

Research Article

Supply Chain Integration in the Manufacturing Firms in Developing Country: An Ethiopian Case Study

Fasika Bete Georgise,^{1,2,3} Klaus-Dieter Thoben,² and Marcus Seifert²

¹ International Graduate School for Dynamics in Logistics (IGS), University of Bremen, Hochschulring 20, 28359 Bremen, Germany

² Bremer Institut für Produktion und Logistik GmbH-BIBA, Hochschulring 20, 28359 Bremen, Germany

³ School of Industrial and Mechanical Engineering, Hawassa University, P.O. Box 05, Hawassa, Ethiopia

Correspondence should be addressed to Fasika Bete Georgise; geo@biba.uni-bremen.de

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With the advancement of information and communication technologies, supply chain integration has been considered a strategic tool for firms to improve their competitiveness. The supply chain integration within processes and between organizations has enhanced value creation. However, the fragmented nature of the business in developing country demonstrates a noticeable difficulty in terms of competitiveness and efficiency. Lack of a relevant literature on practical experience in supply chain integration in developing countries is one of the challenges. The purpose of this research is to identify the level of interorganizational and intraorganizational supply chain integration practices. It also analyzes the challenges faced in the manufacturing firms in developing countries. The methodology followed a thorough review of literature and semistructured interviews amongst the Ethiopian manufacturing industries. The preliminary findings of the study highlight that prevailing approach to supply chain integration is limited to ad hoc functional based boundaries within the firm. The SC integration enablers are also restricted to the traditional way of communications such as telephone, fax, and letters. Firms need to focus on those issues that require attention in pursuance of greater SC integration.

1. Introduction

Recently, the manufacturing industry in developing countries (MIDC) has been facing unprecedented competitiveness pressure generated by the new business trends. To cope with this pressure, the manufacturing industries have tried to upgrade their operations by using different manufacturing techniques such as Total Quality Management, Business Process Reengineering and Lean Technology, and others. Despite these efforts, the MIDC has not yet made their share of markets. This drives industry to get additional efficiency from their production systems. Effective supply chain management and supply chain (SC) integration are becoming increasingly critical factors for business success. The integration of SC members can significantly support the MIDC to face the constantly changing competitiveness scenarios. Companies versus companies have been replaced with supply chain versus supply chain competitiveness strategy. However, the number of companies that have truly integrated

their supply chains to take advantages of this opportunity is still small [1, 2]. The effects of globalization and fiercer competition have forced firms to focus their attention on entire supply chain integration (end-to-end) rather than on effectiveness and efficiency of separate business functions within their own premises. Firms both in developed and developing countries are trying to integrate more in their production activities such as sourcing, manufacturing, and delivery processes. The MIDC has been a part of the global supply chains for long time as a supplier of raw material and manufacturer of finished products. Nevertheless, some sectors like textile, garment, and leather industries even though such cooperation and integration is at infant stage; it does not create value as expected. The system was inefficient. Figure 1 shows the typical leather industry supply chain that involves the firms from developing and developed countries.

This paper aims to assess the supply chain integration level in one of the developing countries, Ethiopia, and recommends future research directions. The paper begins by (a)

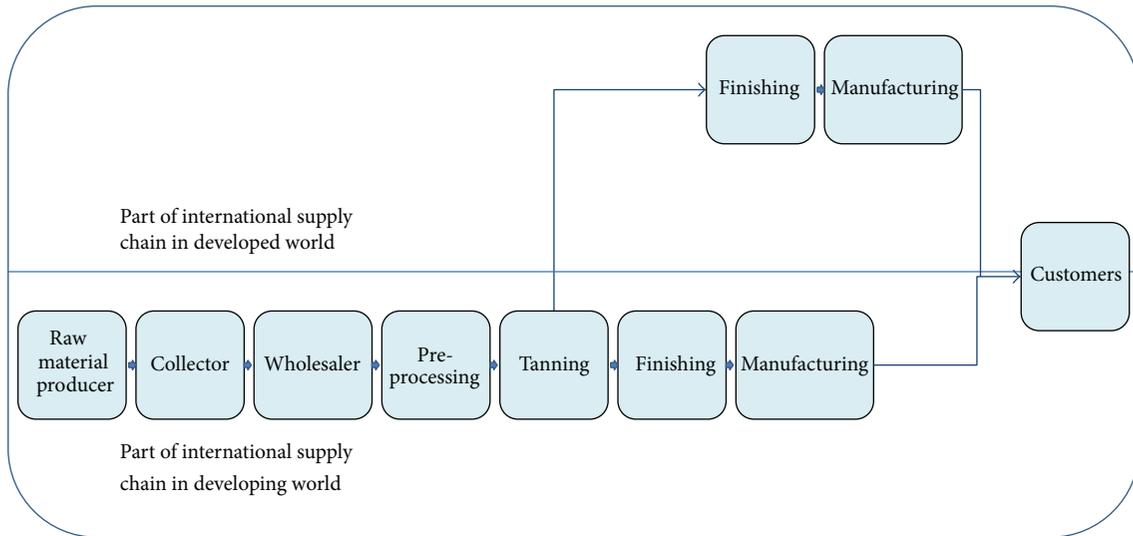


FIGURE 1: Typical leather supply chain involving developing countries.

reviewing the literature on supply chain integration practices and (b) analyzing and discussing the empirical field findings. In doing so, Section 2 of this paper focuses on the theoretical issues of supply chain integration. Section 3 reports the research design and methodology. The field findings and discussions are described in Section 4. The conclusions and future research agenda are described in Section 5.

