level III measure the performance of the operations of the organization. This level is related to the operations at the factory floor or routine operations of the enterprise. The outputs of these KPIs are generally used by companies to improve their performance. Similar to the discussion of the level II KPIs, the level III KPIs complement the high levels of the hierarchy with further details, i.e. level II. For example, for measuring the time consumed in the making process, there is one key performance indicator in the first level which shows the order fulfillment cycle time of the supply chain, and if a deeper analysis is required, the second and third level indicators can be analyzed to find the causes of the performance gaps.

In the third level analysis, only make-to-stock product process element is selected for adaptation. Figure 5-16 shows the adapted KPIs for elements of make-to-stock process. The dominant KPIs are the costs and asset management. Some additional SCOR model KPIs are also added for responsiveness and reliability, and two quality KPIs for quality performance attributes. It is likewise important to understand that the proposed KPIs in this thesis are based on a developing country survey, and thus, care should be taken in generalizing results to all supply chains. The importance of individual metrics presented herein might not apply to all supply chains in all industries. Again, the proposed KPIs are only a starting point. It is hoped that the proposed KPIs will assist practitioners in their efforts to assess supply chain performance.

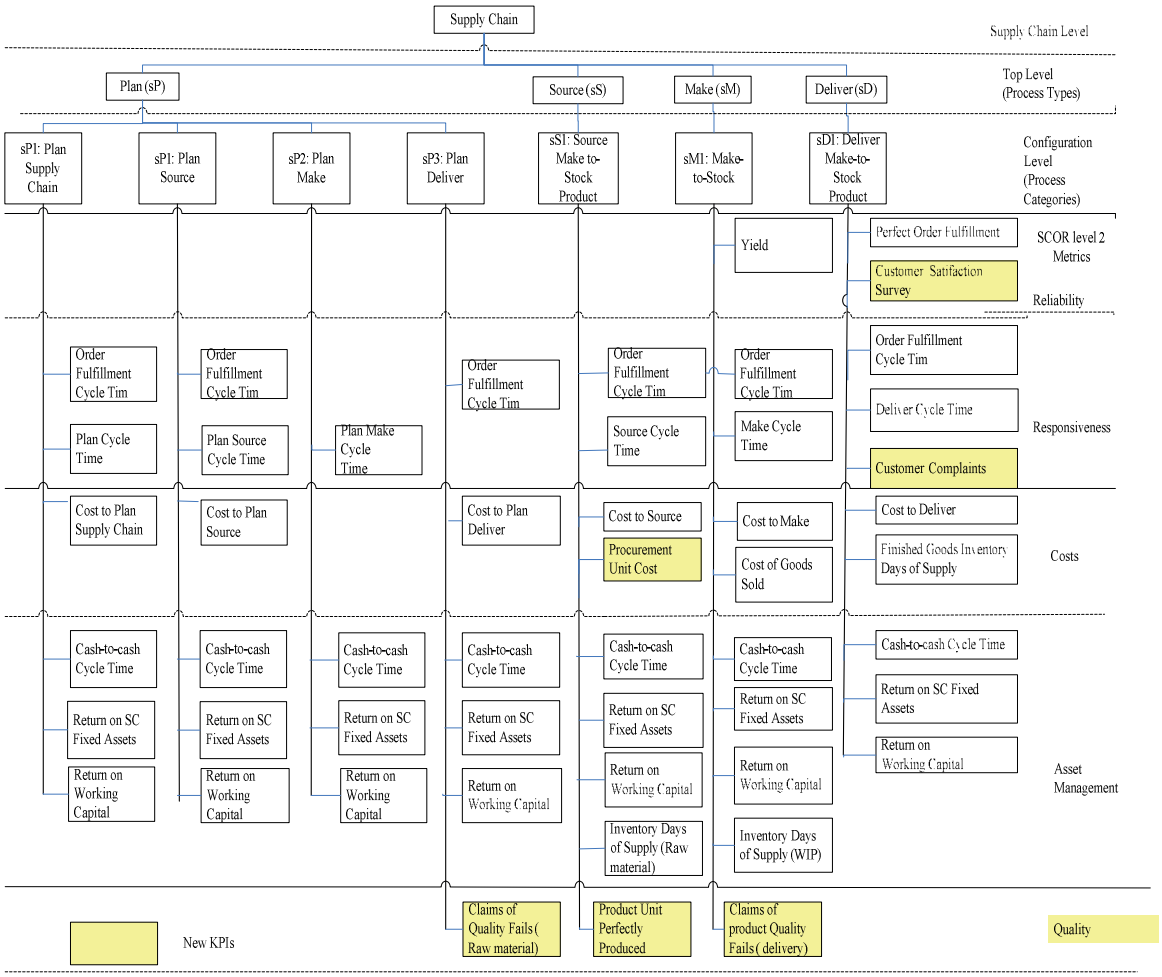

Figure 5-15: Adapted KPIs for selected processes for level II

Table 5-3 summarizes the proposed additional key performance indicators in all levels I, II, and III.

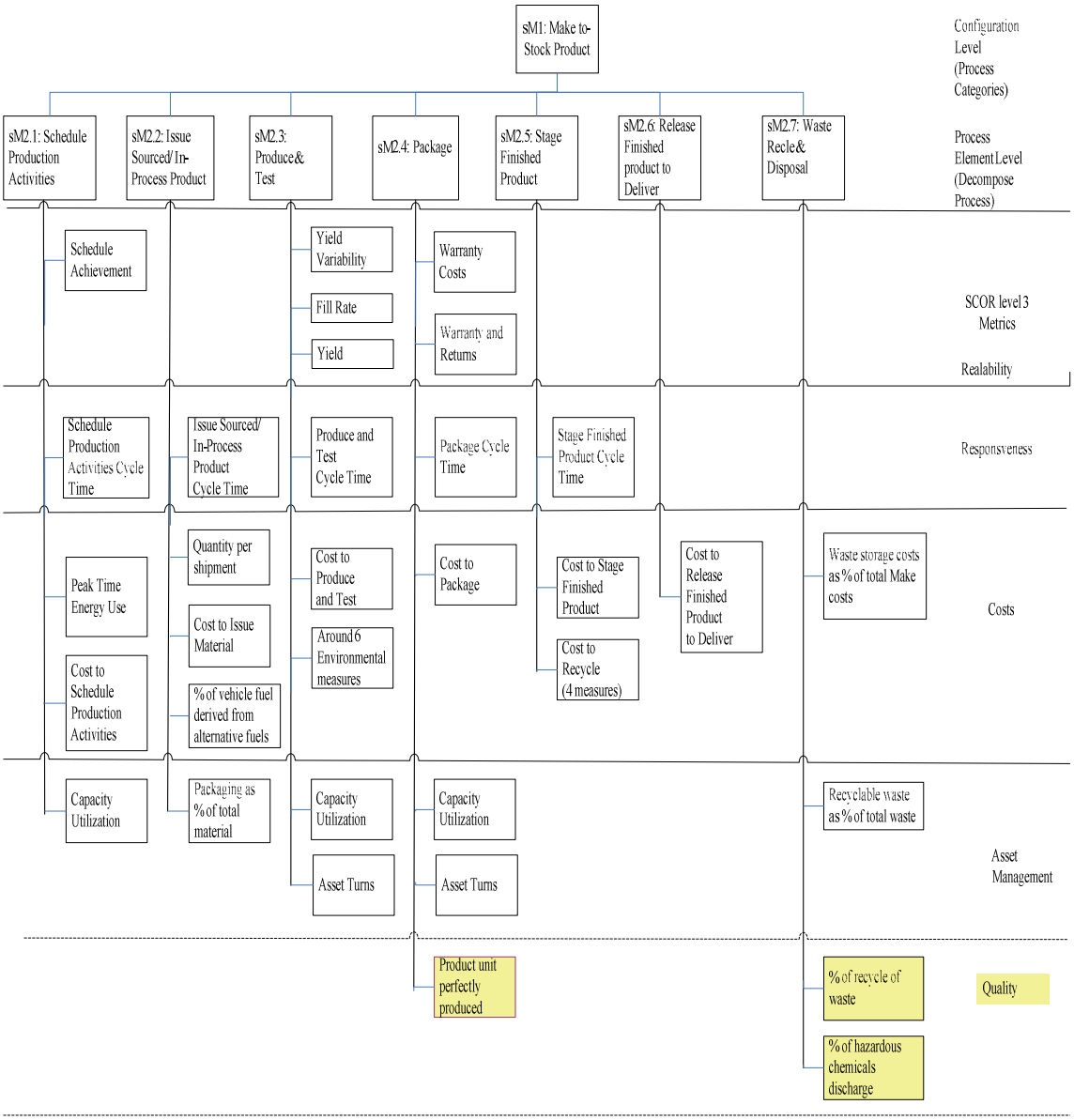

Figure 5-16: Adapted KPIs for make to stock product process for level III

5.4 Adapting the SCOR best practices

Rutkowski (2010) determined that the best practices should be selected by their nature and application spectrum whether they are applied in all organizations or not universally. However, there are some which are highly specific to some firms, these may differ significantly from each other and may require a completely different approach to achieve success. This finding has implications for firms as it provides a means to help them to select, adapt, and apply best practices that suit the existing conditions and factors affecting process. Table 5-5 illustrates the current best practices in the investigated firms.

Table 5-4: Additional KPI for adapted SCOR model, level I, II & II

Level	Key performance indicators	Remark
I	Right quality of raw material product, and process	
II	Claims of quality fails (raw material)	
	Procurement Unit Cost	
	Product Unit Perfectly Produced	
	Claims of product Quality Fails (delivery)	
	Customer Satifaction Survey	
	Customer Complaints	
III	Product unit perfectly produced	Only for MTS Process
	% of recycle of waste	
	% of hazardous chemicals discharge	

Managers should understand and emphasize the importance of overcoming these challenges for the successful implementation of best practices in their firms. The issue of applicability of the best practices to developing countries should be settled on the basis of the outcomes of their implementation. The search for best practices in developing countries required an appropriate selection, adaptation, application, and evaluation of the results above all else. Based on these findings, the firms need to follow a systematic approach for adapting the SCOR model best practices.

In this regard, it is important to consider their existing scenarios, situations, and priorities. The SCOR best practices generally can be categorized into two categories as shown in Figure 5-17. Due to the existing challenges and lack of basic requirements as enablers to implement best practices in scenarios of developing countries, firms must look for the best practices that suit their scenarios. Some of the best practices need larger investments than others to implement in infrastructure. Other initiatives can be the best solutions for current high-priority problems like quality and productivity improvement activities. However, their adaptation initiatives are influenced by challenges and current business practices.

Table 5-5: The existing major best practices characteristics

Questionnaire Survey result	Semi-structured interview result	Result Comparison
Most Frequent • Total Quality Management • Benchmarking • Available to Promise (ATP) • Carrier Agreements • Outsourcing • Supplier Performance Assessment System **Least Frequent** • Electronic Data Interchange ; Bar coding/automatic identification; VMI; Six Sigma; Collaborative Planning, Forecasting and Replenishment; Postponement; Cross-Docking	**Most Frequent** Business process reengineering, ISO 9001:2008, environmental management system, Total quality management, Kaizen, Benchmarking, Balanced scorecard, Food quality & safety standard, Outsourcing **Least Frequent** ICT based best practices	• Quality, productivity, and some generic have practiced well • Modern best practices those highly depend on ICT infrastructure were hardly practiced in the companies • Product traceability with bar coding and automatic identification were not started in the companies

An initial guidance model to adapt the best practices has been proposed and shown in Figure 5-18. This proposed model focuses on four steps to select suitable best practices, which provide a structured process for making rational decisions. This proposal is based on investigations of previous models such as Mohammed (2009), Fan (2001), and other research. These five closely linked stages are: industrial need and gap analysis, searching and selection, adaptation, application, and evaluation. The first stage in the adaptation processes is industrial analysis. In this stage, the results will reveal the organization's real situation and priorities for improvement. It also leads to identifying existing enabling technologies. After this situational and contextual analysis, the second stage requires searching for and selecting the appropriate best practices that suit the existing situations and scenarios. This analysis leads to a decision of which best practices are suitable to adapt to the firms' current reality. The third stage relates to the analysis of the best practices content to be adapted, while the last two stages involve the implementation and assessment of the results of the adapted contents. In stage two and three of the adaptation processes, the analysis is always subjected to the adaptation factors that influence the adaptation processes. These are: (i) technical and IT, e g. Outdated technology and lack of integrated computerized systems; (ii) supply chain relationship, e.g. reluctance to adopt partnerships alliance based relationships; (iii) national infrastructure, e.g. inadequate ICT and physical infrastructure like road and rail, and (iv) organizational and managerial, e.g. obsolete functional-based models and working cultural differences (Georgise et al., 2013). This proposed adaptation model has unique highlights and recommends the need for understanding new scenarios and environments, as well as provides an initial guide for the selection process. Finally after full implementation, it will be important to measure the improved perform-

ance or changes in the organizational performance as a whole. For this purpose the SCOR model also contains performance measures and benchmarking tools for further improvement and gap analysis. Feedback is also important after implementation for further improvement.

