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Effect of Supply Chain Practices on Lead Time in Textile and Apparel Industry in Kenya

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Abstract: ***This paper investigates the effect of supply chain practices on lead time in textile and apparel industry in Kenya. Specifically, the study focussed on four supply chain practices i.e. modularity based manufacturing, supply chain integration, supply chain relationship management and supply chain responsiveness. The study targeted all the 59 textile firms in Kenya, with one key informant selected from each firm was selected purposively based on their knowledge of the performance measures the firms use. The findings revealed that modularity based manufacturing, supply chain relationship management and supply chain responsiveness have a negative and significant relationship with lead time. Further the results also showed that supply chain integration has non-significant and positive relationship with lead time. The study highlight the importance of supply chain responsiveness, modularity manufacturing and supply relationship management on reducing lead times. The study recommends that textile firms adopt modularity based manufacturing, supply relationship management and supply chain responsiveness as a way of reducing lead time.***

Keywords: Modularity based manufacturing, Sustainable supply chain performance, Supply chain integration, Supply relationship management, Supply chain responsiveness and Lead time

1. Introduction

Textile companies today face consistent changes and increased competition in their business environments. This creates challenges for companies who need to take action and be proactive in order to stay competitive and survive. Textile firms are thus face with increased pressure to meet both customer demands in a dynamic environment within the shortest time possible and at minimal cost. Christopher (2011) further states that this requires operational excellence across the stages of supply chain and adoption of best supply chain practices. Chan and Chong (2013) assert that for textile companies to be more competitive they need to develop their supply chain management, through this the firms achieve more efficiency in meeting customer value.

Glock (2011) explains that an efficient supply chain means to have a supply chain process that uses the lowest amount of input to create the greatest amount of output. In enhancing supply chain performance in textile industry, Godinho and Veloso (2012) emphasize the importance of reducing lead time through efficient supply chain management practices. Chan and Chong (2013) also stress that firms should focus more on making their supply chain more efficient and flexible in the global supply chain. As textile/apparel supply chains are becoming increasingly global, the rising level of outsourcing has placed increasing focus on lead time with shorter lead time demanded in meeting deliveries. To meet consumer demands on time, textile firm in Kenya and across the globe are expected to address social sustainability issues concerning lead time.

As one of the growing industries in Kenya, sustainability issues in the textile and apparel industry have received great attention. The geographically long and complex global production and market networks have brought to the fore lead time of textile and apparel firms in Kenya. To compete successfully in the competitive textile and apparel practices, textile firm in Kenya have been adopting supply chain practices as a way of minimizing lead time and other management deficiencies (Nuruzzaman, 2007).Here in this paper will examine the supply chain practices and the impacts of lead time in the textile and apparel industry in Kenya.

2. Problem Statement

Sustainability is an important performance dimension that has gained significant traction on supply chain designing. Sustainable Supply Chain (SSC) is driven by environmental and social objectives with economic benefits (Taticchi, et al., 2013). A sustainable supply chain offers competitive advantages to firms that have oriented their existing supply chains. Several researchers have conducted studies on drivers, enablers and barriers of sustainable supply chain performance. Reviewed studies indicate that sustainability of supply chain performance varies with industry; as such sustainability studies in various sectors are recommended (Khurana, 2016; Oelze, 2017; Köksal, Strähle, Müller & Freise, 2017).

Social sustainability issues in the textile and apparel industry have attracted the attention of scholar over the past two decades. The textile industry in Kenya is not without sustainability issues, with the textile industry's supply chain identified as having a significant social sustainability issues relating to lead time. (Andebe, 2012) emphasis that the challenge of lead higher team among Kenyan firms is linked to sustainability in raw material supply due to inadequate supply of locally produced cotton due to poor quality and is heavily reliant on out-dated machines. Tuigong & Kipkurgat (2015) in their study on challenges and opportunities for

textile firms in Kenya recommend the adoption of best supply practices as a way of reducing lead time among textile firms in Kenya. Although supply chain practices has been acknowledged as having potential effect on lead time, little evidence exists regarding this relationship. Thus this paper seeks to analyze the effect of supply chain practices on lead time in apparel and textile industry in Kenya.

3. Objectives of Study

General Objectives

The general objective of the study was to determine the influence of supply chain practices on lead timein apparel and textile industry in Kenya.