2. Supply Chain Integration

Supply chain integration is becoming one of the academic areas of interests for research and practical applications. In other words, firms have started to question how they can integrate and improve their material and information flow activities and processes inside the organizations and with their supply chain partners. In order to fully benefit and implement supply chain management concepts, it is important for the firms to integrate efficiently with their suppliers, customers, warehouses, and other intermediate value-adding partners. Different research results have suggested that the higher level of integration with suppliers and customers in the supply chain benefits at greater extent [3–8]. Stevens was one of the pioneer researchers on the supply chain integration (see Figure 2) [6].

He has identified four stages of supply chain integration. The first stage represents the fragmented operations within the individual company. The characteristics of second stage are limited to integration between adjacent functions, for example, purchasing and materials control. In the third stage, the integration requires the internal integration of the end-to-end planning in the individual company. Finally, the last stage represents the true supply chain integration including upstream to suppliers and downstream to customers.

Frohlich and Westbrook have explained the importance of strategic decision on the extent of integration with the upstream and downstream members of the supply chains in manufacturing industries. They have introduced the concept

of “arcs of integration” which acts as a trigger point for the flourishing supply chain integration literature. Depending on the complexity of sourcing and market spectrum, the manufacturing industries can decide to engage in relatively little or larger extent of integration with suppliers and customers. In their study, they have examined the effect of supply chain integration level on performance and classified the supply chain integration in five classes (inward-, periphery-, supplier-, customer-, outward-facing) according to the integration intensity of the company towards the customer and the supplier directions. They have examined the performance differences between these five classes. As a result, it is found that outward-facing companies which were defined as the most comprehensive integration level of supply chains have better performance in many criteria than the other companies in other classes [7]. In the other research result, Bowersox et al. [8] have classified integration in a supply chain context in six different types. These are customer integration, internal integration, material and service supplier integration, technology and planning integration, measurement integration, and relationship integration [8].

Information and communication technology (ICT) is an important enabler for efficient supply chain integration, and many ICT applications have recently gained popularity. This is due to their ability to facilitate, coordinate, and integrate the flow of information across the supply chain. ICT is an enabler which helps supply chain members to establish partnerships for better performance. To mention some of the ICT potential applications in developed country firms, these are electronic data interchange (EDI), Internet and enterprise systems such as enterprise resource planning (ERP) and radio frequency identification (RFID). Gunasekaran has explored that ICT is an essential ingredient for business survival and improves the competitiveness of firms [9]. Besides that, McLaughlin et al. [10] have found that the secret of success for the companies around the world is partly dependent on their ability to apply ICT to SCM [10]. The findings by McLaren et al. [11]

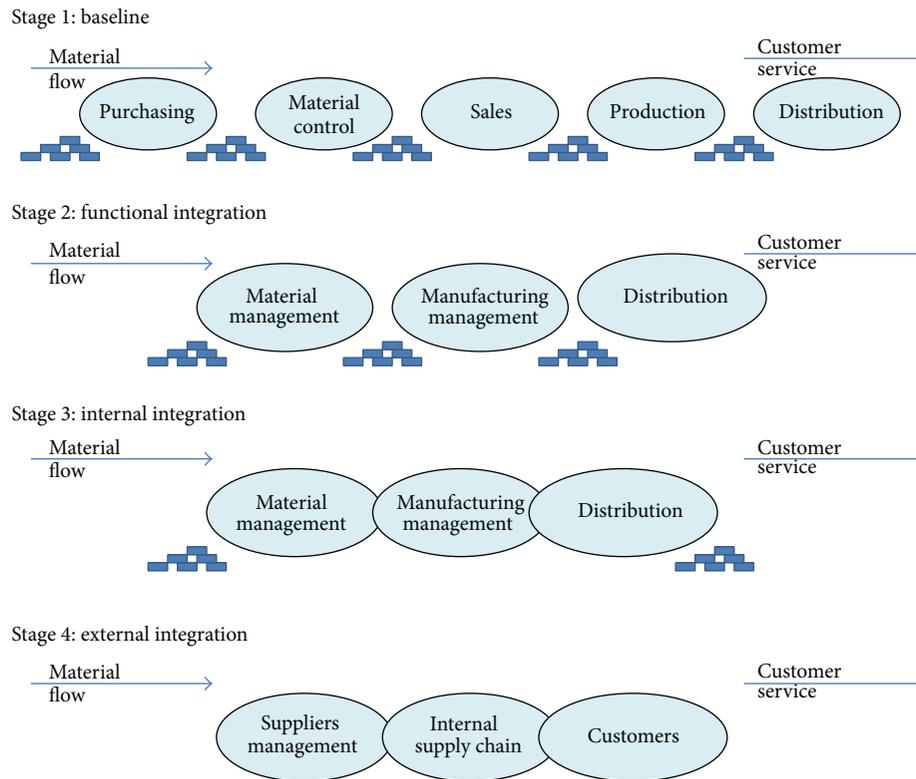


FIGURE 2: Achieving an integrated supply chain [6].

show that operational efficiency and operational flexibility have direct relationship with SCM information system [11]. The application of ICT enhances the service level of SCM and improves operational efficiency and information quality [12]. The multiple benefits through successful utilization of ICT deliver advantage in both tangible and intangible ways. The selection of the available ICT and cost associated with their implementation is still challenging tasks. Nevertheless, the manufacturing industry in developing countries needs to adopt appropriate ICT tools to leverage their business advantage. Effective utilization of ICT tools will provide the MIDC a better option in their global supply chain integration efforts, where decisions concerning supply and demand are fully supported by facts.

3. Research Methodology

This study is based on the field works conducted on the Ethiopian manufacturing industries. These manufacturing industries are mainly producer of basic consumer products. By interviewing a variety of manufacturers from representative domain level, enablers and challenges of supply chain integration were identified. Therefore, the data presented in this paper is collected and the conclusions presented here are based on interim findings.