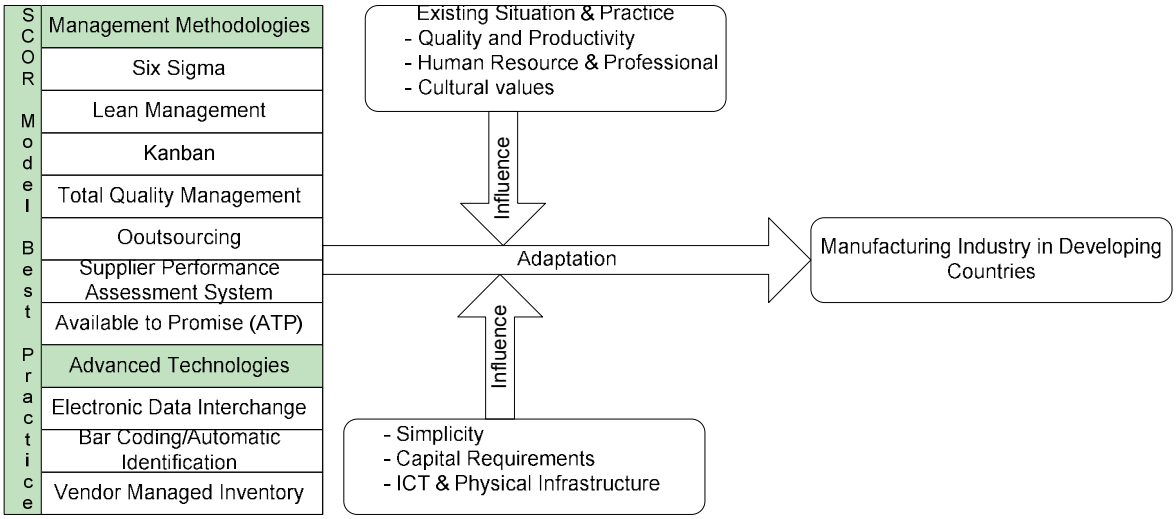

Figure 5-17: Best practices adaptation consideration

As per discussion previous literature review part, there is a large group of best practices that can help firms in their organizational improvement activities. These practices have been collected from firms in developed countries. Definitely, they have shown successful results so far. When we came to the real situation of the firms in developing countries, the existing conditions were not in line with the assumptions of the SCOR model. From the field results analysis and literature review, the SCOR model practices should be adapted carefully to consider the real conditions and factors in developing countries. The field survey and literature review provides the following key insights and lessons: (a) future best practices adaptation should be flexible enough to respond to dynamic manufacturing scenarios and markets; (b) best practices adaptation should favor approaches that provide a number of different technologies and management practices, which firms can search, select, adapt, implement, and evaluate so that they can fit; (c) practices adaptation should help in closing the gap between those practices observed in the field and those reported in the literature; and (d) beneficial adaption requires a conducive industrial environment and good linkages with supply chain members and factor markets to enhance returns.

The SCOR model best practices adaptation activities need to start from the existing best practices within industries and their priority areas for performance improvement. The other important issue to be considered is the nature and type of the current dominant industries. From the field results and the literature reviewed, the

dominant manufacturing industries were light manufacturing industries that focus on efficiency and functional products. It is also recommended that firms focus on those best practices that improve their efficiency. The best practices adaptation activities should give priority to those best practices that help performance improvement based on quality, productivity, and performance measurement systems. In the field survey for example, a good adaptation activity was undertaken by government initiatives by forming the Ethiopian Kaizen Institute for adaptation of Kaizen to local scenarios by involving firms, consultants, and higher educators. The successes and challenges of this practice should be evaluated, and lessons can be taken for further adaptation efforts to local scenarios.

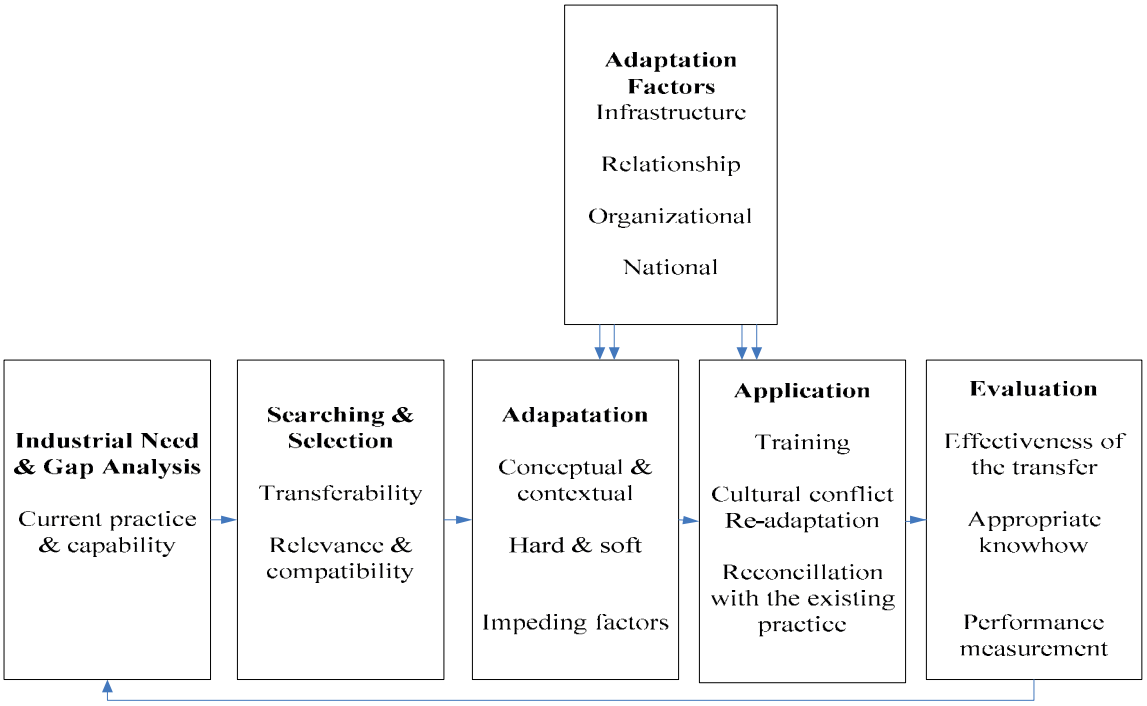

Figure 5-18: Recommended best practices adaptation steps

From the field survey and supply chain characteristics of developing countries, the modern best practices which are highly dependent on ICT infrastructure were hardly practiced in the companies. Product traceability with bar coding and automatic identification was not started in the companies yet. So, the adaptation of best practices that highly depend on ICT will not be successful in most firms. However, some export-oriented companies who can afford some additional expenses and are ready to face the challenges could start implementing adaptation activities, especially those practices that are intended to improve customer services, electronic commerce, and supplier management practices. The major challenge in the future will be in addressing the environmental factors and conditions that challenge the implementation of the best practices in developing country scenarios. This will re-

quire new kinds of adaptation mechanisms for best practices to suit the existing scenarios.

5.5 Enablers

The enablers are tools to facilitate linkages of intra and inter–organizational partnerships both in upstream and downstream supply chains. The research findings about existing enablers both in software and hardware were far below the minimum requirement of the SCOR model. Most company's information collection and exchange activities in supply chains was done mainly based on manual paper works or fixed telephone means. Some of the companies have already started to afford internet connections on their premises. However, they have used it for other purposes like routine clerk work, rather than facilitating their strategic businesses objectives. Few firms have started to use the internet to search for potential suppliers and purchase imported raw materials. Generally, companies' managers greatly prefer to have personal conversations rather than communicate using paper based messages or fixed telephones. Currently, mobile telephones are widely used. For local purchases from suppliers, communications were via mobile and fixed telephones. So, it seems mobile communications have better potential for future information exchange and communication activities between businesses and local suppliers.

In the context of Ethiopian manufacturing industries, while the benefits of having both software and hardware enablers are tremendous, the costs associated with purchasing, operating, and maintaining such a system can be unaffordable. The enablers' costs may include costs for software, hardware, training, and maintenance. Most of the commercial software available in developed markets requires considerable "further development" according to the needs of a company in a developing country (Kureshi, 2010). Such development can take a long time-even up to many years-and may not give expected results as stated in one of the interviewee companies. An alternate is to use standard software, which is considerably lower in cost, but requires the user to change its business processes to fully utilize the intended functions. It is not thus a surprise that only one interviewed company had such software at least in pilot stage. However, there were some initiatives by the interviewed companies to develop local software for their needs.

Companies in developed countries must also be careful in their interaction with their suppliers in developing countries in general because they may not have an "IT culture" in their operational activities. The normal practices of integration using application software may never actually be completely adopted by all supply links (Kureshi, 2010). In most developing economies, the internet still represents an expensive form of communication, and hence is limited to urban areas. In the future, along with efforts to implement the standard enablers, the use of traditional com-

munications and information exchanges should work side by side. In rural areas, where it is not feasible to expect significant investment to procure and install computer/internet systems, cheaply available mobile phones with basic functions can be a cost-effective alternative for information exchange.

5.6 Integration of SCOR with d-SCOR model

The two models should be integrated together to create synergy and fulfill the ambition of improving the whole supply chain involving manufacturing industries in both developed and developing countries. Since supply chain improvement is the overall intention of this thesis, there is a need to devise a way to integrate the new d-SCOR model with the existing SCOR model for better enhancement. One of the important points to consider after adaptation is how the adapted d-SCOR model will couple to work together in the whole supply chains context. In order to improve the whole supply chain, we need to examine how we can integrate in the interference face of two models. The focus of the d-SCOR model is mainly in primary manufacturing industries sourcing their inputs from agriculture and natural resources. Figure 5-19 shows the consecutive supply chain activities from natural resources to final customers. The natural resource and agricultural activities are not included in this analysis. The adaptation excluded upstream agricultural and natural resources for this work. It is assumed that the SCOR model is perfectly suitable to the processes of developed countries' firms.

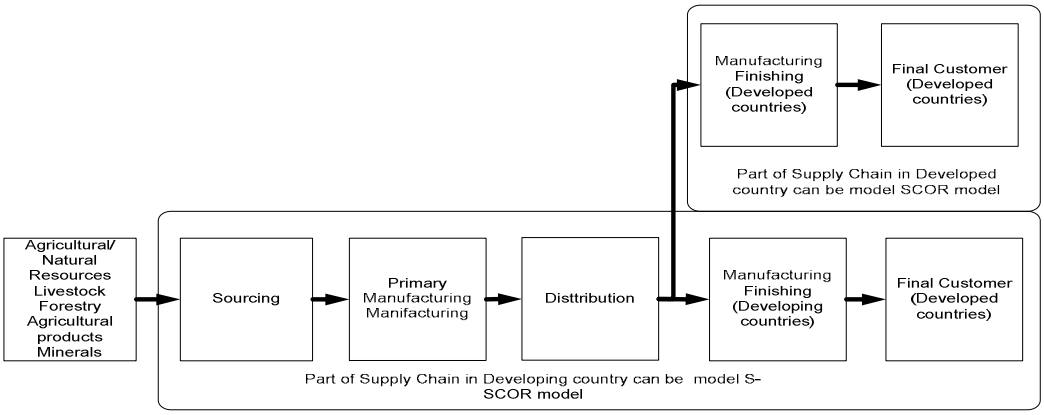

Figure 5-19: The application area of the SCOR and d-SCOR models

Supply chain management is primarily concerned with coordination of flow dependencies: the business process output of one member is the input of another member's process. The main flows among supply chain business processes are products, orders, and demand and supply information. The supply chain members in both developed and developing countries interact whenever there is exchange of products, information, or capital from one to the other. For example, industrial input raw material transfer from a developing country's warehouse to a manufacturer's warehouse for further processing. In order to understand supply chain interac-

tions, a tool is needed to properly design, model, and evaluate the supply chain. This thesis has proposed an adapted model for use in developing countries' situations. This proposed model needs to integrate with the original model and create synergy to improve the whole supply chain. For this effect, the adapted model (d-SCOR) should interface the original model (SCOR) to have smooth material, finance, and information interactions.

Generally, the models can be identified by two types of inter-firm interactions. These are operation interface and inter-firm coordination interactions. In operational exchange of products, transactions and information are exchanged between different processes and control of the involved actors. The inter-firm interactions deal with alignment of the firm‘s control requirements in order to manage dependencies between integrated systems. The models focus on operational interactions of business processes. The basic idea of control is the introduction of key performance indicators that measure system behaviour and correct if measurements are not compliant with targets. The key performance measures should be also aligned to evaluate the whole supply chains. The two important key performance indicators are order fulfilment and supply chain cycle time.

