Identifying the Characteristics of the Supply Chain Processes in Developing Country: A Manufacturing Industry Perspective

FASIKA BETE GEORGISE[1, 2, 3], KLAUS-DIETER THOBEN[2], MARCUS SEIFERT[2]
[1] International Graduate School for Dynamics in Logistics (IGS), University of Bremen
[2]Bremer Institut für Produktion und Logistik GmbH - BIBA, Hochschulring 20, D-28359 Bremen, Germany
[3]School of Industrial and Mechanical Engineering, Hawassa University, Hawassa, Ethiopia
{geo, tho, sf}@biba.uni-bremen.de

Abstract: - Lack of appropriate tools to model, evaluate and improve the supply chain is considered as one of the initiatives to major challenges to promote improvement among the firms in developing countries. The basic constituent of such models is the business processes. Firms in developing countries are lagging behind the recent trends of practices and researches. For continuous and sustainable improvement program that involves the entire supply chain including developing countries, it is necessary to have a well designed supply chain models that also consider the firms of the developing countries. The existing successful process-oriented models are highly dependent on the current business practices of the companies of the developed world. For both the new development and adapting of the successful models require the understanding of the characteristics of the existing supply chain processes and practices in the firms in a developing countries. The aim of this article is to identify the main characteristics of the current supply chain processes of the firms of the developing country based on the SCOR model business processes: Plan, Source, Make, Deliver and Return. The research methodology includes the literature review, questionnaire survey and semi-structured interview. The research data was collected from the Ethiopian manufacturing industries practices. Finally, the research findings reveal the characteristics of the supply chain processes. The identified processes characteristics could be used for the future model adaptation works.

Key-Words: - Business process, SCOR model, developing countries, supply chain

1 Introduction

In today's ever increasing competition and globalized business environment, manufacturers have been exploring innovative technologies and strategies to achieve and sustain competitive advantage. One of the strategies which has got wide acceptance and agreement among academicians and practitioners is supply chain management (SCM) [1] [2] [3] [4]. As a new way of doing business, however, a growing number of firms have begun to realize the strategic importance of modeling and improving the whole supply chains. Firms in developing countries have started also different initiatives to collaborate, share benefits and risks in the form of partnerships with their counterpart firms in developed countries [5] [6] [7]. Recently, the developing countries have shown enthusiasm in supply chain models. Even though, companies in developing countries have shown interests and try to implement these models, the applications of such concepts have faced different challenges. The existing models are developed and implemented in situations of the firms of developed countries. Nevertheless, most of the firms in developing countries still have focused their attention to the effectiveness and efficiency of separate business functions. Hence, the anticipated improvement of the whole supply chain has been unsuccessful.

Supply Chain Management (SCM) is primarily concerned with coordination of the flow of the business process output of one actor to the input of another actor's processes. The main flows among supply chain business processes are products, orders, and demand and supply information. According to Davenport and Short [8] ``A business process is a set of logically related tasks performed to achieve a defined business outcome``. Intra- and inter-company processes can be presented in a well structured and clear way that allows companies to analyze their business processes and to identify possible inefficiencies. The proper use of the supply chain

model describes the characteristics of the supply chain such as the relationship between members, business processes and flow of information. From a scientific perspective a business process reference model for the firms is an important basis to build upon for analyzing business processes and whole supply chain. Processes-oriented reference models can be used to infer strategies for further industrialization, to reveal inefficiencies, and to develop solutions that facilitate the improvement of the firms in developing countries [9].

Consequently, business process reference models are strategically important in order to allow companies to model and measure their supply chains, determine where weak links exist in their processes and identify how to make improvement. In order to be able to have a clear picture about the organization performance, parties involved must have a clear view of current supply chains (As-Is) as well as the future ones (To-Be). The existing models were based on the experience and practices of the business processes of the firms in the developed countries. They did not consider the real situation of the firms in developing countries. In order to respond to these requirements and to have tools to model, evaluate and improve the entire SC, it is necessary to have clear understanding the current supply chain business processes in developing countries. For this purpose, we have used the SCOR model to obtain reliable information about the firms' current characteristics of the supply chain processes.

The aim of the article is to outline the characteristics of business processes based on the data collected from the Ethiopian manufacturing industries practices. In the remaining sections, we first introduce the SCOR model and its building blocks. The literature review focuses on current literature about the previous researches on the SCOR model discusses in third section. The fourth section shows the research methodology. In fifth and six parts, we present the research result analysis about questionnaire survey and semi-structured interview. The identified characteristics of the business processes briefly are explained in section seven. Finally, the paper concludes and shares the direction of the future research.

2 SCOR Model

The Supply Chain Operation (SCOR) Model is introduced in 1996 and has been endorsed by the Supply-Chain Council (SCC) which comprised of a global organization of firms interested in SCM. The SCOR model endeavors to incorporate the concepts of business process reengineering, benchmarking, process measurement, best practice and enablers' information technology and apply them to SCs [10] [11]. It lays a tool to diagnose the business flow between a firm's first & second tier customers and suppliers.

The SCOR model offers users the following benefits: 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, enablers: standard alignment to software features and functionality that enable best practices.

Supply chain operations reference (SCOR) model is one of those operations reference model which enjoys its level of industrial quasi-standard. Companies have realized the benefits of the SCM concepts and SCOR model in developed world. Moreover, the language used for model development is easily recognized and common in the supply chain area. The SCOR model adaptation offers a number of benefits that the firms in developing countries can tap into, such as reducing new model development time and costs, integration to global supply chains using the common business processes language. However, adapting the SCOR model to meet new requirements is challenging due to a number of constraints, including lack of well-defined national infrastructure, supply chain relationship, technical and information technology and organizational and managerial capabilities [12].