The primary and secondary data collection methods are employed. The secondary data are based on existing literature on SC integration, while primary data is collected through semistructured interviews. Literature review and qualitative

semistructured interviews with consenting respondents are used in data collection. Literature review was the first phase of the research with the secondary data derived from relevant books, journals articles, conference proceedings, and reports. The second phase involves the collection of primary data, wherein the information is collected through semistructured interviews. All interviews were recorded and transcribed verbatim, each interview lasting approximately one hour. The respondents of these qualitative semistructured interviews were selected from the Ethiopian manufacturing industries published by Ethiopia Statistics Authority [13]. The respondents are selected on the basis of their experience on export market and their interactions in global supply chain member. Letters were posted and e-mailed to the manufacturer. Then, follow-up telephone calls were made for the interview arrangements. Accordingly, nine manufacturers are involved in manufacturing activities for long time. The structured questions are attached in the Appendix.

4. Main Findings

An interview protocol containing a covering letter and semistructured interview questions were sent to nine Ethiopian manufacturing industries. The sample population was fairly evenly distributed between those who are manufacturers for export market and those who are a producer for local market. The respondents' participation as an exporter has provided an opportunity to examine

TABLE 1: Profile of interviewed company.

Company	Types of industry	Type of product	Number of employees	Production strategies	Market target	Position of interviewee
A	Chemical	Liquor drink and alcohol	580	Mainly MTS	Local with little export	Techniques and production manager
B	Garment	Different garments	1300	MTO	Export	Task force chief
C	Wood	Chip wood	140	MTS	Local with little export	Techniques and production manager
D	Textile	Textile	800	MTS/MTO	Export and local	Planning and marketing Manager
E	Leather tannery	Hides and skins	500	MTS/MTO	Export	General manager
F	Leather tannery	Goat skins	214	MTS/MTO	Export	General manager
G	Food	Foods	300	MTS/MTO	Local with little export	Director general
H	Leather garment	Garment/Article	250	MTS/MTO	Local with little export	General manager
I	Ceramics	Sanitary and house hold items	500	MTS/MTO	Local	Planning and marketing manager

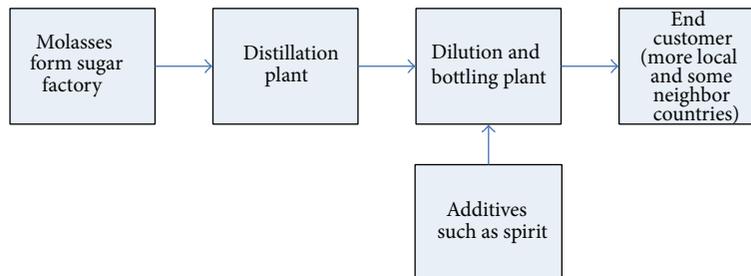


FIGURE 3: Liquor and alcohol industry supply chain.

level of SC integration prevalent in the organizations. In-depth interview has been conducted in nine manufacturing industries in Ethiopia. The organizations were systematically sampled from the initial list of survey respondents and volunteers who send feedback for the e-mail requests.

4.1. Field Study Organizations. The organizations are systematically sampled from the initial list of survey respondents and volunteers who send feedback for the e-mail requests. Furthermore, deliberate effort was made to ensure that a wide variety of organization from different sectors were included in the case study (see Table 1). The data collection is conducted via semistructured interviews along with the industrial visit with top managers in their respective organizations.

4.2. Findings on the SC Coordination. Among the studied companies, the supply chain integration especially on some factors was unique. Based on the interviewed companies, configuration and coordination aspects of the Ethiopian firms supply chains have been investigated, for example, sourcing processes from local and international suppliers, supplier selection, and price decision issues in the chain. The first issue to be addressed is the identification of supply chain members and allocation of functions among the members.

These aspects are depicted as representative in Figures 3, 4, 5, 6, 7, 8, and 9. The figures also show the material flow and some aspects of coordination, which in this case refer to the presence of formal orders, information exchange, and standard procedures. Looking on Figures 3–9, we can observe that each of the supply chains consists of different members. The supply chain members in the chain are wholesalers that act as their direct customers, manufacturer, and agents—which distribute the products to the end customers. Sometimes, the agents can also deal directly with companies without the presence of wholesaler. The important major differences in the SCs are the wholesaler participation in sourcing and delivery processes and supply chain members in such activities. For example, in Ethiopian context, manufacturer wholesaler and small retailers actively participated in both sourcing and delivery processes to the suppliers and the final customers. This makes delivery process more challenging and unique in the developing world. The seven figures (Figures 3–9) show the typical supply chain configurations in alcohol, textile, wood, food, garment, leather and leather garment, and ceramics in the case studies.

Firm A (Liquor and Alcohol Factory). Factory A is a pioneer in manufacturing liquors and alcohol products in the country.