The main physical interface between two models will always be between the different processes: Plan-Plan, Deliver-Source, Return-Return. There are different ways process-process interaction takes place. However, for the information exchange point of view all the SCOR and d-SCOR model processes will also have an interface. The core plan process will have an interface for information exchange, especially demand and supply management including another plan for the whole supply chain. This information is used to further plan execution processes: Source, Make, Deliver, and Return processes. The second interface is the planning process in both models. In order to get better interference, the main challenge is information exchange activities and time of planning. Figure 5-20 illustrates the two model's integration.

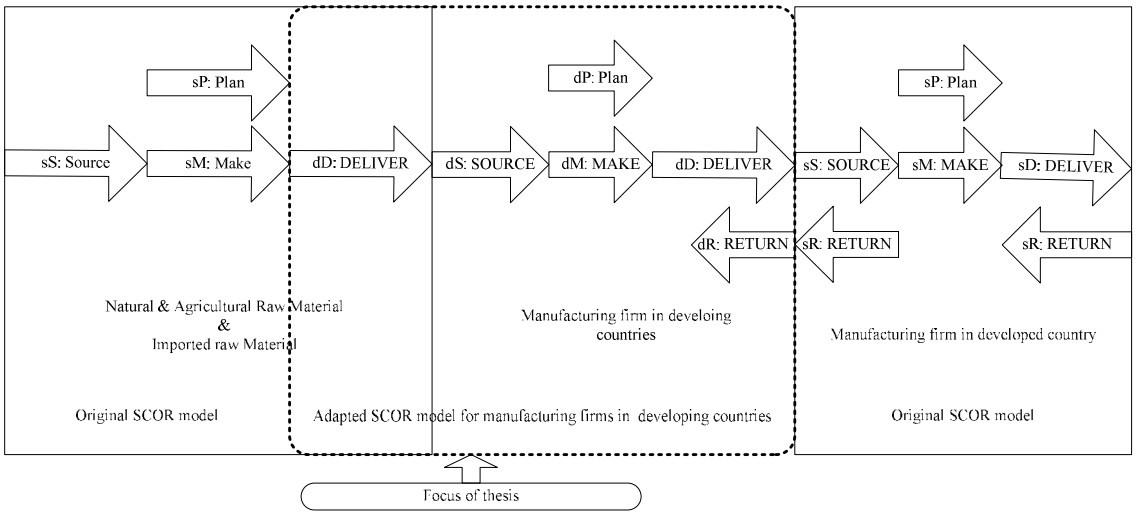

Figure 5-20: Interference between the SCOR & d-SCOR models

The third interface focuses on the interaction between the Source in the adapted d-SCOR model and the Deliver process from the standard model. The source process is the counterpart to the deliver process of a unit upstream supply chain. It has to interface to the deliver process. This process has a high level of interaction between the two models, because it covers different activities of the processing of customer inquiries to routing shipments, and finally transports the goods to final destination. Depending on the criteria of urgency and customer requirement, the means of transport decision takes place by both parties. A precise and accurate interface in this process reduces defects and non-conformance in the delivered products. The Make process covers mainly production, testing, and packaging of products to be transferred to the deliver process. Even though this process has minimal interface between members, the knowledge and information transfer can provide inputs in design specifications and technical advice for their production activities. The current level of return process practices and interactions are below the expected level in the investigated companies. In future, this process will also need better interface for appropriate action.

6 EVALUATION: IMPLEMENTING THE ADAPTED SCOR MODEL

The previous chapter presented a proposed and adapted supply chain reference model for firms in developing countries. This chapter discusses the implementation of the adapted model by applying it to a case study. Being deliberately selected from the initial case studies, this study offers the advantage of readily-available data for analysis. The objective is the implementation of the adapted d-SCOR model using a comprehensive case study to test the applicability of the model. Implementation of the model uses a case study from the leather and leather products industry. The case study presents the d-SCOR model environment in the leather and leather products industry and provides example for implementation scenarios. This case study explains how the proposed model can improve supply chain performance with its effective implementation. In particular, this study discusses the results of using the d-SCOR model in the design of the "TO BE" system and the analysis of the leather and leather products industry supply chain processes. This case study demonstrates that the proposed model helps managers of local manufacturers to successfully implement a d-SCOR model to improve supply chain performance. This chapter is organized as follows: The case study is presented in first section. The second section then shows the case study implementation results. The third section presents the proposed level II and III "TO BE" business processes using the d-SCOR model. Based on the results of the previous section, some improvement initiatives are proposed in section four. Finally section five discusses and summarizes the results.

6.1 Case study in leather and leather products industry

The application of the adapted d-SCOR model is examined in the context of a case study. The case study is based on the information collected from two leather and leather products manufacturing firms. Data was collected during company interviews conducted during field research. The leather and leather products industry is one of the top strategic areas where developing countries can go forward to enhance their competitiveness. Due to the existence of large livestock potential and a promising market for leather and leather products, currently the industry is trying to get gain advantages from the sector. However, the industry is highly fragmented. The presence of many supply chain participant members creates high price fluctuations and an unstable market. Generally, the literature reviewed and field collected data also revealed the importance of integrating firms in developing countries into global supply chains.

6.1.1 Companies' background

The application case study is conducted in two leather and leather products industries. The two companies have been selected from those that volunteered to be semi-structured interviewees. Both belong to the leather industry. Because of their long term experience in global integration of leather exports, they were good examples for application. The first leather industry produces gloving hides. Currently, the company employs more than 500 workers. The main products are finished sports gloving leather from sheepskin. While employing a conventional tanning process, the factory has installed an exemplary effluent treatment plant which makes for an environmentally compliant industry. By implementing ISO 9001 quality standards, it has received certification for its accreditation. The factory mainly produces finished dress and sports gloving leather from sheep, and has penetrated the international market. The factory has also delivered their products to local shoe and leather garments manufactures in local markets.

The second case study is about another member of the supply chain in the garment industry. It produces leather goods and garment articles mainly for local markets and a few products for export markets based on foreign customer orders. The company produces finished leather garments for men and women. Up to the time of the interview, the company mainly produced for local markets. It is trying to penetrate an export market to new customers focusing on jackets, bags, and other articles depending on customer requests. The factory has achieved process management standards and received ISO 9001 Certification. The firm has around 250 employees.

6.1.2 Leather and leather products supply chain

The supply chain in leather and leather products industry starts with the animal industry producing raw materials; hides and skins as by-products of slaughterhouses, which are transformed to various leather manufactured end-products. Generally, the supply chain has four processing stages, each of them requiring different combinations of material inputs, labour, and capital. In the first stage, hides and skins are recovered from dairy, beef, sheep, goats, and other animals. The quality of hides and skins at this stage is linked to animal husbandry and breeding of animals as well as proper slaughtering, flaying, and post-slaughter handling. The Eastern African region has the highest population of livestock in Africa. Ethiopia has 41 million cattle, 25 million sheep, and 23 million goats. Therefore, this livestock resource base is capable of producing adequate hides and skins for the leather industry. However, due to poor animal husbandry and low off-take rates (averaging at 14 percent for cattle and 27 percent for sheep and goats) the potential output is not realized. The low off-take rates plus decentralized slaughtering in urban and rural villages and poor collection implies that a

considerable number of hides and skins do not enter the market. Figure 6-1 demonstrates the leather and leather products industry supply chain

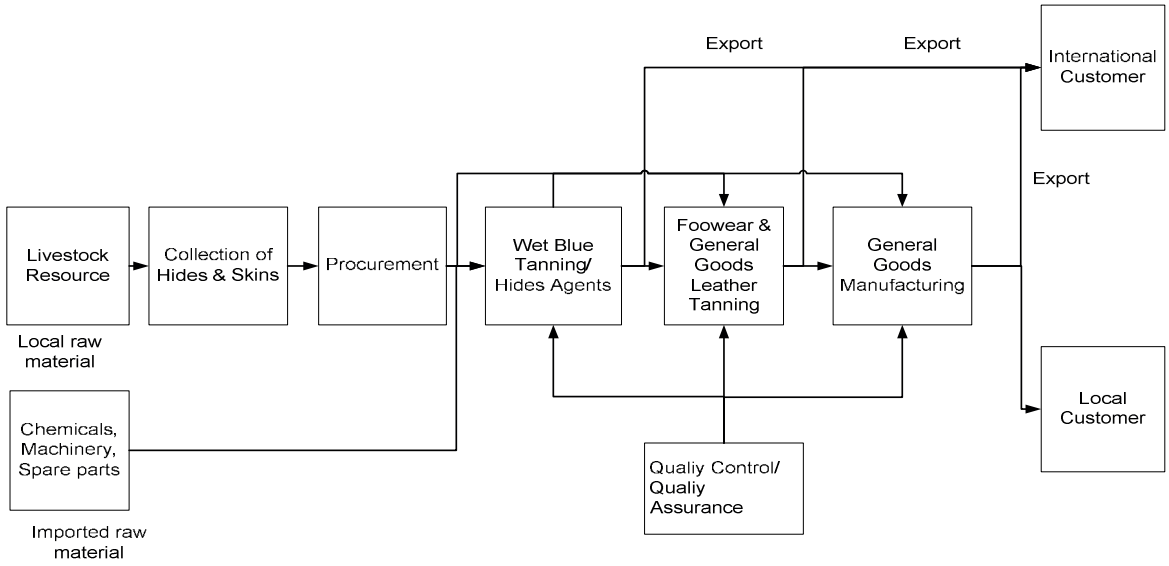

Figure 6-1: The leather & leather products supply chain

The second stage in the supply chain mainly focuses on collection and procurement activities. The firms' main functions comprise procurement, movement, and pre-treatment of raw materials. Firms, at the same time, also source chemicals, machineries, and spare parts from international markets. The hide and skin collection process is usually done by local agents (wholesalers) through door-to-door collection and district shops in different cities. Currently, experience shows that the raw skins and hides purchases take place through price negotiation, when the local collectors can sell their products directly to a wholesaler or sell to the local tanning industry. At the same time, there is an increasing trend of recovery of hides and skins from municipality slaughtering houses. However, in recent years, some of the big manufacturers are trying to establish a new partnership type of relationship with middle men (wholesaler agents). The manufacturer supplies salt for skin and hide preservation with appropriate training.

Third stage activities involve leather tanning and finishing to either pickled, wet-blue, crust, or finished leather types. These activities are capital intensive and usually constrained by strict environmental standards from government regulation and European customers. The tanning process receives hides and skins as the raw material combined with imported chemicals and produces blue skins and hides. In this case study, stage two and three were performed by one manufacturing enterprise. The fourth processing stage is labour intensive and includes production of leather products (footwear, travel goods, personal leather goods, etc.). The manufacturer uses this for further processing for consumers in the local and

international markets. The firm uses Make-to-Order strategies for export market according to their initial agreement. For local markets, on the other hand, the firm uses both Make-to-Stock and Make-to-Order strategies. Finally, the manufacturer distributes finished goods widely through their own shops and a small amount of products are also distributed by retailers and wholesalers.

As described in the discussion of the field results chapter, different manufacturing industries' practical experiences were collected. Different groups of senior managers of the firms were also interviewed and visited. The research analysis was based on the five SCOR model processes: Source, Make, Deliver, Return, and Plan. In addition to the interviewed person's resources, a company visit was accomplished at the end of the interview process. Interviewing the manufacturer revealed some pains and challenges in the supply chain. The firms are facing a lot of challenges or pains in highly competitive markets. These challenges include: high operating cost, high inventory level, unavailability of reliable suppliers, lack of information about the suppliers, inadequacy of suppliers' performance measurement criteria, lack of long term contracts between the manufacturers and suppliers, foreign currency problems, frequent quality problems on the raw material suppliers, low speed network connection especially to exchange data with foreign consultants and suppliers, low implementation status of ERP as promised and lack of expertise, poor integration from end-to-end, low level of vertical and horizontal integration, presence of supply chain members without value adding activities, the poor quality of hides and skins, poor and deteriorating physical infrastructure, environmental pollution due to lack of facilities for treatment, and disposal of hazardous wastes and environment protection measures. Table 6-2 shows the clustering of these challenges/pains into four categories. These four pains in the case study are clustered. The results of the field study were used as inputs to identify pains (weak points) for further improvement activities. Figure 6-2 shows this strong relationship. The cluster pains are inter-related and influence each other. If one field is changed, all of the other three have to be aligned.

6.2 Mapping of the leather & leather products supply chain using d-SCOR

The methodology for the application of the adapted d-SCOR model is based on the research result of Rollstorf and Rosenbaum (2003). The leather and leather products supply chain mapped in level I processes focus on Source, Make, Deliver, and Plan processes. The supply chain starts from sourcing process from both local and imported raw material suppliers. It includes the Tanning and Manufacturing (Finishing) activities. The firms at both the Tanning and Manufacturing levels export to international markets. For this case, the two manufacturing processes are performed within one-enterprise premises. Mapping the material flow, starting from the local and imported raw materials, have been performed with the d-SCOR model in level II. The first step was to determine problem areas within the supply chain by interviewing, visiting, and finally, modeling the supply chains business

processes level II using the process categories of the d-SCOR. The material flow for these raw material items, from local and imported raw material suppliers to the tanning industry site, has been analysed using the SCOR methodology in level II. Figure 6-3 gives the supply chain including the problem areas within the supply chain. Mapping of the leather industry is used to visualize and identify possible problems in the flow of material. Newly identified problems in planning, sourcing, and delivery processes exist in both the local raw material sourcing area and the quality area in all manufacturing processes.