SCOR consists of four levels as the analytical stages leading to the implementation of an effective SCM strategy which are shown on figure 1. Level 1 broadly defines the key supply chain processes - plan, source, make, and deliver - thereby helping companies establish their SCM objectives. Level 2 defines the core process categories that can be found in an actual and idealized supply chain around an enterprise. For example, the 'source' category includes 'source stocked products', 'source make-to-order (MTO) products', and 'source engineer-to-order (ETO)

products'. Level 3 contains information for the supply chain entities to plan and set goals for their SCM strategy, including process definitions, benchmarks, and system software capabilities. Level 4 focuses on implementation. Because SCM implementations are unique to each firm, the specific elements of Level 4 are not defined within the SCOR model.

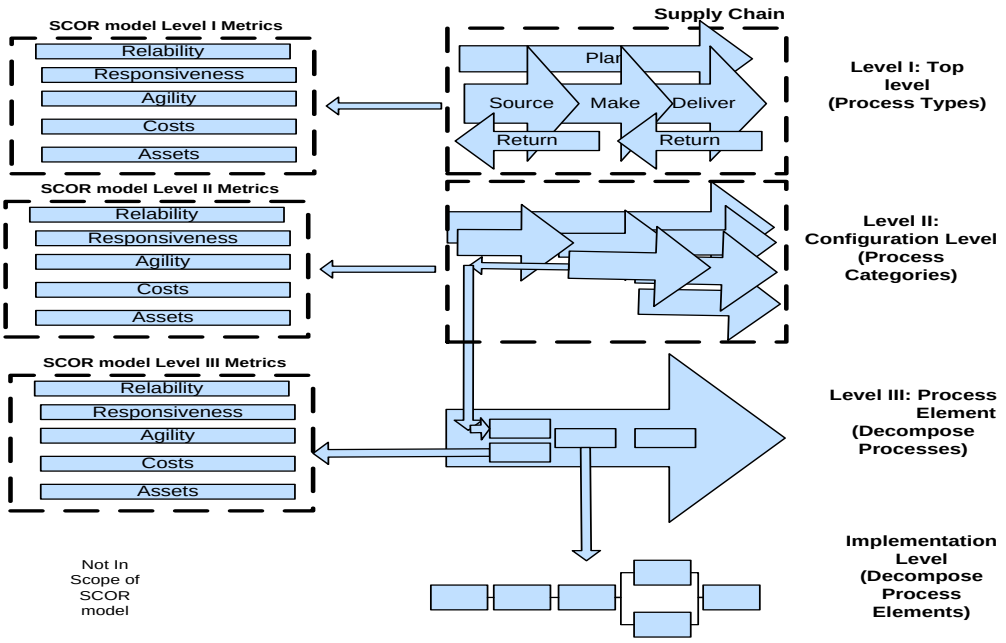

Figure 1: SCOR model decomposition into process element [13] [14]

By providing a complete set of supply chain performance metrics, industry best practices, and enabling systems' functionality, the SCOR model allows firms to perform very thorough fact based analyses of all aspects of their current supply chain. Table 1 shows the SCOR model process definition at level 1. The SCOR model business process elements performances can be measured at several levels also.

Table 1: SCOR Level 1 Process Definitions [14]

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

3 Literature Review

The SCOR model is designed to design, model, evaluate and improve the manufacturing firms in the developed countries. Companies in different industries which operating with different environmental conditions and factors have faced challenges when they are trying to use the SCOR model for design and improve their supply chains. Due to this different academicians and practitioners have tried to adapt and apply it to many different industries, for examples, service industry by Di Martinelly et al. [15], and Xia [16]; for after sale by Legnani [17], for government agency contract requirement by Paxton and Tucker [18], for agriculture industry by Yong et al. [19]. Legnani [17] and Di Martinelly et al. [15] point out that the SCOR model sometimes is too general and adaptations to different industries are necessary. From the experience of these different works, the first step in all adaptation activities was the understanding the current business practices. Both Legnani [17], who adapts the SCOR model to the specifics of the after-sales processes, and di Martinelly et al. [15], to the health care supply chains, seem to have a top-down approach for adaptation.

Even though, the SCOR model was designed and applied for manufacturing industries, based on identified limits and weaknesses, appropriate research adaptation works were done by different practitioners and academicians in this industry accordingly. Then the SCOR model can be extended further increasing its proven practical relevance. One of them was ongoing research done by Fronia et al. [20] have shown how SCOR may be extended in order to develop a framework for supply chain to the new scenarios. The researcher has suggested six standard process models for source process in level II. In comparison to those natives to SCOR, these six models are shown to be advantageous, distinguishing more clearly between different modes of procurement. Successively, it is demonstrated how these level two models were detailed on the SCOR level III and IV.

The other industry types that need modeling and improvement tools are 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 is identified [21] [22]. In addition, Johansson and Persson [21] recommend for the use of the SCOR model in the construction industry as a suitable analysis tool. After a long group research by Johansson and Persson [21] they have reached to the conclusion that the construction industries have a strong need for a structured analysis tool with predefined metrics and process definitions which support the logistics activities at the construction site. This is where the SCOR model can prove to be a useful starting point for further development of the construction adapted SCOR model. In their recent paper Persson et al. [23] have introduced an adapted version of the SCOR (Supply Chain Operations and Reference) model. In their observation at a construction site by using the Deliver and Source processes and metrics in the SCOR model, suggestions for important changes that need to be made to the SCOR model are given. The research is done by using case study as a research method for theory building. In their findings from the case study, the final result was 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).