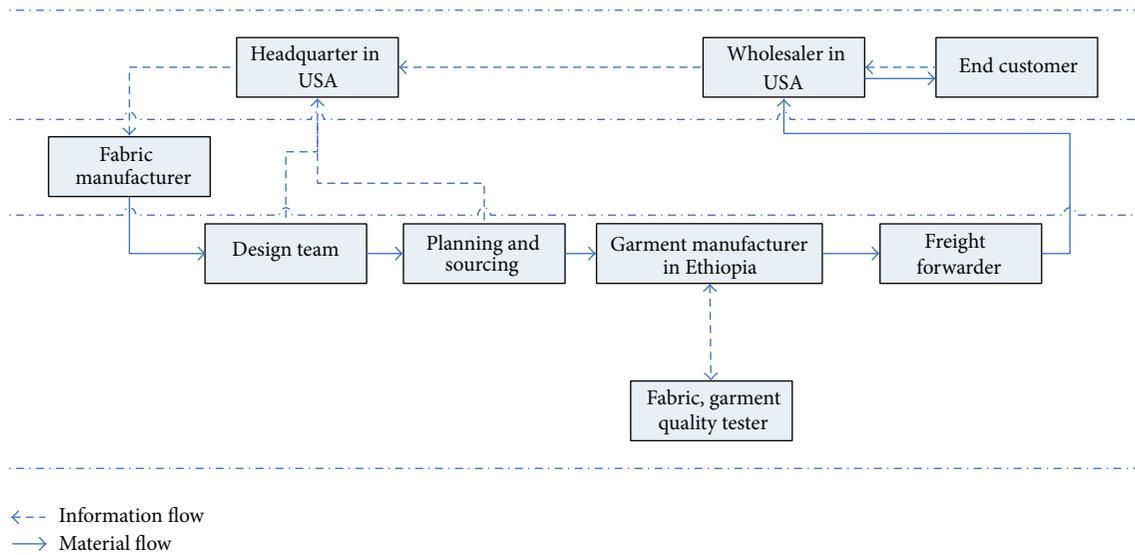


FIGURE 4: Garment industry supply chain.

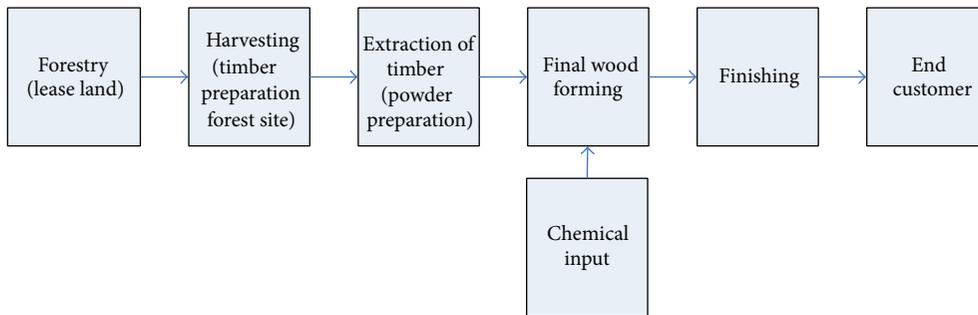


FIGURE 5: Wood industry supply chain.

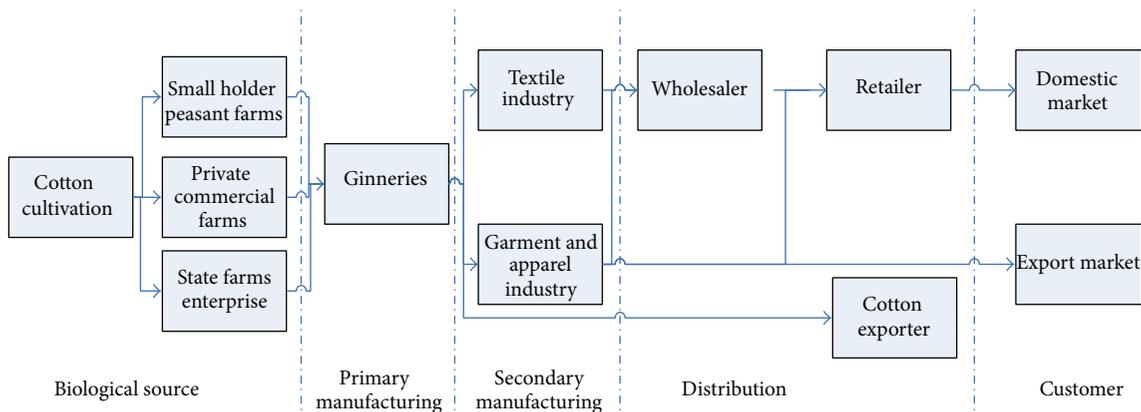


FIGURE 6: Textile industry supply chain.

The factory attempts to produce and distribute alcohol and various liquor products based on customer demand. Figure 3 demonstrates liquor and alcohol industry supply chain. The factory is working with its customers to meet and exceed their needs. It has employed different strategies to reach all potential market areas locally and globally by building its own capacity through the project expansion. It has started

to maximize the business opportunities over the next years being supported by the implementation Quality Management System ISO 9001:2008. The company has developed different systems to insure the outmost satisfaction of its customers. The firm measures its customer's satisfaction level through market survey every year. It has also developed and implemented customer complaint handling system. The company

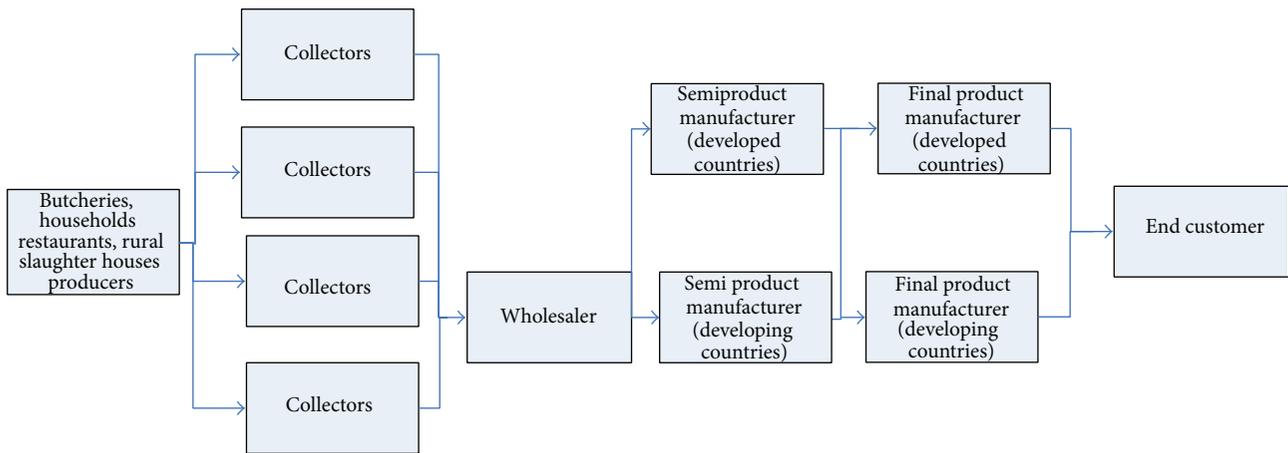


FIGURE 7: Leather industry supply chain.