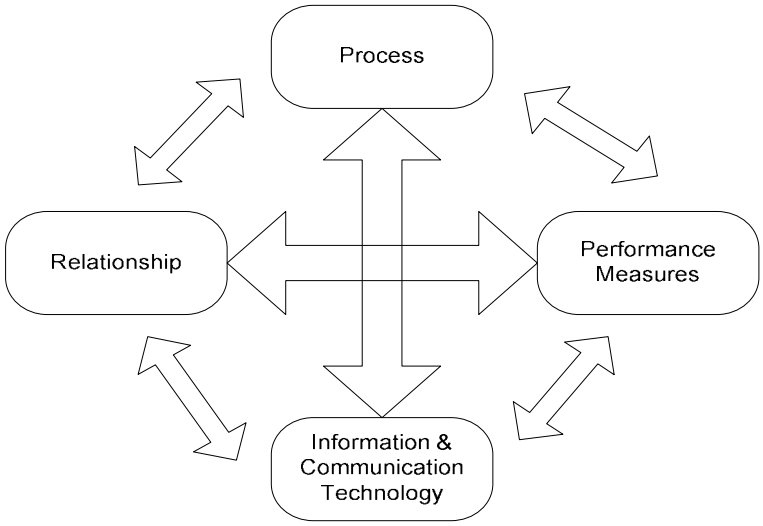

Figure 6-2: Inter-related pains

6.2.1 Mapping the level III using d-SCOR model

The next step is to model the above supply chain at the process element (d-SCOR level III) level, which includes capturing the best practices. An example description of level III sourcing process has been given in this section. These identified problems are then linked to those identified at the beginning of the process. The aim is to use information captured at d-SCOR level III to address the problem correctly within the supply chain. If the firm addresses these identified problem areas within the supply chain, there is a possibility of saving a huge amount of costs per annum, which would allow the firm to employ additional resources without further investment.

A critical problem along the entire leather and leather products supply chain in Ethiopia is the inconsistent supply of hides and skins resulting from a lack of organized processing and poor veterinary practices. Basically there are two kinds of raw material supplier problems in the leather and leather product industry context in Ethiopia. The first one is related to imported raw material sourcing and procurement which mainly focuses on suppliers' availability, cost of purchase, quality, and so on. In other words, the supplier cannot satisfy the manufacturer's total re-

quirements. Therefore the manufacturer needs to purchase one time from one supplier and another time from another supplier to satisfy the needs of the firm or to minimize quality problems they have experienced with previous suppliers. In addition, the Ethiopian Federal Central Bank has formulated a binding rule for foreign purchases through international bidding due to shortage of foreign currency. The enterprise must bid internationally to decide which supplier it should contract. Figure 6-4 shows the existing imported raw material procurement process. The imported raw material procurement process is run once every three months, meaning imported materials are procured four times per year. At the factory level, managers feel that their method for import ordering with respect to stock-outs is quite safe, but it becomes a big challenge to the supply chain principle of fast reaction.

Table 6-1: Clustering the challenges/pains areas

Process	**Performance measures**	**ICT**	**Organization/ Relationship**
High operating cost	Inadequacy of performance measure	Lack of information about supplier	Unavailability of reliable suppliers
High inventory level	Lack of environmental measures	Low speed network connection	Lack of long term contracts
Production quality problem		Low Enterprise Planning implementation status	Poor and deteriorating physical infrastructure
Quality of hides and skins			Poor interaction between supply chain members
Environmental pollution due to lack of facilities for treatment and disposal of hazardous wastes			Presence of supply chain members without value adding activities
			Shortage foreign currency

Seasonality of the raw material and price fluctuations create problems for raw material availability, supplier selection, and strategic relationships. In other words, the available suppliers cannot satisfy the manufacturer's requirements for demand, quality, delivery, etc. Despite the fact that Ethiopia is one of the largest producers of livestock in Africa, the livestock sector in Ethiopia is dominated by small private farms, and virtually no commercial production of livestock exists in the country. The lack of a commercial livestock sector can be attributed to the absence of a livestock supply chain. In this context, the problem can be categorized into two areas: raw material sourcing and quality limitations. When skins are available in the

market, the availability and supply is driven by meat consumption rather than by the leather and footwear industry, and by financial shortfalls of the farmers.

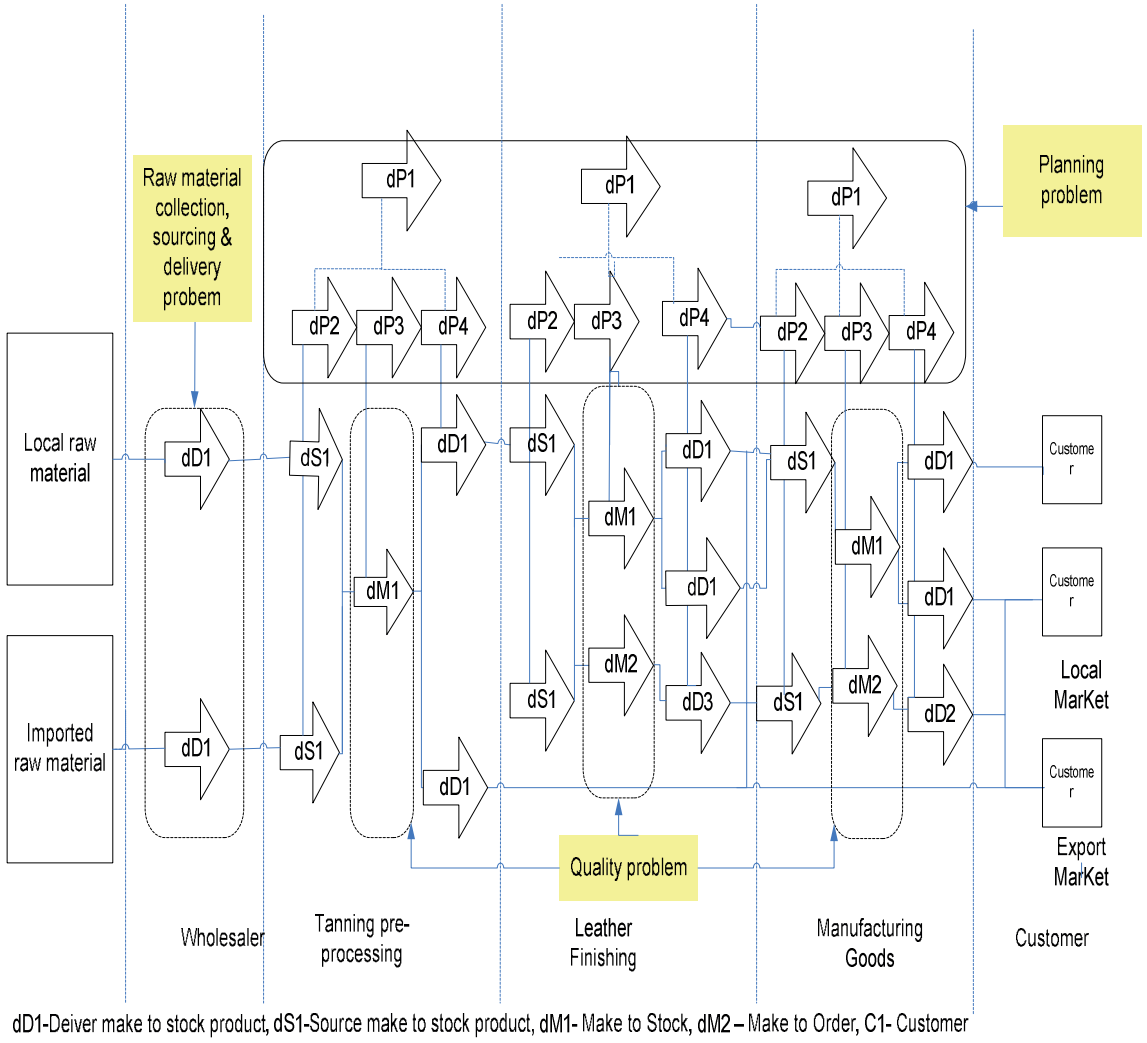

Figure 6-3: The leather & leather products supply chain with d-SCOR model

There is an absence of strong backward linkage between the source of supplies for hides and skins and the value added sector, i.e., the leather and footwear industry. Given the challenges associated with the supply of skins, tanneries in Ethiopia are operating at an average capacity utilization of approximately 48%. Figure 6-5 demonstrates the local raw material sourcing process by local manufacturer.

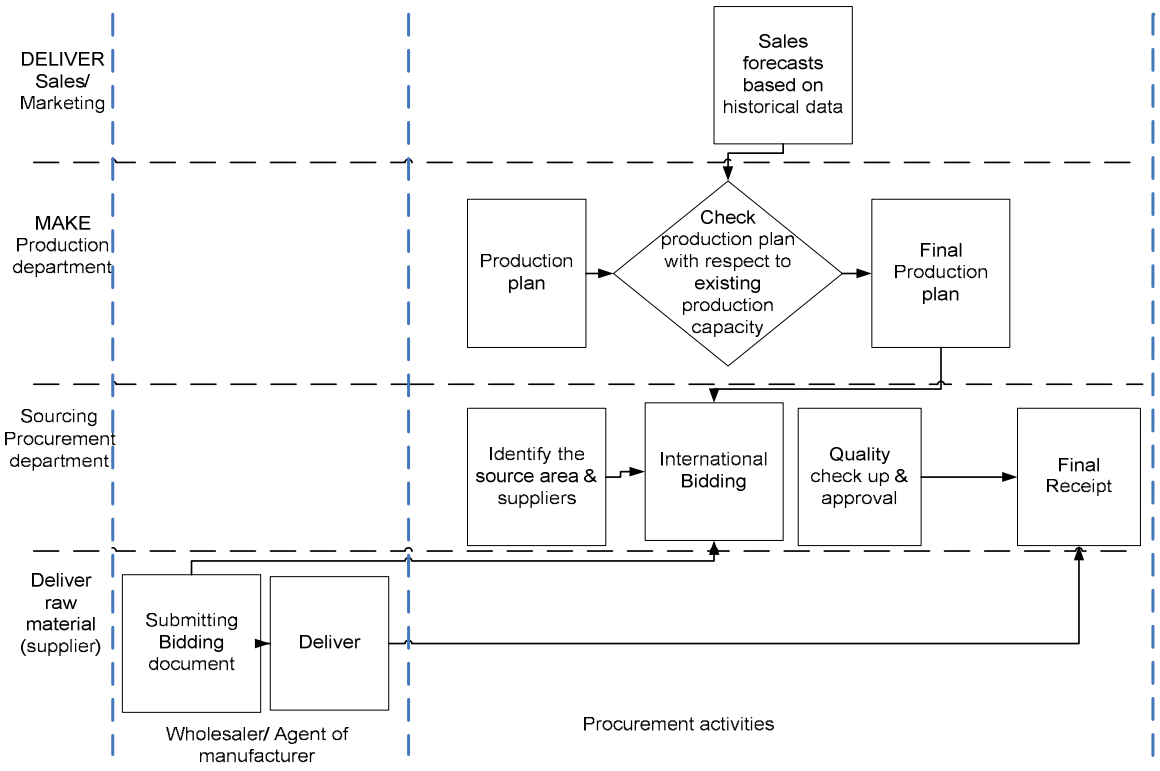

Figure 6-4: Imported raw material procurement practices

6.3 To-Be model for level II and III processes

The field analysis result and the As-Is model revealed real practical situations. This will be the basis for starting the To-Be model for further improvement activities. There are different inputs that can be used to facilitate improvement activities. These are the As-Is model, gap analysis, and best practices. Based on the collected data, gap analysis, and best practices, new level II business processes are designed by the researchers in order to improve the existing bottlenecks. Three main processes changes are proposed in planning, sourcing, and quality related activities. Figure 6-6 demonstrates the "To-Be" level II processes. The first process extends the plan process (focused on the finishing manufacturing activities) to involve other actors early in the supply chain. The annual planning activities should also involve the wholesaler and garment manufacturers. The second proposed change is to quality control and assurance activities. The quality control and assurance activities need to extend their coverage up to the raw material suppliers (wholesalers). In addition, the manufacturer could develop new types of partnerships in training, finances, and technical support. From the field analysis we have learned that the manufacturers are working below capacity. The third proposed change is extension of the sourcing activities to neighbouring African countries.