Bean et al. [24] have tried to adapt the SCOR model to suit the military industry in South Africa. Three case studies with increasing complexity were conducted and during these case studies it was ascertained that the SCOR model did not cover the activities of supply chain sufficiently. Consequently the SCOR model had to be extended to be more suitable for the military environment.

It is indicated that there are several management tools available to assist GIS units to enable them to manage themselves [25]. Schmitz [25] 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. This 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). One of the more recent works exploring the intricacies of SCOR is the research performed

by Fayez [26]. This work documented the weaknesses of the SCOR model and developed views of the framework to enhance the capability of the model [26]. 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 was the need for a variety of views for other sectors outside of manufacturing.

James B. [27] has presented his research findings on SCOR model adaptation to service sector. He conducted a research to define comprehensively, a new services supply-chain model that was applicable to the United States government's classification of a service and to ensure the scalability and integration capability of the model. To satisfy his objectives, it was necessary to understand the characteristics describing the services supply-chain process. Finally, the characteristics were the input into deriving the processes and terminology of the generalized services supply-chain. Terminology and processes are then used to create a supply-chain framework using input from the Supply-Chain Council's Supply-Chain Operations Reference (SCOR) model. SCOR provides a foundation for describing the processes and defining the terminology in an already accepted format. A final verification of the model by industry experts insures conceptually that the framework is applicable to the current problem. Baltacioglu et al. [28] also developed a new framework, which is built on the existing knowledge derived from the SCOR and Ellram et al. [29]. 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 (Izmir University of Economics (IUE)) and Service Supply Chain Model (SSCM). After thorough investigation, they constructed IUE-SSCM model to cover three basic units in the chain: the supplier, the service provider and the customer.

Georgise et al. [30] have presented their findings why and how previous works done by academicians and practitioners tried to adapt the SCOR to their local operating conditions and environmental factors. In their literature review, they have encountered a number of research works and papers on SCOR model adaptation. From their literature review, they have taken different lessons how different researchers have extended and adapted SCOR model to their specific situations. In all works, the first step was to understand the activities and practices that were different from the existing models. The methodology followed to achieve their objectives was also other important lesson for the researchers. A better understanding of the existing activities and business processes was the starting point to further adapt the relevant model.

4 Methodology

The research methodology is based on empirical data collected through a survey with the help of a questionnaire and semi-structured interview questions. The objective of this survey is to examine the supply chain business processes characteristics with help of the five SCOR model processes: Plan, Source, Make, Deliver and Return. The data has collected by survey through a questionnaire and personal interviews. Final version of the questionnaire was sent to the 200 companies. 32 filled responses have been received, which gives a response rate of 16%. The industrial analysis and fieldwork were carried out in two stages. The first stage of the fieldwork was based on an exploratory questionnaire survey and was focused on issues related to the supply chain characteristics in Ethiopia. The second stage was carried through semi-structured interviews with senior managers of Ethiopian manufacturing industries. The main objective of the second stage was to ascertain the supply chain characteristics in the Ethiopian manufacturing industry with close observation. A total of 12 top managers responsible for production operations and supply chain were interviewed. The interviewees were drawn from companies selected for questionnaire survey, which mainly responded to the survey questionnaires and three companies which did not respond to the survey questionnaires but prefered to participate in interview activities. The duration of the interviews varied from 90 to 120 minutes. The participants for both the interviews and the questionnaires were selected from Ethiopian medium and large manufacturing industries. In both cases, the respondents were decided by top managers in command of operations and supply chain.

The use of manufacturing industries in Ethiopia as an example was interesting to understand the perspective from industries operating in a developing nation. It is also justifiable because Ethiopia is an example of developing countries and many Ethiopian firms are second or lower-tier suppliers to western firms. This research presented a new perspective than that of companies operating in the developed world because companies in developing countries such as Ethiopia have more difficult access to capital, skilled labour, and other resources. Also, developing countries do not have as long an industrial history as developed countries on which to build their capabilities. Research on the Ethiopian industries provides a perspective from industries operating in a developing nation that may differ from more developed countries due to the cultural behaviour, type of main industry or infrastructural resources.

5 Questionnaire Survey Findings

The survey's finding is presented into five categories in five business processes areas according to the organization of the survey questionnaire. The survey's focus area was the five SCOR model processes: Plan; Source, Make, Deliver and Return. The respondents were asked to rate their degree of agreement to some statements related to supply chain practices. The questionnaire consisted of scaled response from 1 to 4 such that 1 = strongly disagree and 4 = strongly agree. The mean and standard deviation (S.D.) were calculated and then used as standard to compare the relative importance of the variables.

Plan process: Table 2 indicates firms' supply chain planning process practices within the survey. It has been found that firms often relied on **"**What-if" analysis which has been implemented for supply/demand balancing (mean = 3.00), as well as the use of historical data in the development of forecasts which were largely practiced compared to other practices. 'The company use information system in their forecasting activities' (mean = 2.90) is also important. The activities which 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 plan departmental activities such as production, and sales (mean = 2.55). Meanwhile, the buying firm hardly adopts activities such as performance indicators which have been defined for their department (mean = 2.29) and the company frequently contacts retailers to get information about market demand (mean = 2.29). These were the least practiced planning activities. However, the high standard deviation scores found in many of categories imply inconsistencies in the respondent's answers.

The respondent companies followed traditional forecasting procedure which dominantly which based on previous two-three years sales historical data. They did not use no direct feedback data from direct customers or users. The poor performances were observed in the 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 activities' was also lowest level of practices due to lower level of collaboration activities between different departments.