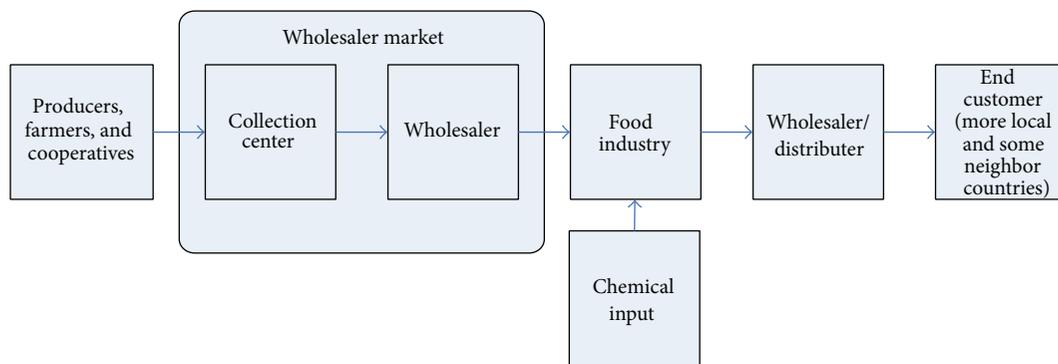


FIGURE 8: Food industry supply chain.

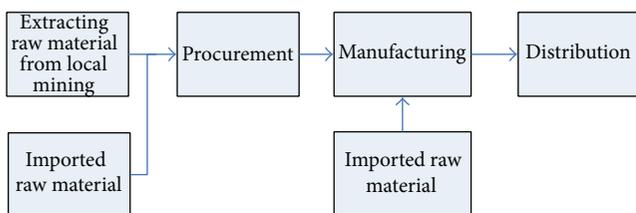


FIGURE 9: Ceramic industry supply chain.

market is segmented geographically. The firm has domestic and international market. In domestic market, the firm is selling its products throughout the country. Currently, the company has faced higher challenges in their raw material sourcing because its raw material has strategically diverted to the production of ethanol alcohol by policy maker for blended kerosene production. Therefore, the firm needs to find the new raw material resources for the future purpose.

Firm B (Garment Industry). This firm is a foreign company in the garment products in USA market. It has a turnover of over \$143 million with over 1,300 employees and customers situated in USA market. An interview was conducted with a senior member of staff in the department responsible

for development and legal issues. Textile sewing has been in the business of cotton spinning factory. Company B is an apparel manufacturer of students and medical uniform for the ready to wear apparel mass market. It is producing 460,000 pieces for school uniforms and 60,000 garments for medical uniforms designed for the USA market. The company is part of a group of firms operating at different points of the garment supply chain, namely, a fabric producer, an apparel manufacturer, and a wholesaler, respectively. The company's success primarily relies on cost efficiency that enables it to compete very aggressively on price in USA market. The company's supply chain is illustrated in Figure 4.

The company purchases most of its textile fabrics from the group's fabric producer and relies for its delivery on the headquarter office. It delivers its products by retailer sales. The company sources its major raw material from Chinese fabric manufacturer and delivers their readymade garment to USA market. In this supply chain, their geographical location and distance between customers, producers, and suppliers create its own unique features and challenges as global supply chain. The main challenges for such a supply chain were information exchange and planning activities to fulfil the appropriate delivery lead time. From the challenges of on-time delivery, the company lost a large amount of money. The company has been also challenged in delivery quality

product to the retailer because the end customers are far from the manufacturing place. For transportation and distribution of finished products, the company adopted two different procedures. Transport of products to large distribution chains is outsourced to wholesaler and the logistical requirements of the consignments. The degree of satisfaction of the customers is monitored through a formal program based on monthly reports. By contrast, transport of finished products to independent retailers is carried out by company B with its own logistical resources so as to guarantee flexible deliveries.

Firm C (Wood Factory). The factory is finalizing its construction and starting production and sales of particle board in the last two years. The factory is designed to produce 40,000 m³ of chipboard annually for local and export markets. Figure 5 illustrates chip wood supply chain. This process begins with logging operations; logs are then sent to the sawmill where crushing woods are sent to the chip wood manufacturer (chip wood operations). Lastly, once chip woods are manufactured, they have to reduce appropriate size and send to sales department to a wholesaler or directly to the final customer. The factory lies in an area of 69,000 square meters with integrated forestry development on 985 hectares of wood land.

Firm D (Textile). The textile is one of the potential areas for further development and job opportunities in the developing countries at present and in the near 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 were lack of technology know-how and high competition from global markets. The company needs to upgrade its capacity to compete in the global supply chain. The firm manufactures textile mostly for local market. The company operates as a textile mill. The 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 6 shows the textile supply chain industry. The supply chain starts from cotton cultivation from local suppliers and ends with the final customers both to local and foreign materials.

Firm E (Tannery). The leather industries are other potential areas for the developing countries. The sector is trying to get advantages from large livestock potential and promising market for leather products. However, the industry is highly fragmented. The presence of a large number of chain participants is creating high price fluctuation and unstable market. The industry is operating in production of the gloves and hides. The company produces finished sports gloves leather from sheepskin. While employing conventional tanning process, the factory has installed an exemplary Effluent Treatment Plant, an environmentally compliant project. The factory has achieved process management standards and received ISO Certification. The factory has produced finished dress

and sports leather gloves from sheep have penetrated the international market. Company has more than 500 workers.