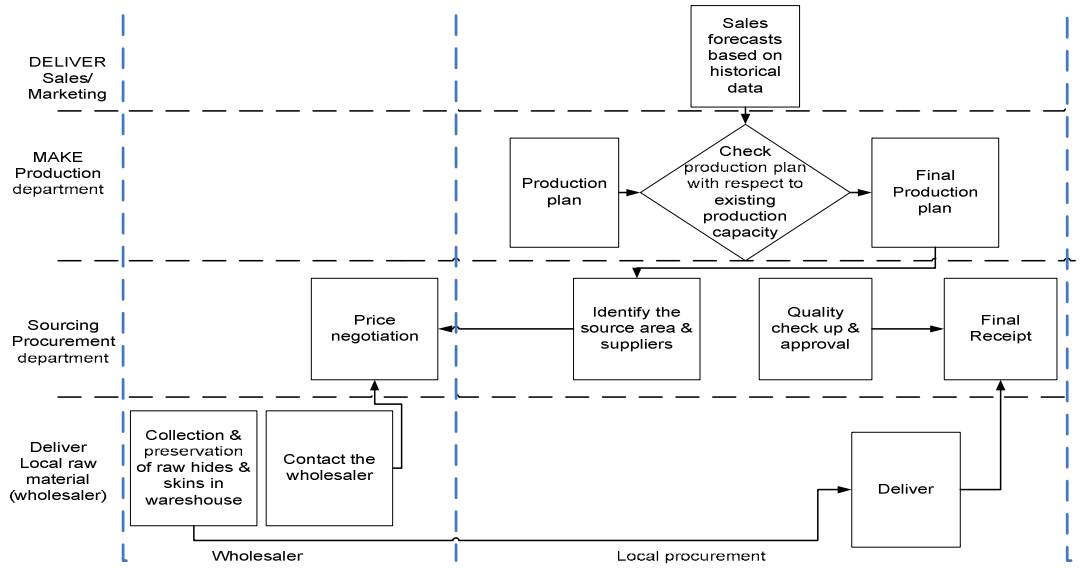

Figure 6-5: Local raw material sourcing practice

The To-Be business processes mapping at level III has been performed for the local raw material processes. In this industry, aggregate planning is driven by historical sales information which is necessary to plan production. In the existing procurement practices, the Sales, Marketing, Manufacturing, Production, and Purchasing and Supply Departments were actively participating in imported raw material sourcing. When the leather and leather products industry gets an order, the process of production scheduling begins. The production schedule is based on spreadsheet data. As the manufacturing process continues, work on preparation of production plans (dP3.1) takes place. The plan enables scheduling of production activities (dP1.2). The schedule of production activities (dP1.2) is used as support for the next bidding preparation process. Another process that supports the procurement plan is the delivery plan (dP2.4). Purchase requirements for imports are made through international bidding. Mostly, the local agents deliver orders, and available stock will be shipped directly from the warehouse. When the imported item arrives, the product is considered received (dS1.4). As the products are received, verification (dS1.5) is performed. After the verification, the products are transferred to the manufacturing processes. The invoice is then compared to the delivered quantity (dS1.6). Then the imported raw material is sent to the production department for further processing. Finally, planning, local raw material purchasing, and the make process was modelled using d-SCOR level III processes as shown in Figure 6-7.

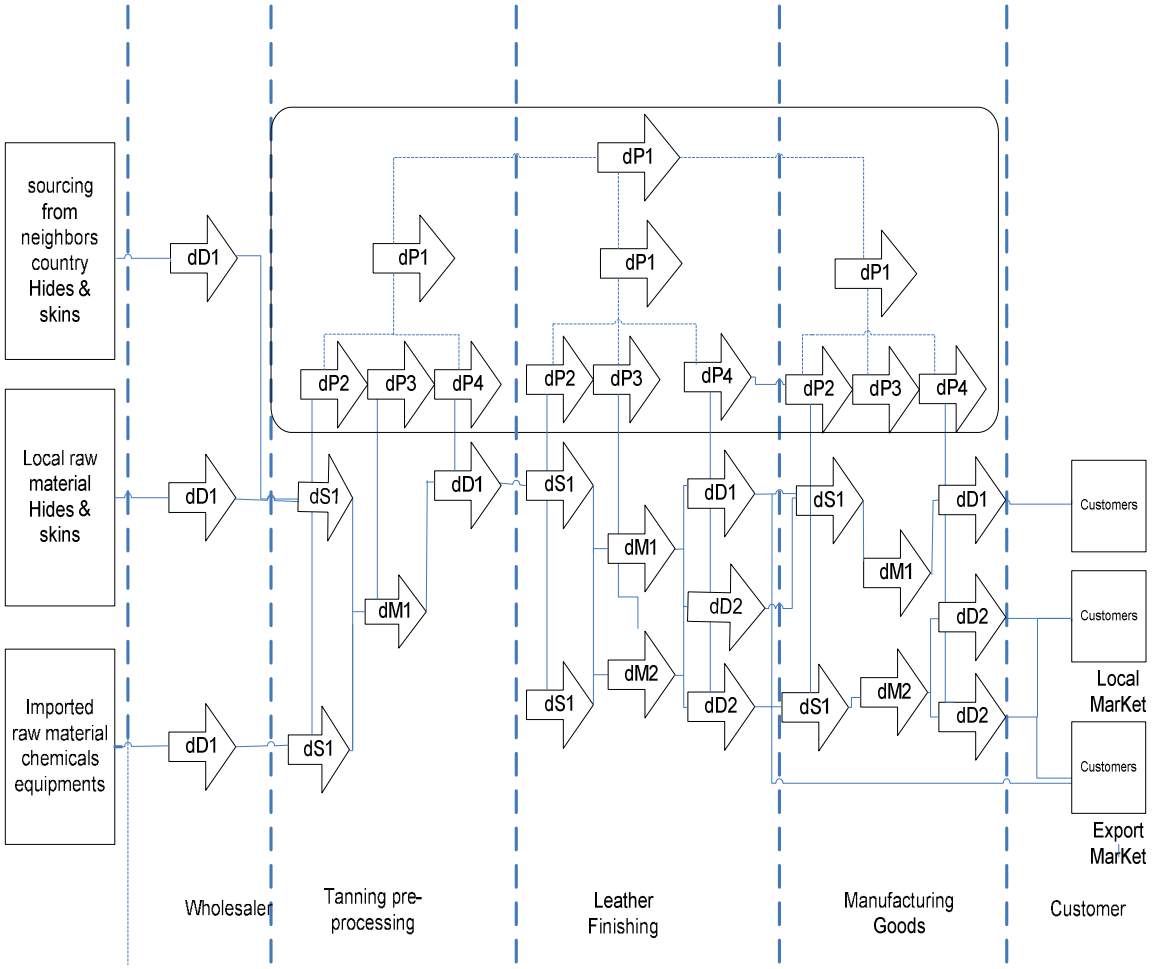

Figure 6-6: SCOR model level II processes (To-Be)

6.4 Proposed improvement initiatives

After careful analysis of the existing practices, the resulting As-Is model reveals the real scenarios. This will be the basis for starting the To-Be model for further improvement activities. To-Be modeling is one of the important steps to go forward with company-wide improvement initiatives. There are different inputs that can be used to facilitate improvement activities. These are the As-Is model, gap analysis, and best practices. From the previous discussion, the SCOR model provides a variety of best practices that have proven to be successful for industries. However, the previous literature review and field results have shown that not all best practices are applicable to manufacturing industries in developing countries. As per the research result for SCOR model adaptation discussed in chapter five, the model should be carefully selected, analysed, and adapted as per the requirement of the company in question (Georgise et al., 2013b). Table 6-2 explains the identified initiatives for improving firms' pains.

From interview feedback and analysis of the identified challenges, further estimated qualitative benefits were gained for each of major initiatives. Finally, the research has proposed four initiatives for implementation consideration: developing collaboration and integration with suppliers; supplier performance evaluation; sourcing from neighbour African countries; outsourcing non-core functions to other companies such as delivery and warehousing functions.

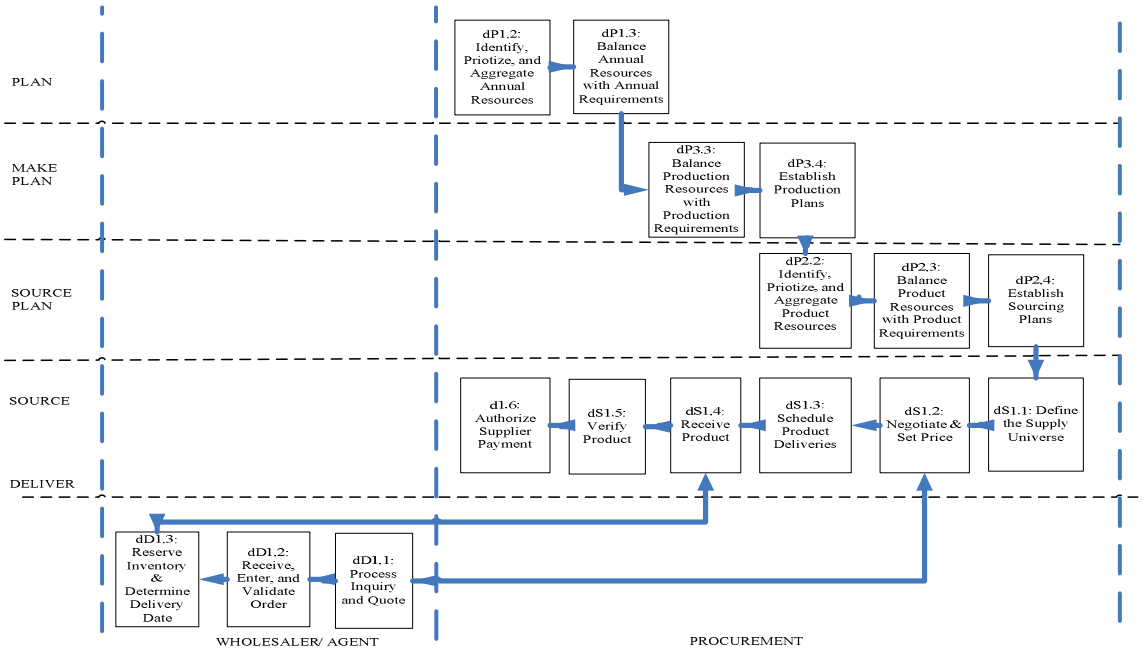

Figure 6-7: d-SCOR model level III processes (To-Be)

6.5 Discussion and results of the case study

A comprehensive case study has been presented describing the leather and leather products industry supply chain in Ethiopia. The case study demonstrated the feasibility, comprehensiveness, and adaptability of the model to suit a scenario in a developing country. Further integration of the new model with the existing SCOR model is presented in the next section. The following are anticipated contributions: a d-SCOR model specific to the manufacturing industry in developing countries, and an extension of the existing SCOR model that enables the manufacturing industries in developing countries to adopt a scalable, enterprise integration-based standard for the improvement of the whole supply chain. These analyses suggest that leather and leather products manufacturers in Ethiopia can take advantage of the high quality skins available in the local market to transition away from what seems to be a price maximization strategy in the low quality mass product market to a market share maximization strategy in the higher end markets. But this will require investments in labor and technical skills, as well as strengthening the existing supply chain for hides and skins. Both would create opportunities for leather shoe

manufacturers in Ethiopia to respond effectively to both the quality and quantity challenges that the currently face in the international market.

Table 6-2: Identified major initiatives

No.	Major initiatives	Impacts
1	Revising the current planning system	Reducing uncertainty in the firms and increasing the accuracy of plans
2	Develop collaborative and integration with suppliers	Enabling continuous raw material supply and utilize the full capacity
3	Revising the raw material and finished goods inventory control system	Decreasing the inventory system cost
4	Sourcing the raw hides and skins from neighbour African countries	Enabling continuous raw material supply and utilize the full capacity
5	Integrating the different departments using IT and enable internet based pro-	Facilitate data exchange and information sharing
6	Designing the system of suppliers identification, selection and performance	Decreasing supply costs and increasing the reliability of supply chain
7	Implementing adopted Enterprise Resource Planning systems	Increase data handling and data storage capacity firms and increasing the accuracy of

Initial gains from the implementation of the d-SCOR model are evident in the accurate description of business operations at both a strategic and tactical level. To address the influences on the business, the strategic level includes the enterprise and supply chain level. At the tactical level, the model enables the benchmarking and measuring of processes. While the firms currently take measurements, the use of measurements were minimum on other firm's operations because of the non-standardized processes, metrics, and benchmarks. So, this case has identified the advantages of implementation. It has been argued throughout this research that the complex and different environmental factors that affect the supply chain process mean that any attempt at existing model implementation will be almost impossible. The proposed business process is an initial step for the d-SCOR model and provides the first guide for any manager to model, evaluate, benchmark, and improve their company's key areas of activities, which can enhance their competitiveness in the market. This is a generic model; it targets mainly some key areas of the manufacturing industry in developing countries. In short, this research has tried to propose a business process modification for a d-SCOR model for modeling, measuring, and improving the performance of developing countries.