Table 2: Supply chain plan process practices

Planning practice	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 plan 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

Inventory management practices were also assessed. Table 3 shows the level of inventory management practices. The two 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 is practiced at lower level of use. Inventory management practices which are frequently used in the supply chain, such as vendor managed inventory at production sites; joint inventory by suppliers and manufacturer have shown even poor levels of practice.

Table 3: Inventory Management

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
Lowest inventory driven costs	2.21	0.86
Automated warehouse management	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

Source process: Table 4 indicates supply chain source process practices. Generally, the sourcing process activities were at the lower level of practice. The firms have often relied on long-term relationships with strategic suppliers (mean = 2.78), as well as imported raw materials that are always available for manufacturing companies (mean = 2.34). Frequent performance feedback to suppliers (mean = 2.22) was also important. The activities which were implemented to a lesser extent are: reduction in the number of suppliers (mean = 2.18), the company's use of information system in procurement process (mean = 2.13), just-in-time delivery from suppliers (mean = 2.08). Meanwhile, the following activities were lower in performance: the buying firm hardly adopts activities such as performance indicators have been defined for your supplier (mean = 1.97), Frequent measurement of suppliers' performance (1.97) and the imported raw materials are always available locally with affordable prices (mean = 1.88). However, the high standard deviation scores found in many of categories imply inconsistencies in the respondent's answers.

Table 4: Supply chain source 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

The source process is one of the important strategic areas for company success and further improvement activities. The main reason for this is due its position as starting activity for the flow of raw materials into final product within the company (Carter et al., 1998). The responses from respondent companies were interesting especially their sourcing process for imported raw material. Even though they have expressed their difficulty in getting reliable and cheap supplier for imported raw material, they have kept large inventory in their warehouse for this challenges. They have shown lack of experience in supplier evaluation and giving feedback for their strategic suppliers. There were low levels of information technology application in sourcing activities of the respondents.

Make process: Planning procedures and processes related to material and capacity planning is being done by cross functional teams and the outcomes of planning procedures and processes related to material and capacity planning is aligned with actual demand have been rated the most frequent manufacturing practices (2.7). The last activities 'delivery 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 5.

Table 5: Supply chain making process practices

Make 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

The companies making process was investigated also focusing on the material requirement and capacity planning in relation to deliver times and customers services. 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 the help of computer and software.

Deliver process: Nowadays, product delivery time and customer service are one of the areas for a company's competitiveness. The next research observation was about the company's distribution activities. The following table (Table 6) presented the results of the questionnaire survey on the delivery processes in the respondent companies. The general results of the survey were somewhat poor in the most deliver processes. The companies have shown better delivery practices in handling customer order and responding to major customers order 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 practices. The performance indicators were not determined for distribution process also.

Table 6: Supply chain deliver 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

Return process: Almost one fourth of the respondent companies have shown lack of experience about the return process activities by responding on ``Not applicable`` column part. However in the case of claims and emergency return, companies have responded a higher level for prepared specification or criteria for the return product. Table 7 shows the results of the survey. Reverse logistics and document on return process have shown poor performance levels in the respondent companies.

Table 7: Supply chain return 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

The companies' response about return process was generally at 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 were al lower level of practices.

6 Semi-structured interview results

This section presents the cross-organization analysis of the semi-structured interview results. The field results discussed the supply chain processes using the SCOR model five business processes. The experience of twelve manufacturing companies were collected, tabulated and analyzed for better understanding. In-depth interview has been conducted in twelve manufacturing industries in Ethiopia. The organizations were systematically sampled from the initial list of survey respondents and volunteers who sent feedback for the e-mail requests. The twelve organizations in this case study were selected because of their experience in export market and integration with global supply chains. Furthermore, deliberate effort was made to ensure that a wide variety of organizations from different sectors were included in the case study (see table 8). The data collection was conducted via semi-structured interviews along with the industrial visit with top managers in their respective organizations.

Table 8: Profile of interviewed company

Firm	Types of Industry	Type of Product	Number employee	Market Target	Position of interviewee
1	Chemical	Liquor drink	580	Local with little export	Techniques & production manager
2	Garment & Textile	School uniform	1300	Export	Task force chief
3	Wood/Forestry	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	Local with little export	Production manager
7	Leather tannery	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 & household items	500	Local	Planning & marketing Manager

Plan process: The plan process in supply chain activities highly relies on forecast data which uses the information as inputs for its sourcing, making, inventory management and deliver activities in supply chain. Demand forecasting usually takes demand data from salespeople who receive sales and demand information from customers. It appears that the two most important factors that companies considered when preparing forecasts were past two-three years sales historical data, capacity and the prevailing economic conditions in the country. Uses of computers in forecasting activities were 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 very developed activity within manufacturing companies in Ethiopia.

The respondents' have also shown the different level of extent companies use variety policies when initiating purchase orders. Variety of policies are used, the most frequent ones being purchasing orders being initiated according to the production plan and current

inventory levels. It also used a periodic interval policy. Even though only small proportion of the respondents relied on actual customers initiate purchase orders, the firms mainly used MTS 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, it seems 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 by low skilled labor manually.

Source process: All respondent companies have practiced raw material sourcing from local and foreign supplies. Depending on their production operations their dependency on local, imported raw material and their procurement activities follow different purchases strategies. One of the important points here was supplier selection. Supplier selection process refers to the process to select the reliable suppliers including selection criteria and negotiation. Most of the respondent companies practiced price negotiation and direct purchase for local material from wholesaler. The leather and food industries raw material collection were done through different collectors by focusing on seasons and different occasions which the raw materials can be collected. For the international purchase, companies need to follow the Central Bank of Ethiopia (CBE) procedure for their bidding and procurement activities.