Firm F (Tannery). This tannery is dedicated in production of goat suede and shoe leather. This firm is producing raw leather for foreign market export which is mainly located in Italy. The company produces finished goat suede for shoe upper, finished cowhide for shoe upper, and finished crust lining leather. A chrome-recovery project has been put in place at the goat suede and shoe leather. The factory has achieved process management standards and received ISO Certification. The company earned annual revenue around 43 million dollar before tax. The firm has around 200 employees. Figure 6 demonstrates the leather industry supply chain involving different players.

Firm G (Food Industry). This firm is a pioneer of food processing industry in Ethiopia. The current capacity had reached 21,600 MT/annum. The factory has been reestablished as a share company in 1999 by transforming the previous public enterprise. It had also undergone rigorous expansion and innovation works to satisfy the ever-growing demand of the society. Currently, the capital has grown up and also has implemented integrated food safety and quality management system (ISO 22000-2005), certified by Republic of South company called SABS. Figure 8 demonstrates the food supply chain.

Firm H (Leather Garment and Article). This factory is producing leather goods and garment article products mainly for local markets. The company produces finished leather garments for men and women. During the interview time, the company are mainly produced for local market focusing on jackets, bags, and some leather article. The factory has achieved process management standards and received ISO Certification. The firm has around 250 employees. The firm has planned to enter aggressively to export markets. The firm also has introduced new fashion design cloth for the markets.

Firm I (Ceramics Products). Company is producing ceramic and sanitary products. The company earned the profit from sale of more than 6,000 tons of various ceramics products. It was established before twenty years and has more than 600 workers. Figure 9 shows the ceramics supply chain. Ceramic industry generally occurs near the source—opencast minings with special requirements—mixture of mineral resources (raw materials) with the necessity of energy infrastructure and water. The raw material is relatively inexpensive. Development of ceramic products manufacturers was followed by development of the technology for their production, design, and industry of additives for the production that mainly came from foreign companies. Apart from the manufacturer, main members of ceramic tiles supply chains or networks are retailers, wholesalers, and carriers. On the other hand, there are a relatively small number of stores that operate exclusively. Usually, the company has its own distribution centres; it also organizes part of retail supply through its own fleet.

TABLE 2: Summary of integration within the firm activities.

Firm	Integration within the firm			
	Information exchange between functions	Information storage and sharing	Collaboration (cross functional team)	Inventory management
A	Letter and phone still dominant but local area network has started through	Manual and paper based and begins modern-management information system	Cross cooperation highly manifested in planning	Utilized inventory management system software
B	Letter and verbal instruction	Manual and paper based however started data storage with computerized system	Group work for piece rate payment	One-month finished goods and 3-month stock level
C	Letter, phone	Manual and paper based	Silos mentality	Two-month stock level
D	Letter are dominant	Manual and paper based but started use of shared server	Silos mentality	One-year seasonal stock
E	Letters are still dominant but local area network	Computerized common data base	Ad hoc based integration	Six-month stock and large collection seasonal raw material
F	Letter, telephone, e-mail	Computerized common data base	Ad hoc based integration	Six-month stock and large collection seasonal raw material
G	Letters are still dominant but local area network	Computerized common data base	Team work less frequently practice	Six-month stock and large collection seasonal raw material
H	Letter, phone, mobile, e-mail	Manual and paper based	Quota based production	Just in time inventory supplies
I	Letter, phone, mobile	Manual and paper based	Rarely practiced	Six-month stock and large collection imported raw material

4.3. Findings on the SC Integration. Supply chain integration plays an important role in achieving the firm's goals. The relationship and integration of activities with suppliers and understanding of customer's needs result in greater benefits for companies. Supply chain practices are directly related to the firm internal integration, relationship management, which includes suppliers and customers. Currently, the company supply chain integration within the organization and its suppliers and customers are becoming the basis for company success. For this research we have investigated the company relationship with their customers, supplier, and within the company itself. To further investigate this integration, the information exchange, handling, and storage activities have been examined with encountered challenges.

Integration within the Firm. The details of supply chain integration practices inside the firm for each company's case study are discussed in Table 2. In order to investigate firms' levels of integration within the organizations, we have examined the information exchanges between departments, information storage and sharing, cross functional collaborations, and inventory management practices. The results show that the interviewed firms still practice the traditional information exchanges between the different functions such as telephone, letter, and verbal instructions. Data collection, storage, and handling mechanisms were highly manual and

paper based. However, firms have started to collect data in the form of soft copy with help of computer. Some of the firms have started also to use information management system for the same purpose. This practice was just at infant and pilot stage.

The inventory management policy was governed by high stock level for long period of time to control supply and demand uncertainty. In particular for imported items some firms kept up to maximum of one-year stock level. This practice has created financial constraints and storage problems. These challenges were true also for seasonal agricultural products such food, wood, textile, and leather manufacturers also.

Supplier Relationship and Integration. Companies in developing countries were searching for sustainable raw material suppliers for their competitive position for manufacturing sector. For the objective of improving their competitive advantage, firms depend both on local and imported raw material. Table 3 shows the current supplier relationship practices of the interviewed firms. In the interview questions, we have found that the main raw material for the companies was sourced mainly from agricultural product. However, some companies' production activities were still dependent on imported inputs such as plastics and beverages. Most firms depend highly on the local raw material but some of the firms

TABLE 3: Summary of firm and supplier integration.