Specific Objectives

The specific study objectives for the research were:

1) To determine the influence of modularity based manufacturing of a firm on lead timein apparel and textile industry in Kenya.
2) To establish the influence of supply chain relationship management of a firm on lead timein apparel and textile industry in Kenya.
3) To assess the influence of supply chain integration of a firm on lead time in apparel and textile industry in Kenya.
4) To determine the influence of supply chain responsiveness of a firm on lead timein apparel and textile industry in Kenya.

4. Theoretical Review

SCOR Model (Supply Chain Operations Reference)

The Supply Chain Operations Reference model was introduced by the Supply Chain Council (SCC), an independent, not-for-profit, global corporation interested in applying and advancing the state-of-the-art in supply-chain management systems and practices. SCC was established in 1997, when 69 visionary supply chain practitioners from a variety of industry segments formed a cross-industry forum to discuss the issues related to supply chain management. The Supply Chain Operations Reference model (SCOR) is a management theory used as a tool to address, improve, and communicate supply chain management decisions within a company or supply chain environment and with suppliers and customers of a company (Tu*et al.*, 2004).

The model helps to explain the processes along the entire supply chain and provides a basis for how to improve those processes by measuring specific supply chain performance through defined metrics. The score model advocates for a lean supply chain where waste has been eliminated and the metrics in the SCOR model entails measuring supply chain plans which include sale and operations planning, source which include upstream flow from supplier side, make whose main concern is at the transformation stage where there is manufacturing, assembly and kitting, deliver entails transportation optimization and lastly return where the measures entails shipping mistakes and product quality. The SCOR model has been described as the most promising model for supply chain strategic decision making (Tu*et al.*, 2004).

The SCOR-model comprises five components: Plan, Source, Make, Deliver and Return. Each of these components is considered both an important intra-organisational function and a critical inter-organisation process. The five components of the model are integral part in modular manufacturing, supply chain relationship management, supply chain integration and supply chain responsiveness.

Plan: Planning the design and configuration of a supply chain is found to contribute to achieving competitive advantages. The major planning tasks include developing joint business plans among supply chain (SC) partners, determining SC quality objectives, creating process improvement plans, conducting demand and material replenishment plans, and setting up production plans. Decisions in the Plan area affect the entire supply chain activities, either directly or indirectly.

Source: This step describes sourcing infrastructure and material acquisition. It describes how to select suppliers, manage inventory, develop supplier network, keep delivery promise, and evaluate supplier performance. It also discusses how to handle supplier payments and when to receive, verify, and transfer products (Soffer and Wand 2005).

Make stage involves transforming demand through manufacturing and production. The Make step includes production activities, packaging, staging product, inventory process, material flow, releasing, etc. It also includes managing the production network, equipment and facilities, and transportation. The make component is seen as make-to-stock, make-to-order, or engineer-to-order, with employees as the most valuable resource (Georgise, Thoben, & Seifert, 2012).

The delivery decision area includes delivery plans, quality service expectations, inventory management, order management, warehousing, transportation, and import and export regulatory compliance. It also includes receiving orders from customers and invoicing them once products have been received. Delivery reliability (such as on-time delivery) and responsiveness (such as just-in-time delivery) are important component of this stage.

Return. The return process is a reversed logistics process. This process involves the management of business rules, return inventory policy, transportation arrangement, and regulatory requirements and compliances. Companies must be prepared to handle the return of containers, packaging, or defective products. All return defective products should be traced back to the source. Reliability and responsiveness are important quality indicators for the return process (Thilakarathna, Dharmawardana, &Rupasinghe, 2015).

The benefits that SCOR can deliver in terms of fostering true supply chain commitment to quality assurance through joint planning on quality standards are reflected in supply chain customer-facing performance. Studies by (Kocaoğlu, Gülsün and Tanyaş, 2013: Thilakarathna, Dharmawardana and Rupasinghe, 2015) have indicated that SCOR model promotes collaborative and commitment among supply chain partners thereby contributing to sustainable

performance in firms. In this study, SCOR-model was employed to empirically analyse the relationship between supply chain practices (practices involving planning, sourcing, order transformation through making, order delivery, and return processes) and sustainable supply chain performance in textile firms.