Generally, the companies used different supplier selection criteria such as the quality of material, price, delivery time, previous experience, and reliability of suppliers. There was a standard procedure in place especially for international purchase. The companies import from different countries and also export products to various countries and each country has a variety of standards. Although the companies have to set rules for effective negotiation procedure, procurement department's 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 of companies have prepared a standard contract for all suppliers. However, it was common practice to ignore the contract and go to new buyers if they have got a price advantages. Usually, the procurement process starts when procurement department receives a purchase requirement from customers i.e. production department sends this requirement to the purchasing department.

Manufacturing industries have faced a lot of challenges in their sourcing function. The sourcing challenges were generally categorized into two categories. One of the challenges related to imported raw material purchase and other related to local raw material purchase. Concerning to the imported raw material purchase, the main challenges were lack of foreign currency, inconsistency of quality raw material during bidding time and final delivery, unavailability of local suppliers for imported items and long processing and delivery time due to lengthy bureaucratic procedure involved in the purchase of the imported raw material. The local sourcing was also challenged by the following factors. High price fluctuation, lack of commitment and loyalty, most suppliers are interested even to gain smaller financial benefits, less conscious for raw material quality and its handling were the major challenges. The important challenges were the seasonal and occasional sensitive availability of raw material such as agricultural raw material and livestock raw material (leather) in public holiday. However, the manufacturers were starting some initiatives to create collaboration with their main supplier and customer in preparing like ``Customer Day``.

Make process: Manufacturing industries are trying to satisfy their customers with the help of available information and forecasts of demand. Depending on their data and types of products they produced, they are setting their production strategies. Most of the respondents in the interview were using push-type of production strategy for their products. So, they were using Make-to-Stoke (MTS) strategies in their operations. However, some of the companies were using Make-to-Order (MTO) in their production activities. Leather, garment and textile 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 differed depending on the production strategies the firms followed. Generally, a lesser involvement of customers and suppliers were observed in MTS than MTO strategies. In the MTO strategy, firms were a frequent contact with their customers than suppliers. Their collaboration started in the design stage and completed after final product approval such as Garment Company producing products for USA customer. 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 test of new raw materials. Customers comments and complaints collection were done mostly with help of data log manually. 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 quality inconsistency for imported raw material.

Deliver process: Customer order processing and delivery aim to providing the requested products with a short lead-time. Generally, the respondent companies were using four different strategies for distributing their final products. Figure 2 demonstrates the four distribution strategies from manufacturer to final customer. Firms used different distribution channels such as own outlets, wholesaler and through retailers markets. The wholesale distribution strategy was the dominant one. Most of the times the same wholesaler plays role as supplier of local raw material also with help of this collectors. So, they have played dual role in the developing countries. Most of the respondent companies were using their own transport facilities to transport and distribute final product. Some of the companies have started using third party logistics (3PL) providers for their distribution functions. The main challenges observed here in the deliver processes related to the distribution activities because of Ethiopia having no access to sea (Land-locked country) and back ward transport infrastructure. Due to this the deliver process was expensive and challenging. This hinders the firms' competitiveness of the country.

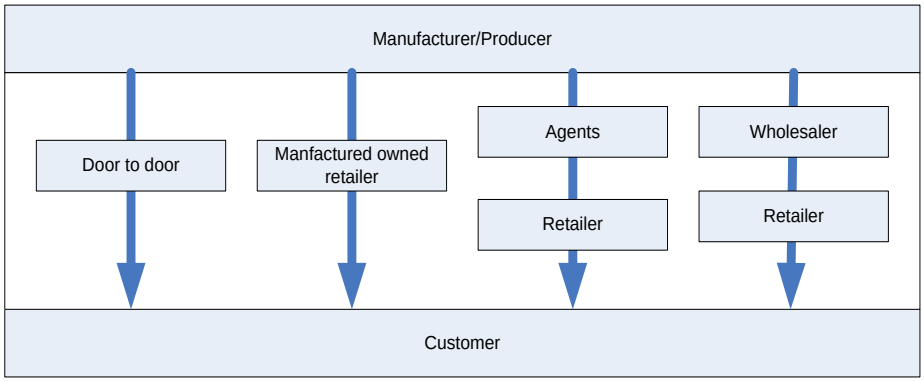

Figure 2: Distribution channel in firms

Return process: Companies under the investigations have no planning at all for the return process. However, they have some mechanism to handle their customer complaints with ad hoc basis. The customers' complaints were handled with fast responses according to the respondents. Most of the cases the complaints' analyses were done after faster responses to the customer. For this analysis the main members were from production, quality and market departments. Most companies used the final results of ad hoc for improvement activities. Due to the natures of the existing manufacturing industries being basic products manufacturers such as food, garments, textiles, leather etc, they practiced push-type production strategies for long time.

7 Research results analysis

The companies under the investigation have shown a unique configuration of the supply chain especially on some factors such as whether to source from local or international suppliers, supplier selection and price decision issues in the chain. The important major differences were in sourcing and delivery processes and their participants in such activities. In developing countries, manufacturer, wholesaler and small retailers actively participated in the delivery process to the final customer. This makes delivery process to be more challenging and unique in the developing world. The three figures (Figure 3, 4 & 5) show the typical supply chain configurations in textile, garment and leather industries in the case studies.

Figure 3 shows the supply chain characteristics of the garment industry in Ethiopia. The company sources its major raw material from Chinese's fabric manufacturer and delivers their readymade garment to USA market. In this supply chain, their geographical location and distance between customers, producers and suppliers creates its own unique features and challenges as global supply chain. The main challenges for such supply chain were information exchange and planning activities to fulfill the appropriate delivery lead time. From the challenges of on-time delivery, the company has lost a large amount of money. The product quality was the big challenge to the company also because the end customers were far from the manufacturing place.