Integration firms	Supplier relationship					
	% share on raw material	Local Information exchange (phone, fax, mobile, e-mail)	Purchasing activities	% share	Foreign Information exchange (phone, fax, mobile, e-mail)	Purchasing activities
A	65	Phone, letter	Direct in purchase	35	Telephone, e-mail	International bidding
B	—	—	—	25	Telephone, e-mail	Partner supplier
C	70	Phone, letter	Own site	30	Fax, e-mail	International tender
D	75	Performa, phone, letter	Direct purchase	25	Phone, e-mail	Through agents
E	95	Phone, letter	Direct negotiation with supplier	5	E-mail, fax, telephone	Central office handles the purchasing functions
F	95	Phone, letter	Direct negotiation with supplier	5	E-mail, fax, telephone	Central office handles the purchasing functions
G	95	Phone, letter	Direct purchase	5	E-mail, fax, telephone	Online bidding
H	95	Phone, letter	Sister Company	5	E-mail, fax, telephone	International tender
I	90	Phone, letter	Direct purchase	10	E-mail, fax, telephone	International tender

are still importing resources and technologies to remain in competitive advantages, such as machinery, chemicals, and spare parts. There are also some disadvantages that companies have to take into account when evaluating whether or not to work with offshore companies. Importing raw materials, technologies, and spare parts increase the dependence on suppliers and the need for further improvement in this relationship.

However, there are challenges and barriers identified in their sourcing activities such as foreign exchange rate, regulations, quality, and transportation delays to improve supplier and buyer relationship. The interviewed firms followed different purchasing strategies. Because of the international bidding requirement for international purchases companies are inclined to work with different suppliers in different ways. It would be difficult also to create long term partnership. It is important to recognize that such relationship with suppliers did not satisfy their company need.

For the local purchase, it is common practice that purchasing activities is based on negotiation between buyers and suppliers. This type of relationship with suppliers was a challenge for further improvement in the supply chain. It may be advantageous to have a close relation with supplier, to develop partnerships and alliances that will benefit both partners. There is some pilot collaboration in leather industry with financial loan and chemical input such as salt for preserving and processing raw leather to obtain mutual benefits and coordinating plans, permitting the improvement of the supply chain. The means of communication and interaction within and outside companies mainly depend on telephone and fax machines. Some of the companies have started e-mail communication for their international purchase activities. The main challenges encountered in their relationship were

inconsistency in raw material quality, late deliver, loyalty, and price fluctuation.

Customers' Relationship. The customers for manufacturing companies were mixture of local and international markets. Those companies were targeted for international markets of textile, garment, and leather industries. With regard to customer relationship, the researcher found that most firms relied on walk-in customers who had little interaction to the improvement of the product. Even though most firms rely on their local customers, there are firms which are working for export markets especially leather, garment, and textile markets. The interviewed firms were actively participated in distribution function either in their shop or delivery door to door to their customers. The information exchanges are still limited to traditional one like letter, telephone, and fax. However, some firms have started to use e-mail connection especially with foreign customers. The global markets offer a variety of products of different quality and cost. As a result, companies are always competing and trying to reduce costs and improve quality. The relationship with customers has turned a strategic issue for today's companies. The interviewed firms need to change their relationship with customers and understand their customers more for market success. The details of the firms' customer integration practices for each company are discussed in Table 4.

4.4. Findings on the Existing Enablers and Challenges. Some of the interviewed companies used different types of information and communication technologies enablers. Most of them used traditional communication means such as letter, fax, and telephone dominant ones. However, during foreign sourcing process, most companies use fax, telephone, and e-mail to

TABLE 4: Summary of firm customer integration activities.

Firm	Customer relationship							
	Local				Foreign			
Market share, %	Information exchange	Delivery activities	Participation level in production	Market share, %	Information exchange	Delivery function activities	Participation level in production	
A	97	Phone, letter, visit	Own delivery and agents	Product Taste	3	E-mail, phone	Wholesaler and agents	None
B	None	—	—	—	100	E-mail, fax	3PL and wholesaler	Product design
C	100	Phone, letter, in person visit	Own shop	Sometimes in product design	—	—	—	—
D	100	Letter, fax	Wholesaler	Product design	—	—	—	—
E	5	Phone, letter, fax	Own delivery and wholesaler	None	95	E-mail, fax	3PL and wholesaler	None
F	—	—	—	—	100	E-mail, fax	3PL and wholesaler	Product design
G	98	Phone, letter, fax	Own delivery and wholesaler	Product design	2	E-mail, fax	3PL and wholesaler	Product design
H	100	Phone, letter, fax	Own shop	None	—	—	—	—
H	97	Phone, letter, fax	Own shop	None	3	E-mail, phone	Wholesaler and agents	Product design

contact with suppliers and send purchasing order (PO) to confirm the order. Types of ICT enablers and challenges within the firm for each company's case study are discussed in Table 5. Generally, simple communication system such as telephone, fax, and e-mail is used for communicating with suppliers. State-of-the-art electronic business (e-Business) was not started yet in any place. Most of the companies have no company website even with primary information about their product information. Three companies out of twelve have a plan to use ERP system in the future to create e-Business via Internet. Furthermore, the current information exchange system uses paper which is commonly used and larger space is needed for keeping the record because there are many copies of purchasing orders for each order. Most companies plan to develop the paperless system by working with networked computer and link the departments' process via local network and Internet. Thus, the use of information technology among the company, customers, and suppliers is the issue that has to be improved.

5. Conclusion

The semistructured interviews are conducted to examine the experience of representative manufacturing industries. Semistructured interviews were conducted in the selected firms to better understand their practices on intra- and interorganizational supply chain integration. In summary, through a review of previous research we have examined the practices of supply chain integration, benefits, and challenges associated with them. Based upon the findings of the research, the companies investigated seem to be oriented towards interorganization integration. The results revealed

that degree of integration is low when it comes to Ethiopian firms but there were some promising initiatives undergoing. The existing practices have shown that firms manage the information flows in a number of ways, mainly telephone, mobile, letters, and faxes over the years. Recently, firms have started using the Internet to create connections with imported material suppliers in foreign purchase, even though telephone and fax are also still dominant ways for integrating their supply chains. In contrast to the current dominant manual paper based interactions, the current supply chain integration requires an information and communication technologies that enhance data management in great way both from automated sources such software applications and RFID technologies. Actually, one of the major obstacles to fully integrate materials and information flows across the supply chain lies in the inadequacy of the Internal management systems of the individual firms—for example, fragmented information flows, lack of integration amongst different company's departments/functions, low level of rationalization, and standardization in operational processes. In addition, the findings have shown that the firms have limited understanding and awareness of the importance about external integration with suppliers and customers. The ICT system implementation is a main key factor in developing country that is trying to penetrate the export market so that they can have a fast and reliable interaction with suppliers and customers. Therefore, ICT system is very important step in order to gain competitive advantage in their planning, sourcing, production, and distribution activities.