7 CONCLUSION & OUTLOOK

Many advanced applications of the ICT enhance manufacturing firms. However, most DCs have not yet fully benefited because of their specific and unique challenges. Model adaptation research offers a number of benefits for a developing country, such as reducing research and development time and costs, and improving further adaptation research in the already tested successful models from developed countries. This research does not answer all the possible questions related to the MIDCs' situation in supply chain business processes, nor does it attempt to. This is the first research to examine the supply chains of manufacturing industries in Ethiopia from the perspective of the supply chain modeling and evaluating. The results can apply to the flow of material from other raw material suppliers from developing countries (Africa) to their customers in developed nations. Hopefully, this research has raised many more questions than what it has answered. However, it does contribute to defining the supply chain characteristics of the manufacturing industries and adapting the SCOR model to suit this situation. While not being a complete answer to the multi-faceted problems faced by manufacturing industries supply chains in DC, the d-SCOR model does go some way to help and guide the direction for future practical research and work, as well as being a practical tool, useable in real situations.

Adapting a supply chain reference operations model is a challenging task. In the context of developing countries this becomes more difficult due to the constraints imposed by unavailability of literature and the existing different dynamic situations. In order to facilitate this adaptation process, the overall goal of this research as defined by the research question was to guide the model adaptation with its building blocks: business processes, performance metrics, and best practices, along with the existing enabling technologies. The research has explored and proposed the supply chain processes for the manufacturing industry in developing countries based on the SCOR model's five processes, best practices, and existing enabling technology. The research has determined that although there are quite a number of similarities with the SCOR model business processes, there are many differences due to the existing situations and environmental factors. After identifying the general characteristics of a supply chain business process, the research proposed a business process for a developing country SCOR model, which is used to model the supply chain operations in developing countries and helps the companies to model, evaluate, compare, and benchmark the key areas that can help them to maintain their pace and expedite their success. The primary significance of this work is the adaptation of the SCOR model to the scenarios of firms in the developing countries' situations. It highlights also how the integration of this model with the standard SCOR model can improve of entire supply chains, starting from a raw material supplier from a developing nation to the final end customers in developed countries. These integrations enable firms to coordinate

relationships in their processes and communicate between members of supply chains to improve their impact on supply chain success. Therefore, the model could be used for further research purposes not only in developing countries but also in wider supply chain improvement research involving both developed and developing nations. The d-SCOR model addresses the missing part of the existing SCOR model by attempting to ensure that characteristics of the supply chain and the current situations are included and addressed. The study also provides a deeper understanding of the current supply chain practices, performance measures, best practices, and available enabling of information systems in developing countries. The implementation of the new d-SCOR model is evaluated as the case study in the leather and leather products industry. The research findings provide an adapted d-SCOR model to practitioners for their systematic performance measurement and improvement activities, for measuring, evaluating, benchmarking, and improving their manufacturing activities via a tailored business process that suits their unique situations. The model incorporates also the KPIs, best practices, and enabling technologies.

Although this research is based on a comprehensive review of relevant literature, field questionnaire surveys, and semi-structured interviews, the quality and scope of present day literature proved to vary significantly between topics. For example, very limited literature was available in the context of the supply chain modeling or improving manufacturing industries in developing countries. The limitations of the study are related to the methodology followed for data collection, the analysis method, and the location of the research (question of generality with respect to other developing countries). The findings in this research are based on studies undertaken in Ethiopia (a developing country in East Africa). Therefore, it is difficult to make generalizations about the applicability of the findings to other developing countries with different manufacturing industries bases and scenarios, since some of these findings could be tightly related to factors that are unique to characteristics of the studied manufacturing firms in Ethiopia. However, the research findings can be relevant to other developing counties. For example, the methodology used business processes, KPIs, and best practices that can be tailored and modified for other developing countries. Several different ways are suggested in which the various concepts identified in this research can be extended into the future. For example, further development work could upgrade these proposed business processes and modify other business processes, and identify appropriate key performance indicators (KPIs) and best practices that suit the scenarios in other developing countries. More research into the d-SCOR model would be beneficial, and may develop further the adapted model. When future research focuses on different countries, it will identify more interesting results. These would lead to an assessment of the SCOR model in different cultures and contexts. Future practical implementation and application of the adapted d-SCOR model in the situations of different manufacturing industries in another DC would allow for analysis and possibly quantification of the benefits of the adapted model.

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9 APPENDIXES

9.1 List of publications

1. Georgise, Fasika B.; Thoben, Klaus-Dieter, Adapting the SCOR Model to Suit the Manufacturing Industry in Developing Countries, Research Report 2010/11,International Graduate School for Dynamics in Logistics, Vol. 2 2011, pp. 21-24, University of Bremen.
2. Georgise Fasika B.; Thoben, Klaus-D.; Seifert, Marcus, 2011, Supply Chain Modeling and Improving Manufacturing Industry in Developing Countries: A Research Agenda, World Academy of Science, Engineering and Technology, Vol. 60 pp. 1998-2003, USA.
3. Georgise, Fasika B.; Thoben, Klaus-D.; Seifert, Marcus, 2012, Adapting the SCOR Model to Suit the Different Scenarios: A Literature Review & Research Agenda, International Journal of Business and Management, Vol. 7, No.6, March 2012, Canada
4. Georgise, Fasika B.; Thoben, Klaus-D.; Seifert, Marcus. 2012. A Framework of the Forces Influencing the Adaptation of the SCOR Model to the Situation of the Manufacturing Industry in Developing Countries, in. Dynamics in Logistics (3rd International Conference on Dynamics in Logistics – LDIC 2012 proceedings); 2013 Springer-Verlag Berlin Heidelberg.
5. Georgise, Fasika B. Best Practices for Manufacturing Industry in Developing Countries: An Ethiopian Study, Research Report 2012/13 International Graduate School for Dynamics in Logistics, Volume 3, 2013, pp. 15-18, 2013, University of Bremen.
6. Georgise, Fasika B., Thoben, K.-D., Seifert, M., (2013a), "Assessing the Existing Performance Measures, & Measurement Systems in Developing Countries: An Ethiopian Study", Global Journal of Researches in Engineering: Industrial Engineering, volume 13, Issue 2 version 1 2013.
7. Georgise, F. B., Thoben, K.-D., Seifert, M., (2013b), Implementing SCOR model Best Practices for Manufacturing Industries in Developing Countries, International Journal of u- and e- Service, Science and Technology, Vol. 6, No. 3, 13-26, 2013.
8. Georgise, Fasika B.; Thoben, Klaus-D.; Seifert, Marcus. Application of the Adapted SCOR Model to the Leather Industry: An Ethiopian Case Study, in. 4th International Conference on Dynamics in Logistics – LDIC 2014, February 08-14, Bremen, Germany.
9. Georgise, Fasika B.; Thoben, Klaus-D.; Seifert, Marcus. Adapting the SCOR Model Deliver and Source Processes for the Manufacturing Firms in the Developing Countries, in. 4th International Conference on Dynamics in Logistics – LDIC 2014, February 08-14, Bremen, Germany.
10. Georgise, F. B., Thoben, K.-D., Seifert, M., Identifying the Characteristics of the Supply Chain Processes in Developing Country: A Manufacturing Industry Perspective, WSEAS TRANSACTIONS on BUSINESS and ECONOMICS Volume 11, 2014, 12-31.
11. Georgise, F. B., Thoben, K.-D., Seifert, M. (2014), Integrating Developing Country Manufacturing Industries into Global Supply Chain, Journal of Industrial Engineering and Management, Vol. 7(1), pp. 174-193.
12. Georgise, F. B., Thoben K.-D., Seifert M., Supply Chain Integration in the Manufacturing Firms in Developing Country: An Ethiopian Case Study, Journal of Industrial Engineering, Vol. 2014, Article ID 251982, pp. 1-13, http://dx.doi.org/10.1155/2014/251982.

9.2 Survey questionnaire on supply chain modelling & improving the MIDC

General introduction & guideline:

The purpose of this questionnaire is to investigate and elicit understanding of the current situation. It will try to get an experience from organizational practices, problems (& solutions) in relation to supply chain measurement and improvement. The results of the survey will be an input for adapting the SCOR model and apply it for evaluating and improving manufacturing industry operations in developing countries. This PhD research will be conducted in the Faculty of Production, Bremen University, Germany with engineering

The following instructions preceded the instrument:

a) For the following questionnaire, please answer the questions below, either mark them with a cross ``X'' or a tick ``√'', or circle the appropriate option, or highlight the appropriate option, or write/complete the appropriate answer.

b) There are some definitions that you might find useful while answering the questionnaire attached as annex.

c) If you have any difficulties responding to any of the questions, please provide your comments so that we may improve the questionnaire.

d) There is no right or wrong answers.

All responses are confidential.

Only aggregate summaries will be reported.

No information you submit will be identified with you or your company.

Your participation will help improve supply chain modeling and improvement of manufacturing industry in developing countries. Your firm will receive an executive summary report abstracted from the research study.

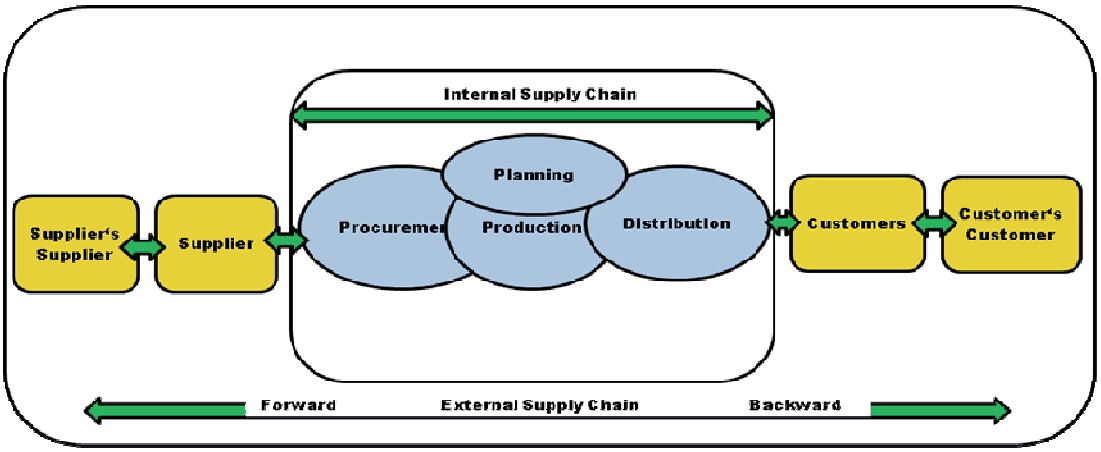
If you feel that there is an individual in your firm who is better qualified to complete this survey, please feel free to forward the survey to him/her.

If any part of the questionnaire is not clear, or if you have any queries, please contact me, Mr Fasika Bete, at +251916823287 or +25916824552.

Once you have completed your questionnaire, please return the questionnaire in the enclosed self-addressed envelope to: Mr. Fasika Bete, P. O. Box 568, Hawassa. Alternatively, please return it to me via fax to number +251462205421 or email it to: geo@biba.uni-bremen.de. It would be appreciated if you could return the completed questionnaire to me by no later than 30 September 2011.

Thank you for your time and cooperation.

Section I. Supply Chain Relationship: level of integration, coordination of their business environment.



Supply Chain Relationship: Referring to the above diagram, please indicate your organization's level of integration with suppliers, internally, and with customers.	Engaged				
	Very Poor	Poor	high	Very high	Not Applicable
With Suppliers					
Information exchange with suppliers through internet or web-based technologies……..……...					
Level of strategic partnership with suppliers…….……...					
Participate level of suppliers in the design stage…….…….					
Participation level of suppliers in the process of procurement and pro-					
Establishment of quick ordering system……..					
Stable procurement through network (e.g. electronic data interchange (EDI))……..……..					
Within the Company					
Data integration among internal functions through network					
Real time inventory management……..……...					
Real time access to logistics-related information…….					
Data integration in production processes…….					
Cross functional teams information exchange……...……..					
Online integrations between production and sales functions...					
With Customers					
Integrated demand forecasting……..……..					
Online order taking…….…….					
Speed of order processing…….……...					
After sales service support.....…….……..					
Follow up with customers for feedback…….…..					

Section II. Performance Measurement & Performance Metrics: Current practice and future plan for performance measurement.

A. What type of performance measurement system (PMS) does your company use to evaluate its internal operations, its suppliers and customers?

☐ Balanced score card (BSC) ☐ Logistics Scoreboard
☐ Activity based Costing ☐ Economic Value Analysis

☐ SCOR Model ☐ European Foundation for Quality Management (EFQM) Model

☐ Other:_____

☐ No Performance measurement system used for performance evaluation

B. Does your company is planning to implement a new approach for performance measurement in the foreseen future? If yes, please specify the type of performance measurement and reason for your selection?

Yes ☐ No ☐

_____

_____

_____

_____

C. Performance Measures: Please indicate how frequently your organization uses each of the following performance measures.	**Frequency of Use**				
	Never	Sometimes	Frequently	Always	Not Applicable
On-time delivery…….....					
Compliance…….....					
Damages…….....					
Order accuracy / fill-rate…….....					
In-stock rates / stock-outs…….....					
Number of units produced…….....					
Backlog in the delivery schedule…..…….....					
Total sales revenue…….....					
Amount of finished goods inventory…….....					
Rate of incidence of production defects..…….....					
Amount of material inventory…..…….....					
Number of worker injuries…….....					
Gross profit margin…….....					
Cost of goods sold..…….....					
Number of customer orders completed…….....					