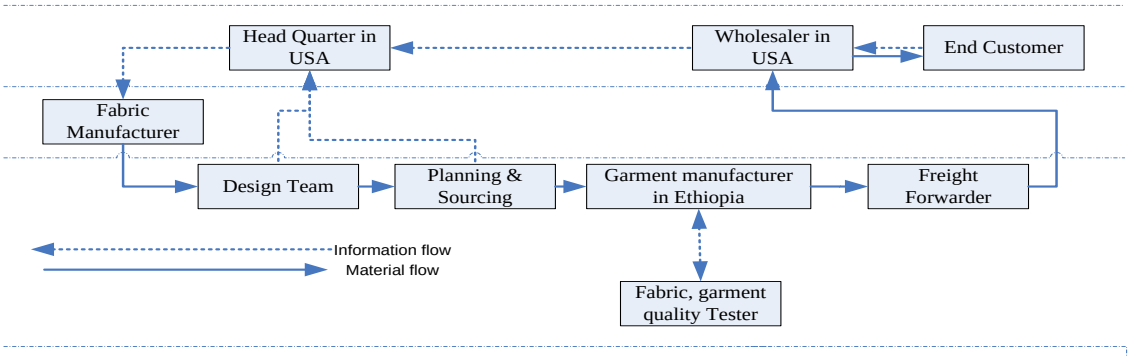

Figure 3: Garment industry supply chain

The textile and garment industries are one of the potential areas for further development and job opportunities for the developing countries at present and in the future. Because of the large agricultural land for production of cotton as the raw material source, the developing countries should take advantages for further processing their raw material to finished product garment. The main challenges in this industry are lack of technology know-how and high competition from global markets. The companies need to upgrade their capacity to compete in the global supply chain. Figure 4 presents the textile supply chain.

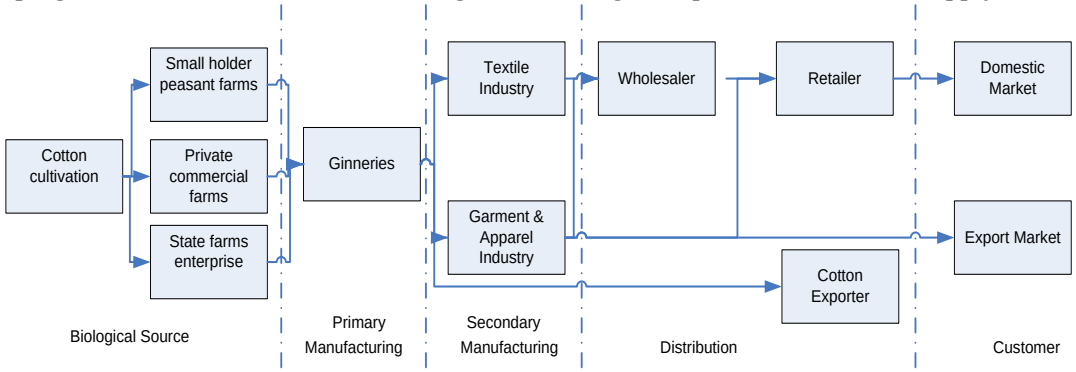

Figure 4: Textile industry supply chain

The 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 get advantages from the sector. However, the industry is highly fragmented. The presence of a lot of chain participants is creating high price fluctuation and unstable market. The Figure 5 demonstrates the leather supply chain.

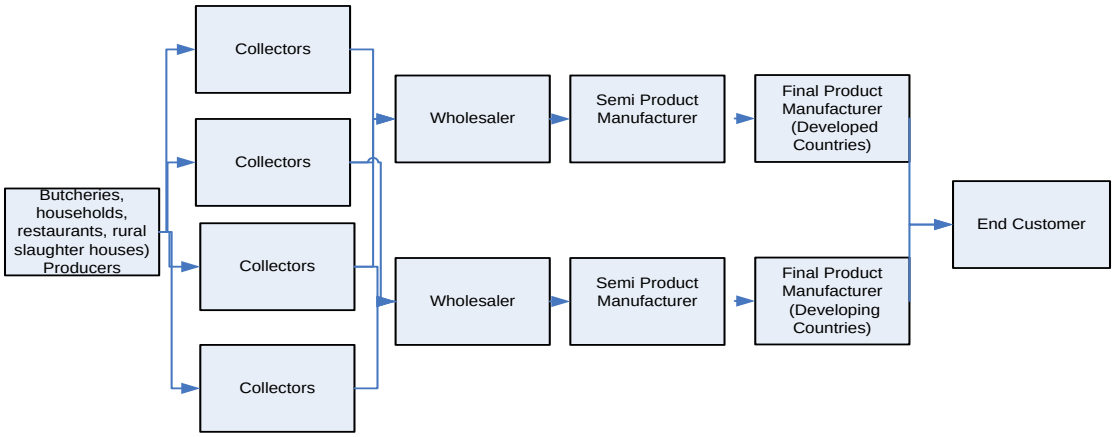

Figure 5: Leather industry supply chain

The next sub sections present the identified major characteristics the five business processes: Plan, Source, Make, Deliver and Return.

7.1.1 Plan process

Planning processes were 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 to the companies' basic operation. As a result of lack of point on sale information, plan process has initiated its demand plan from previous year such as last three to five years sales experience. For the most part, however, companies did not perform well at cross-functional and cross-company planning. Due to departmental silos, the investigated companies have shown lack of a coordinated planning process between marketing and procurement operations compared to the world best practice. The mains reasons for this gap are their poor forecasting standard and 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. While Ethiopian top managers tend to focus on marketing and sales functions for their planning process, they generally have limited understanding on its implications for supply chain's 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. Table 9 shows the general characteristics of planning processes.