Several research agendas can be raised to advance the understanding of supply chain integration. One of the areas to examine involves how effectively and efficiently the firms

TABLE 5: Types of ICT enablers and challenges.

Company	Types of IT enablers	Challenges
A	Wide area network (WAN) with shared server, Internet service for employees, ongoing task for development of management information system that comprises different packages	Lack of expertise and know-how in ICT especially software programming and application
B	E-mail connection with suppliers and head office but in poor connection	Lack of professionals and expertise in ICT infrastructure and software and application
C	The organization is locally connected and Internet services except production and technical department which has its dial up connection	Organizational structure and building have not facilitated the connection works
D	Only financial department has been computerized and use software	Financial constraint
E	Company is not internally networked, but planning to implement MIS with company specific ERP	Financial constraint for big investment in IT, poor integration from end-to-end, low level of vertical and horizontal integration, low awareness as advantages integration
F	Firm is not networked but dial up e-mail is used for communications, company planning to implement MIS with company specific ERP	Lack of expertise and know-how in IT application
G	Internal and Intranet connections with data sharing in company common folder, the company has started to implement locally prepared software for integration such as inventory information management, procurement information system, finance information system	Lack of expertise, experience, and exposure in related topics from developed world and outside Ethiopia. It was hard to convince board of directors to implement the new system with considerable investment, financial and other human related thinking and mentality factors constraints
H	Not networked but e-mail is used for communications, company planning to implement MIS with company specific ERP	Lack of expertise and know-how in uses and advantage of IT application
I	Only financial department has been computerized and use software	Lack of expertise and know-how in uses and advantage of IT application, financial constraint

in developing countries integrated within the organization and with their suppliers and customers even with existing resource constraints. Since global supply chain is trying to integrate the entire supply chain that involves developing countries in the existing enablers and capabilities, future research should identify the factors that facilitate the success of integrated supply chain. It is also important to identify the most appropriate techniques that facilitate the modelling and improvement of the process of integration. Accordingly researchers need to address how to model a supply chain involving developing firms and the influencing factors should be considered in such a model.

Appendix

A. Interview Questions for Supply Chain Integration and Coordination in the Manufacturing Industry in Developing Countries

A.1. *What Are Current Practices and Characteristics of Supply Chain in Your Company?*

A.1.1. *Supply Chain Configuration and Coordination*

- (i) Who are your customers (local, international)?

(ii) Where are your products sold (market: local customer, worldwide)?

(iii) Who are your suppliers (local, international)?

(iv) Where are your suppliers located?

(v) What is the type of strategic for managing the business processes in the supply chain?

(a) Processes tend to be managed within discrete departments, cross functional or interenterprise process management.

(b) Processes are often company-wide and are managed at both the functional and cross functional process levels, interenterprise supply chain partners.

(c) Core processes are managed internally or via outsourcing. Information is frequently shared with external partners.

(d) End-to-end process management, coordination, and collaboration with strategic partners are used for most processes.

A.1.2. *Collaboration: Of the Various Forms of Collaboration Stated below, Indicate Which One Was Practiced with Your Various Clients?*

- (i) Controlling the stock of our client in their company.

- (ii) Carrying out a joint plan demand, production, and supply.
- (iii) Exchanging information on stocks, order, available resource.
- (iv) Sending order confirmation.
- (v) Shipping order information with advance (reference, quantity, date, etc.).
- (vi) Having agreed requirements delivery (packaging, identification, time delivery, etc.).
- (vii) Having a system of traceability order (via Internet, telephone).

A.2. Enablers, Barriers, and Challenges

A.2.1. Enablers: Do You Use Enablers for Successful Functioning of Your Company Supply Chain?

- (i) Does the company use online technologies other than e-mail, like, for example, the Internet or an Extranet, to facilitate the following business activities?
 - (a) Collaborate with business partners in the design of new products.
 - (b) Collaborate with business partners to forecast product demand.
 - (c) Manage capacity or inventories.
 - (d) Exchange documents electronically with your suppliers.
 - (e) Purchase direct production goods.
 - (f) Sell goods domestically.
 - (g) Sell goods internationally.
 - (h) Manage supplier relationships.
 - (i) Manage the logistics.
- (ii) What kind of software/IT tools is used?
- (iii) Do you use computer applications in any department or processes (sales planning, planning of production, materials and capacity, warehouse management, and transport management)?
- (iv) Do you use a computer system communication between suppliers and customers, such as EDI, Internet, and Intranet?
- (v) Is there traceability of products along the supply chain? If there is some kind of traceability, by what system is it done?
- (vi) Do you share information, apart from orders, including its network of agents supply?
- (vii) How do you share data (demand and work flow data) with suppliers in the supply chain?

A.2.2. Challenges and Barriers: Which of the Following Does Your Company View as Barriers in Integrating the Firms in Developing Countries?

- (i) Physical infrastructure, skilled staff and professional knowledge, information and communication technologies, technical standards, business messaging or transaction processing, investment cost, time, readiness of business partners, support from upper management, lack of proven business benefits, lack of direct customer contact, and so forth.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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