D. What are the three most important performance measures/indicators in your company?

_____

_____

_____

_____

Section III. Supply Chain Processes: *the following questions are designed to measure the use of supply chain practices with respective SCOR model five supply chain processes (Plan, Source, Make, Deliver, & Return).*

A. Planning Process:					
Planning practice: Please indicate *to what extent the following planning practices have been implemented in your organization.*	**Implemented**				
	Never	Poorly	Well	Extensively	Not Applicable

"What-if" analysis has been implemented for supply/demand balancing….....					
The use of historical data in the development of forecasts….					
The balancing of product lines on a daily basis…….....					
Performance indicators have been defined for your department…					
The company use information system in their forecasting activities…					
The demand management process is driven by customer information					
Cross functional team help plan departmental activities such as pro-					
Your company frequently contacts retailers to get information about market demand.....					
Your company has the ability to respond to frequent changes in global market demand…….....					
B. Sourcing Process:					
Sourcing Practice: Please indicate t*o what extent the following sourcing practices have*					
Long-term relationships with strategic suppliers…….....					
Reduction in the number of suppliers…….....					
Just-in-time delivery from suppliers…….....					
Performance indicators have been defined for your suppliers					
Frequent measurement of suppliers' performance…….....					
Frequent performance feedback to suppliers……..					
Imported raw materials are always available for manufacturing companies.....					
Imported raw materials are always available locally with affordable prices…….....					
The company use of information system in procurement process…….....					
C. Making Process:					
Manufacturing Practices: Please indicate to what extent the following manufacturing practices have been implemented in your company.	**Implemented**				
	Never	Poorly	Well	Extensively	Not Applicable
Planning procedures and processes related to material and capacity					
The outcomes of planning procedures and processes related to materi-					
Delivery times are extremely important for the department planning					
Material requirement methods are used by your departments planning					
Internal and external customers' needs for material or capacity are met					
Delivery schedules and material requirement planning for external					
D. Delivering Process:					
Delivering Practices: Please indicate, to what extent have the following delivery practices					
We respond to our major customer's needs quickly……...					
We deliver products to our major customer on a just-in-time ba-					
Performance indicators are determined for distribution					
Our company always delivers orders within lead time……...					
Our company use third party logistics for product delivery...					
We have a single point of contact for all order inquiries……					
We have real time visibilities of order tracking……..					
We consolidate orders by customers, sources carriers, and					

We use automatic identification during the delivery process to track					
We maintain the capacities to respond to unplanned orders...					
E. Returning Process:					
Returning Practices: Please indicate, to what extent have the following product return prac-					
We have a set of specifications to verify the quality of returned prod-					
We have dedicated personnel, equipment & facilities to process re-					
We have documentation describing our product return					
Our product return process is easy for our major customer to fol-					
We have accurate forecasts of our product return					
We allocate resources for our product returns during the planning					
Our company managers have practiced reverse logis-					
F. Inventory Management:					
Inventory Management Practices: The following questions are designed to identify the					
Company-wide coordination and management of inventory……..					
Joint inventory management by suppliers and manufacturer……..					
Just-in-time (JIT) delivery.....					
Vendor managed inventory (VMI) at production sites.....					
Lowest inventory driven costs.....					
Regional distribution centers for product distribution……...					
Automated warehouse management.....					
Keeping a safety inventory as a consequence of sales variability……..					

Section IV. Enablers & Challenges: the existing tools & technologies that support the business process and evaluation.

A. ICT infrastructure: the following questions are designed to measure the use of ICT including both hardware and software in your company. Please rate the actual performance of each factor from your perceptions.	Performance				
	Poor	Fair	Good	Excellen	Not Applicable
Advanced planning and scheduling software…….					
Automated material handling system (hardware)……...					
Bar coding/automatic identification system……					
Electronic mail system…….....					
Electronic data interchange (EDI) capability……....…….					
Enterprise Resource Planning systems (ERP) system……					
E-procurement system…….....					
Forecast/demand-management software…….....					
Transportation/warehouse management software……					
B. Resource & Capabilities: What is the extent the parameters are realized by your com-					
Financial resources……					
Technical competency……					
Leadership……..……					
Experience……..……					
Research and development capability……..…					
Innovation capability……..……					
C. Challenges & Obstacles: Participants will be asked to state what	Never Challenge	Few Challenge	Challenge	Strong	Not Applicable
Lack of ICT infrastructure……..….....					
Lack of physical infrastructure……...……....					

A lack of willingness to share needed information.....					
Quality of skilled and cost effective workforce.....					
Difficult to establish relationships based on shared risks & rewards……					
Lack of employee loyalty/motivation/empowerment…….					
Non systematic approach to measuring customer requirements……...					
Difficulty to implement the models & handle for practical operations……					
Management practices and organizational working culture					
The excising model specificity to the developed countries operating environment……					

Section V. Best Practices: Analysis of best practice implementation.

The following questions are designed to identify the use of best practices. To what extent the following best practices have been implemented in your company. Please the actual implementation of each best practice from your perceptions.	Implemented				
	Never	Poorly	Well	Extensively	Not Applicable
Available to Promise (ATP).....					
Co-located Procurement.....					
Benchmarking.....					
Carrier Agreements.....					
Cross-Docking.....					
Lean Production.....					
Postponement.....					
Six Sigma.....					
Electronic Data Interchange (EDI).....					
Collaborative Planning, Forecasting and Replenishment …….....					
Bar coding/automatic identification.....					
Vendor Managed Inventory (VMI).....					
Supplier Performance Assessment System.....					
Total Quality Management.....					
Outsourcing.....					

Section VI. Company Information: Please provide general information about your company.

A. How many people are employed in your company business?

People employed					
0 - 50	51- 250	251 - 500	501 - 1000	1001 - 2000	>2000

B. For how long your company participate in manufacturing?

Number of years					
0 - 5	5- 10	10 - 20	20 - 30	30 – 50	>50

C. Check the approximate category of the overall value of your sales to all of your customers

Overall Sales							
<Birr 5 mil	Birr 5-20 mil	Birr 20-50 mil	Birr 50-100 mil	Birr 100-500 mil	Birr 500 mil - 1 billion	Birr 1 billion - $ 5 billion	> Birr 5 billion

Comments:

If you would like to provide some comments on the questionnaire or supply chain integration in general, please use below. Your opinion is valuable to us and we assure you keep all information confidential.

_____

_____

_____

☐ I am not interested in participating in additional interviews, but would like to receive summary of the results of this study.

☐ I would like to participate in further research. Please contact me by:

☐ e-mail (Optional):…… ……...

☐ Telephone: (Optional):……..…….....

Company name: …….....

Contact Address: ……..…….....

Date: ……...

PLEASE MAKE SURE YOU HAVE ANSWERED ALL THE QUESTIONS.

And please return the completed questionnaire as soon as possible via the enclosed postage-paid envelope.

Thank you very much!

9.3 Interview guide on supply chain modeling & improving the MIDC

Background

The interviews will be conducted during the course of the empirical part of this research following the guideline presents in this section. The interviews aim at gathering both qualitative and quantitative data on supply chain characteristics, processes and technology through a semi-structured approach. There are four major focuses in the interview, i.e. supply chain process, performance measures best practices and enabling technologies based on the concepts of the SCOR model that consists of five supply chain processes (plan, source, make, deliver, and return). Interview language will be either English or Amharic (Ethiopian National Language) depending on the language fluency of the interview partner. The interviews centre around four core questions from which more detail questions will be derived depending on the applicability to the organization's specific approach of supply chain process practices. Questions put to interviewees will be taken from the following non-exhaustive list:

I. Introduction:

The introduction explains the purpose of the study and the role of the respondents. In addition, the aim is to assure the participants' confidentiality and request permission to use a tape recorder.

II. General Company Information:

- What is the size of your organization? (How many employees do you have?)
- What is your organization type of ownership (Public, IJV, MNC, and Local Private)?
- For how long your company participates in manufacturing?
- Check the approximate category of the overall value of your sales to all of your customers
- What is your position within your organization?
- What are your responsibilities within your organization?
- What are the activities that your organization carries out? What kind of products do you manufactured?
- Where is the SC manager in the organizational chart? Has the position evolved overtime? Why?
- Which activities/areas fall under SCM? Have they evolved overtime? Why?
- What is the impact of internationalization of your company in the SCM?

III. Core question 1: What are current practices and characteristics of supply chain in your company?

a. Supply chain configuration & Coordination

- Who are your customers (local, international)?
- Where are your products sold (Market: local customer, worldwide)?
- Who are your suppliers (local, international)?
- Where are your suppliers located?
- For managing the business Processes in our supply chain:
    a) Processes tend to be managed within discrete departments or functions. There is little cross-functional or inter-enterprise process management.
    b) Processes are often company-wide and are managed at both the functional and cross-functional process levels. There is little inter-enterprise process management with supply chain partners.
    c) Core processes are managed internally. Outsourcing is used for most non-core processes. Information is frequently shared with external partners.
    d) End-to-end process management, coordination, and collaboration with strategic partners is used for most processes. Alignment of business objectives and processes is done with each strategic partner.

b. Collaboration:
Of the various forms of collaboration stated below, indicate which practiced with your various clients:

- We control the stock of our client in their company.
- We carry out a joint plan demand, production and supply.
- We Exchange information on stocks, order, available resource.
- Sending order confirmation.
- Shipping order information with advance (reference, quantity, date…)
- Agreed requirements delivery (Packaging, identification, time delivery…)
- A system of traceability order (via internet, telephone)

c. Plan Process:

- How is the production planning and control activities carried out?
- Forecasting requirements
  - What is sequence of forecasting process?
  - Do you have guidelines for forecasting?
  - What are the tools or the forms used to forecast needs?
    - Stock on hand, demographic information, distribution data.
  - Is delivery lead time taken into account?
- What methods used to perform forecast sales for your company?
  - The qualitative (historical study market…)
  - Quantitative (mathematical methods, models…)
  - Quantitative software commercial
  - Do not do sales forecasts
  - Other methods
- Does the company use information system in the forecasting activities?
- Does your company frequently contact retailers to get information about market demand?

d. Source Process:

- How to order input material?
  - What are the types of material that you usually buy from suppliers?
    - How do you place an order? Give an example? Is the process different for different type of material? (Visit the store, Phone, Fax, E-mail)
  - What types of problem faced in procurement process?
    - (Order Lost, Fax not received, Too many papers to fill out, Not a good definition of what is wanted, Poor communication with supplier, Vague stated requirements, Material not available)
  - Do you typically pick your material or you like the supplier/3PL provider to deliver them?
- How do you select suppliers? How do you assess your suppliers?
  - What are the procedures used to evaluate potential suppliers? (Forms used and main criteria)
    - Experience of suppliers
    - Reputation
    - Cost
    - Quality
    - Previously worked with supplier …etc
  - What are the typical problems associated with the evaluation process?
    - Time taken for the qualification process
    - Too many supplier to quantify

- How would you describe your relationships with your suppliers (e.g. traditional/ partnership/ collaborative)?
- Are suppliers involved in the design and development processes?
- What are the challenges dealing with international suppliers?
- Do suppliers have access to raw material inventory?
  - When procurement process occurs (before or after customer order)?
- Identity the level of variety and whether there is high risk to keep huge volume of particular material?

e. Make Process:

- Which type of production strategy does the company follow?
  - Make-to-Stock: Standard parts are produced and stocked before a customer order is received
  - Make-to-Order: Standard parts are not produced until a customer order is received
  - Configure-To-Order: Subassemblies are first produced and stored and then assembled based on customer order
  - Engineer-to-Order: Designed and produced based on customer order.
- What is the loss per production line for stoppages due to stock outs (per hour)?
  - Are your suppliers responsible for this cost if the stoppage occurred because they did not deliver on time?
- What is sequence and description of manufacturing processes?
- What is your company production cycle time?
- How many numbers of manufacturing units does your company have?
- How can you describe the customer interference during the manufacturing process?
- Does your company use information systems in manufacturing process?

f. Deliver Process:

- Estimated time of delivery of your company product?
- Are orders or deliveries plan/schedule/ in advance?
  - If applicable, are orders placed by each store manager, or they made from headquarter?
- Can the delivery time be reduced to reach more optimal time?
- Identify the importance level of delivery process (critical factor to production process- important but is not critical to production process low priority)?
- Does the company used third party logistics or have its own logistics system?
- How can you rate your company reliability of used logistics system?
- What are the number of distributors involved and its locations?
- Do distributors have access to finished product inventory?
- How your company is uses information. system to handle distributor orders (automated system, manual system)
- Does your company follow just in time material delivery?
- Do you stock goods? Internationally? Regionally? Locally?

g. Return Process:

- Do companies have mechanism or processes associated with returning or receiving returned products for any reason?
- If and when would you pick up that defect components have been delivered?
- How do you handle returns to suppliers?
- How do you handle defects (if any)? Are suppliers penalized? If so, how are they penalized?
- What is the rate of returned materials (error rate)?

h. Inventory Management practices:

- Do you have guidelines for stock and inventory management?
- What types of inventory records are maintained in the store?
- Are periodic reports generated? If yes, provide example. Where is the report sent? Frequency?
- Is a physical count undertaken? In what frequency?
- How do you manage discrepancies?
- What are the key constraints for stock and inventory management?
- How would you improve the stock management process?