Table 9: General characteristics of plan process

Process	Key characteristics
Plan	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 & forecasting is very minimal
	Process more of a push strategy primarily driven by sales targets

	No formal forecasting techniques used, uses only a historical data for demand planning
	Marketing department is responsible for initial demand plan
	Production planning follows marketing department's demand plan to make it realistic & 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

7.1.2 Source process

Generally, the companies under the study procure material to stock especially imported raw material and seasonal raw materials such as agricultural product inputs. Processes associated with companies' purchases are defined by the type of the raw material inputs and location of the source. If the raw material input source was from international suppliers, the procurement procedures are determined by Ethiopian Central Bank bidding procedure due to foreign-currency needs. Because of lack of currency, lengthy foreign market, complex custom procedure and other uncertainties, high stock level up to 6-12 months is always practiced as the safe model. With respect to the local purchase, price fluctuation and supplier loyalty were bigger challenges. Table 10 shows the main characteristics found in the supply process.

Table 10: General characteristics of source process

Process	Key characteristics
Source	Supplier lack critical elements of service namely quality, delivery reliability and value added services
	Companies depends on both local & international sourcing for raw material 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 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 practices in local purchase
	Contract breakdown for minor price changes & supplier apathy

7.1.3 Make process

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 with make to order strategy. 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 general characteristics of making process summarized in Table 11.

Table 11: General characteristics of make process

Process	Key characteristics
Make	A push strategy dominates for make to stoke production
	High production costs & 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
	Companies measures productivity in terms of variation between sales/costs budget and real values
	Production schedule 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 & poor road connections
	Packaging material & quantity of products in the package should be with minimum costs to be affordable to larger poor customers

7.1.4 Deliver process

The existing model to deliver products uses three ways: through wholesalers (agents); manufacturers by its own shops; directly deliver through retailers. Some manufacturers make direct visits to retailers and deliver information on demand to wholesalers. Recently, supermarkets have been introduced as means of one option of delivery in some big cities. Table 12 summarizes the general characteristics of delivering process.

Table 12: General characteristics of deliver process

Process	**Key characteristics**
Deliver	Poor customers & smaller markets distributed throughout the country with limited physical infrastructure
	Different retailer outlets such as traditional small kiosks, old fashioned street markets and emerging new supermarkets
	Manufacturer, wholesaler & retailers were involved on delivery process
	For outsourced delivery process, wholesaler was in charge of routes optimization

	The purchasing & marketing characterized with cash-based system
	Time of delivery has variation depending on location and type of the customers
	No third party logistics provider available (either own truck fleet, or customers' trucks)
	The distribution system is heavily regulated with burdensome and bureaucratic public sectors

7.1.5 Return process

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 in 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 international suppliers and customers returns are through negotiations for next orders. However, regarding external suppliers and due to the cost implied by the return, the product loss is assumed by producers or distributors that imported 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. Table 13 shows the summarized characteristics of return process.

Table 13: General characteristics of return process

Process	Key characteristics
Return	Companies do not have a plan for return processes but treated in 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 used as strategies for claims than return

8 Conclusions

In this paper, we explore the characteristics of the supply chain processes of the manufacturing industry in developing countries based on the SCOR model's five processes. The field result also brought out specific characteristics of the supply chain processes from Ethiopia. Although most business processes in Ethiopia lag behind the business processes base for SCOR model, they demonstrate lower level of practices for the supply chain assumptions to the success of the supply chain models' application. We have found out that although there are quite a number of similarities in SCOR model business processes, there is still a large difference due to the existing environmental scenarios. The value of the results of this study is a better understanding of the existing supply chain processes. For example, it will provide different inputs regarding what to include and exclude in the next development of the model and further adaptation activities. As a result, the researchers have a better understanding of how existing companies' business processes practices and it can also provide support for

further model adaptation to developing countries' situations.

After identifying the general characteristics of a supply chain business processes, we can use the result to propose a business processes for new or adapted model which is used to model and evaluate the supply chain operations in developing countries. It will help the companies to identify, evaluate and monitor the key areas which can help them to maintain their pace and speed of their supply chain success. Therefore, the results from field survey will assist researcher to adapt different model in order to apply to developing countries' situations. There are several ways in which the various concepts exposed in this research can be extended in the future. For example, further development work to propose new business processes and modify other business processes, identifying appropriate key performance indicators (KPI) and best practices that suits developing countries situations.

References:

[1] Heriberto, Garcia Reyes, Ronald, Giachetti, (2010) "Using experts to develop a supply chain maturity model in Mexico", Supply Chain Management: An International Journal, Vol. 15 Iss: 6, pp.415 – 424.

[2] Han, S.-H. & Chu, C.-H. (2009) Developing a collaborative supply chain reference model for a regional manufacturing industry in China, International Journal of Electronic Customer Relationship Management, Volume 3, Number 1, 52 – 70.

[3] Irfan, D., Xiaofei, X. and Sheng Chun, D. (2008), "A Scor Reference Model of the Supply Chain Management System in an Enterprise", The International Arab Journal of Information Technology, 5, 3, 288-295.

[4] Han, D., Kwon, I. G., Bae, M. And Sung, H. (2002) Supply chain integration in developing countries for foreign retailers in Korea: Wal_mart experience, Computer & Industrial Engineering, 43 (2002) 111-121.