IV. Core question 2: What type of performance measurement system (PMS) and key performance indicators are available currently in developing countries manufacturing industry supply chain?

- What sort of performance measurement system does your company use to evaluate suppliers and customers? Balanced score card (BSC),Logistics Scoreboard, Activity based Costing Economic Value Analysis, SCOR model ...etc
- Does the presence of a performance measurement differ by country?
- Does the presence of a performance measurement differ by level of the country's economic level?
- Does the presence of a performance measurement differ by end market?
- For managing the Performance of our supply chain:
  a) Supply chain performance is measured predominantly at functional / departmental level.
  b) Supply chain performance is measured predominantly at the company, process, and diagnostic levels.
  c) Supply chain performance metrics are defined internally and there is joint performance monitoring and correction with external partners.
  d) Supply chain performance metrics are jointly defined, monitored, and corrected with external partners.
    - What types of performance measures/indicators are used to asses' company activity? (customer complaints, cost reduction, time delivery, inventory turnover, errors & shipping damages, delivery, quality of the first, customer satisfaction surveys, stock levels, Customer loyalty, …)
    - What type of scale used and frequency of evaluation for performance evaluation?
    - What type of action undertaken?
    - Who initiate and when was the performance measurement have started?
    - Do you have defined key performance indicators? If yes, how do you measure them?

V. Core question 3: What types of best practices are available currently in developing countries manufacturing industry supply chain?

- What types of best practices have implemented or practiced in manufacturing industries?
  Example: Outsourcing, Total Quality Management, Benchmarking, Available to Promise (ATP), Just in time, MRP I/MRP II, Theory of Constraints (TOC), Co-located Procurement
- What barriers encountered for in the process of implementing best practices?
- Of the techniques presented below with respect to the best practices, which are indicated implemented in production process:

VI. Core question 4: Enablers, barriers and challenges

a) Enablers: Do you use enablers for successful functioning of your company supply chain?

- Does the company use online technologies other than email, like for example the Internet or an extranet, to facilitate the following business activities?
  - Collaborate with business partners in the design of new products
  - Collaborate with business partners to forecast product demand
  - Manage capacity or inventories
  - Exchange documents electronically with your suppliers
  - Purchase MRO (manufacturing, repair and operating) goods
  - Purchase direct production goods
  - Sell goods domestically
  - Sell goods internationally
  - Manage Customer Relationships
  - Manage Supplier Relationships
  - Logistics Management
- What kind of software / IT tools are used?
- Do you use computer applications management in any department or processes? (Sales planning, Planning of production, materials and capacity, warehouse management, transport management, supplier management inventory system, enterprise resource planning management (ERP), Not use and program)
- Do you use a computer system communication between suppliers and customers, such EDI, internet, intranet...?
- What data capture system use in your business?
- Is there traceability of products along the supply chain? If there is some kind of traceability, by what system is it done?
- Do you share information, apart from orders, including its network of agents supply? (Estimate joint plans demand, production ...)
- How do you share data (demand and work flow data) with suppliers in the supply chain?

b) Challenges & Barriers: Which of the following does your company view as barriers in implementing a performance measurement system?

- Physical infrastructure
- Lack of skilled staff & professional knowledge
- Information and communication technologies
- Lack of shared technical standards
- Business messaging or transaction processing
- Initial cost is too high
- Time constraints
- Readiness of business partners
- Lack of support from upper management
- Lack of proven business benefits
- Lack of direct customer contact
- Other, please specify_____

9.4 Large and medium scale manufacturing in Ethiopia (ECSA, 2006)

NO.	INDUSTRIAL GROUP	QUANTITY, IN NUMBER	%
1	MANUFACTURE OF FOOD PRODUCTS AND BEVERAGE	373	29.8
2	MANUFACTURE OF FURNITURE: MANUFACTURING. N.E.C.	202	16.24
3	MANUFACTURE OF OTHER NON-METALLIC MINERAL PRODUCTS	152	12.22
4	MANUFACTURE OF FABRICATED METAL PRODUCTS, EXCEPT MACHINERY AND EQUIPMENT	106	8.52
5	MANUFACTURE OF PAPER, PAPER PRODUCTS AND PRINTING	87	6.99
6	TANNING AND DRESSING OF LEATHER: MANUFACTURE OF FOOTWEAR, LUGGAGE, AND HAND BAG	63	5.06
7	MANUFACTURE OF RUBBER AND PLASTIC PRODUCTS	63	5.06
8	MANUFACTURE OF CHEMICAL AND CHEMICAL PRODUCTS	53	4.26
9	MANUFACTUREOF TEXTILES	42	3.38
10	MANUFACTURE OF WEARING APPAREL, EXCEPT FUR APPAREL	31	2.49
11	MANUFACTURE OF WOOD AND PRODUCTS OF WOOD AND CORK, EXCEPT FURNITURE.	29	2.33
12	MANUFACTURE OF BASIC IRON AND STEEL	18	1.45
13	MANUFACTURE OF MACHINERY AND EQUIPMENT. N.E.C.	13	1.05
14	MANUFACTURE OF MOTOR VEHICLES, TRAILERS AND SEMI-TRAILERS	11	0.88
15	MANUFACTUREOF TOBACCO PRODUCTS	1	0.08
TOTAL		1,244	100

9.5 The level 1 metrics used by SCOR

	Performance attribute	Level 1 metric	Definition ofmetrics
Customer-facing	Supplychainreliability	Perfect orderfulfilment	The percentage of orders meeting delivery performance with complete and accurate documentation and no delivery damage
	Responsiveness	Order fulfilment lead times	The average actual cycle time consistently achieved to fulfill customer orders. For each individual order, this cycle time starts from the order receipt and ends with customer acceptance of the order
	Agility	Upside Supply Chain Flexibility	The number of days required to achieve an unplanned sustainable 20% increase in quantities delivered
		Upside Supply Chain Adaptability	The maximum sustainable percentage increase in quantity delivered that can be achieved in 30 days
		Downside Supply Chain Adaptability	The reduction in quantities ordered sustainable at 30 days prior to delivery with no inventory or cost penalties
Internal-facing	Costs	Cost of goods sold	The cost associated with buying raw materials and producing finished goods
		Total Supply chain management costs	The sum of the costs associated with the SCOR Level 2 processes to Plan, Source, Deliver, and Return
	Asset Management	Cash-to-cash cycle time	The time it takes for an investment made to flow back into a company after it has been spent for raw materials
		Return on Supply Chain Fixed Assets	Return on Supply Chain Fixed Assets measures the return an organization receives on its invested capital in supply chain fixed assets
		Return on Working Capital	Return on working capital is a measurement which assesses the magnitude of investment relative to a company's working capital position verses the revenue generated from a supply chain

9.6 Profile of interviewed company

No.	Types of Industry	Type of Product	Number of employee	Market Target	Position of interviewee
1	Chemical	Liquor drink	580	Localwithlitt leexport	Techniques & production manager
2	Garment& Textile	School uniform	1300	Export	Task force chief
3	Wood/Fores try	Chip wood	140	Local	Techniques & production manager
4	Textile	Textile	800	Local	Planning & marketing manager
5	Beverages	Soft drinks	300	Local	Supply& procurement manager
6	Beverages	Beer	100	Localwith little export	Production manager
7	Leathertann ery	Hides&skins	500	Export &local	General manager
8	Leather tannery	Goat skins	214	Export	General manager
9	Food	Children foods	300	Export &local	Director general
10	Garment (leather)	Garment	250	Local	General manager
11	Chemical	Plastics	120	Local	Deputy general manager
12	Non metallic	Sanitary & house hold items	500	Local	Planning & marketing manager

9.7 Invitaion letter for the questionnaire survey

Universität Bremen

Universität Bremen | Bereich 04/09 Postfach 33 04 40 | 28334 Bremen

- Fachbereich 04 – Produktionstechnik

- Fachgebiet 09 - Integrierte Produktentwicklung

Informationstechnische Anwendungen in der Produktionstechnik

Prof. Dr.-Ing.
Klaus-Dieter Thoben

Ihr Zeichen | Ihre Nachricht vom | Unser Zeichen | Datum: 24.09.11

Hochschulring 20
BIBA, Raum 1450
28359 Bremen

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Invitation to Participate in a Research Project Survey
Project title: Supply Chain Modelling & Improving Manufacturing Industry in Developing Countries

Dear industry professional,

My name is Fasika Bete, a doctoral candidate undertaking a research study in manufacturing industry in developing countries as part of a Dr.-Ing degree in Production Engineering. I am undertaking this research study under the supervision of Prof. Dr.-Ing. habil K. D. Thoben from Bremen University, Germany. The project has been approved by Faculty of Production Engineering Doctoral Committee. I would like to request your participation in a research study about the use of performance measurement & improvement in the manufacturing industry as part of a competitive strategy in developing countries.

This study is part of an effort to learn how manufacturing companies are using the business process model, performance metrics and best practice to stay competitive in the global market. We are contacting a sample of manufacturing companies in the Ethiopia that may have an experiences business process modeling, performance metrics and best practice, the benefits that they have seen, limitations and barriers they have faced.

The results of this study will benefit the Ethiopian manufacturing industry by providing information on how manufacturing companies are using a business process model for performance measurement & improvement with their trading partners in the supply chain, to recommend a way for a model adaptation with the case example in conducting adaptation activities that are best suited to their company's needs.

I emphasize that all information is confidential. All data will be reported in the aggregate form to ensure that no individual companies will be identified. When you return your completed questionnaire, your name will be deleted from the mailing list and never connected to your answers in any way. This survey is voluntary. However, your response would help us greatly. If you have some reason you prefer not to respond, please let us know by returning the blank questionnaire in the enclosed envelope.

We would be glad to send you a summary of the results of the study upon your request. If you have any questions or comments about this study, we would be happy to talk with you. Please feel free to contact us via email at geo@biba.uni-bremen.de, via mobile phone at 0916-82-4552.

Your cooperation is greatly appreciated. Thank you very much for your help in this study.

Sincerely,

Fasika Bete Georgise, PhD Student Prof. Dr.-Ing. Klaus-Dieter Thoben, Supervisor

9.8 Invitation letter for semi-structured interview

Universität Bremen

Universität Bremen I **Bereich 04/09** Postfach 33 04 40 I 28334 Bremen

- Fachbereich 04 – Produktionstechnik

- Fachgebiet 09 - Integrierte Produktentwicklung

Informationstechnische Anwendungen in der Produktionstechnik

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Ihr Zeichen | Ihre Nachricht vom | Unser Zeichen | Datum: 22.06.11

Invitation to Participate in a Research Project Interview
Project title: Supply Chain Modeling & Improving Manufacturing Industry in Developing Countries

Dear industry professional,

My name is Fasika Bete, a student undertaking a research study in manufacturing industry in developing countries as part of a Dr.-Ing degree in Production Engineering. You are invited to participate in this research project. This information sheet describes the project, in plain English. Please read this sheet carefully and be confident that you understand its contents before deciding whether to participate. I am undertaking this research study under the supervision of Prof. Dr.-Ing. habil K. D. Thoben from Bremen University, Germany. The project has been approved by Faculty of Production Engineering Doctoral Committee.

The proposed research aims to leverage off the existing practices in performance measurement and improvement in industry by interviewing industry experts and site visits on supply chain process operations. It intends to refine the existing practices and limitation in developing countries for adapting the performance measurement like SCOR model for their performance measurement and improvement.

You have been selected to participate in this study, from the list of a manufacturer in the Ethiopian Statistics Authority (2010, edition) because your organization has a long period of experience.

It is not expected that this process should take more than one hour. If it looks like it will take more than an hour, the interview can be broken into segments and held at times convenient for you. The interview will be conducted at your place of work or at a mutually convenient place of your choice. Your participation has no risks associated with it, but it will be a great contribution to advancement of knowledge in performance measurement in developing countries. The information you give will be kept anonymous.

As a participant, you have the right to withdraw your involvement at any time, without prejudice; have any unprocessed data withdrawn and destroyed, provided it can be reliably identified, and provided that so doing not increase a risk for you; have any questions answered at any time. A report of the project outcomes will be provided to Bremen University in Germany.

Please contact me directly or my supervisors, if you require any further information.

Thank you for considering this invitation.

Sincerely,

Fasika Bete Georgise, PhD Student Prof. Dr.-Ing. Klaus-Dieter Thoben, Supervisor