[5] Trienekens J.H. 2011. Agricultural Value Chains in Developing Countries: A Framework for Analysis. International Food and Agribusiness Management Review 14 (2): 51-82.

[6] Humphrey, John, Upgrading in global value chains Working Paper No. 28, Policy Integration Department World Commission on the Social Dimension of Globalization, International Labour Office, 2004.

[7] Fleury, A. and M.T. Fleury (2001). 'Alternatives for industrial upgrading in global value chains: The case of the plastics industry in Brazil'. In: Ids Bulletin-Institute of Development Studies 32 (3): pp. 116-126.

[8] Davenport, T.H. and Short, J.E., 1990. The New Industrial Engineering Information Technology and Business Process Redesign. Sloan Management Review, 31 (4), 11-27.

[9] Fettke, P., Loos, P., Zwicker, J. (2006) Business process reference models – Survey and classification. In: Lecture Notes in Computer Science, Vol. 3812, pp. 469–483, Springer.

[10] Lockamy III, A. and McCormack, K., 2004. Linking SCOR planning practices to supply chain performance, an explorative study. International Journal of Operations & Production Management, 24 (12), 1192–1218.

[11] Huang, S.H., Sheoran, S.K., and Keskar, H. (2005) "Computer-assisted supply chain configuration based on supply chain operation reference (SCOR) model," Computers and Industrial Engineering, Vol. 48, pp. 377-394.

[12] Georgise, Fasika B.; Thoben, Klaus-D.; Seifert, Marcus. 2013. 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.

[13] Chan, F.T.S. and Qi, H.J. (2003), "Feasibility of performance measurement system for supply chain: a process-based approach and measures", Integrated Manufacturing Systems, Vol. 14 No. 3, pp. 179-90.

[14] SCC. 2010 SCOR (Supply Chain Operation Reference) Model 10.0 by Supply Chain Council USA, 2010.

[15] Di Martinelly, C., Riane, F., Guinet, A. (2009) A Porter-SCOR modeling approach for the hospital supply chain.

International Journal of Logistics Systems and Management, 5(3-4): 436-455.

[16] Xia, L.X.X. (2006), "Supply Chain Modelling and Improvement in Telecom Industry: A Case Study", in (Ed.), Industrial Informatics, 2006 IEEE International Conference on, 2006, 1159-1164.

[17] Legnani, E., (2011), "Controlling and Improving the Provision of after-Sales Services", Doctoral Thesis (Doctor of Philosophy), Universtà Degli Studi di Bergamo, Bergamo.

[18] Paxton, J. and Tucker, B. (2010), "Using SCOR as a Supply Chain Management Framework for Government Agency Contract Requirements", in Mattingly, B.R. & Profet, K. (Ed.), Aerospace Conference, 2010 IEEE, 6-13 March 2010 2010, 1-8.

[19] Yong, T., Zhengying, C. and Huaqing, Q. (2010), "A Process-Based Performance Analysis for Closed-Loop Agriculture Supply Chain", in Kellenberger, P. (Ed.), Intelligent System Design and Engineering Application (ISDEA), 2010 International Conference on, 2010, 145-149.

[20] Fronia, P., Wriggers, F. S., Nyhuis, P. 2008, A Framework for Supply Chain Design, EngOpt 2008 - International Conference on Engineering Optimization, Rio de Janeiro, Brazil, 01 - 05 June 2008.

[21] Johansson, M. and Persson, F. (2011), "Towards a Scor-Based Analysis Tool for Construction Management and Logistics", in Persson, F. & Rudberg, M. (Ed.), PLANs Forsknings- och tillämpningskonferens 2011 - Logistik i praktisk tillämpning, 2011 Norrköping Sweden, PLAN, Stockholm, 125-139.

[22] Persson, F., Bengtsson, J. and Ö., G. (2009), "Construction Logistics Improvements Using the Scor Model – Tornet Case", in Vallespir, B. & Alix, T. (Ed.), Advances in Production Management Systems, 2009 Bordeaux, France.

[23] Persson, F. and Thunberg, M. (2012). Adapting the Scor Model to the Construction Industry Settings. In: Töyli, J., Johansson, L., Lorentz, H., Ojala, L. & Laari, S., eds. NOFOMA 2012 - The 24th Annual Nordic Logistics Research Network Conference, 7-8th of June 2012 Turku, Finland.

[24] Bean, W.L., Schmitz, P.M.U. and Engelbrecht, G.N., 2009: Adapting the SCOR Model to suit the military: A South African Example. In Proceedings of the 14th Annual Logistics Research Network Conference: Volatile and Fragile Supply Chains.

[25] Schmitz, P.M.U. (2007). The use of supply chains and supply chain management to improve the efficiency and effectiveness of GIS units, PhD thesis, University of Johannesburg, South Africa.

[26] Fayez, M. 2005. An automated methodology for a comprehensive definition of the supply chains using generic ontological components, Dissertation, University of Central Florida.

[27] James H. Barnard, 2006, A Multi-View Framework for Defining the Service Supply Chain using Object Oriented Methodology, PhD thesis, Department of Industrial Engineering and Management Systems in the College of Engineering and Computer Science at the University of Central Florida Orlando, Florida.

[28] Baltacioglu Tuncdan., Ada Erhan., Kaplan, Melike D., Yurt, Oznur., & Kaplan, Y. Cem. (2007). A New Framework for Service Supply Chains. The Service Industries Journal, 27(2), 105-124.

[29] Ellram, L., Tate, W. and Billington, C. (2004). Understanding and Managing the Services Supply Chain. Journal of Supply Chain Management, 40(4), 17(16).

[30] Georgise, F.B, Thoben, K.-D., Seifert M. (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; 1-17.