Value Chain Model

According to John Del Vecchio (2004) a value chain is "a string of companies working together to satisfy market demands." The value chain typically consists of one or a few primary value (product or service) suppliers and many other suppliers that add on to the value that is ultimately presented to the buying public. Value chain analysis describes the activities within and around an organization, and relates them to an analysis of the competitive strength of the organization. The concept is was first introduced by Michael Porter in 1980 (Porter , 1980). The Porter classified processes as either primary or secondary activities. Primary activities are those a firm cannot give out and are part of its core competencies and they are deemed to support its operations (Porter, 1991).

Primary activities are, first, inbound logistics which involves arranging the inbound movement of materials, parts, and/or finished inventory from suppliers to manufacturing or assembly plants, warehouses, or retail stores. Inbound logistics within textile industry entail cutting costs and increasing efficiency in their logistics activities. There is always emphasis on suppliers to deliver the product in time. The personnel are trained on how to handle the material when they load and unload the material at factory and warehouse. Thus, they are able to manage delivery times and customers demand more efficiently. They have also restructured their warehouse to enable easy shifting of materials between different floors(Gereffi & Frederick, 2010).

Support Activities are also an important process in value analysis model. These include procurement activities, human resource management, technology development or enhancement in the firms and infrastructure activities. Infrastructure consists of activities such as accounting, legal, finance, control, public relations, quality and strategic management (Mohan, 2012). The components of value analysis model are linked together through information flow and system adjustment processes. The model works in harmony, with no component working at the expense of the other. Through this sustainable performance is achieved. This process was important in understanding the combined effect of supply chain practices through its components on sustainable supply chain performance. This theory was central in analysing the influence of supply chain practices in the value chain of textile firms in Kenya, and understanding its contribution to sustainable supply chain performance.

5. Empirical Review

Modularity-Based Manufacturing

Modularity-based manufacturing practices are a set of actions that enable firms to achieve modularity in product design, production process design, and organizational design (Tu*et al.*, 2004). Schilling and Steensma (2001) suggested that systems will have higher degrees of modularity when their components can be disaggregated and recombined into new configurations with little loss of functionality. A complex system can be easily managed by dividing it into smaller modules and examining each piece separately. The potential benefits of modularity include economies of scale, increased feasibility of product/components change, increased product variety and reduced lead time, decoupling tasks and ease of product upgrade, maintenance, repair, and disposal (Coronado *et al.*, 2004). Modularity manufacturing is viewed in three stages of product modularity, process modularity and dynamic teaming.

Product modularity is defined the practice of using standardized product modules so they can be easily reassembled/rearranged into different functional forms, or shared across different product lines (Tu*et al.*, 2004). Process modularity on the other hand is the practice of standardizing manufacturing process modules so that they can be re-sequenced easily or new modules can be added quickly in response to changing product requirements (Tu*et al.*, 2004). To support these processes is the need for dynamic teaming, which involves having flexible and adaptive functional team in the manufacturing process. Today's rapidly changing manufacturing environment requires a dynamic team structure that is different from traditional cross-functional teams.

Supply Chain Relationship Management

Supply chain relationship management is defined as activities undertaken by an organization to promote effective management of supply chain engagements both in upstream flow and downstream flow (Lapide, 2013). Donlon (1996) considered outsourcing, supplier partnership, information sharing, cycle time compression, and continuous process flow, as supply chain relationship elements. Further, he classified supply chain in three stages of strategic supplier partnerships, customer relationships and information sharing.

Strategic supplier partnerships defined as the long term relationship between the organization and its suppliers within the relationship spectrum. It is designed to leverage the strategic and operational capabilities of individual participating organizations to help them achieve significant ongoing benefits. Strategic partnerships with suppliers facilitate organizations to work closely and effectively with a few suppliers thus giving the partners shared benefits (Thatte, 2007).

Customer relationshipis seen as the entire spectrum of practices that are employed for the purpose of managing customer complaints, building long-term relationships with customers, and improving customer satisfaction (Li *et al.*, 2005). An organization's customer relationship practices can affect its success in supply chain management efforts as well as its performance. Information sharing means distributing useful information for systems, people or organizational units. According to Mäkinen (2017), information sharing can take the different forms across the supply chain stages (Marinagi, Trivellas and Reklitis, 2015).

Supply Chain Integration

The concept of supply chain integration has recently gained widespread attention as firms are now under increased pressure to make their supply chain competitive through integration (Danese& Romano, 2011). Flynn et al. (2010) defined supply chain integration as "the process through which a manufacturer strategically collaborates with its supply chain partners and manages the collaboration process.Supply chain integration can be seen at two broad levels; external integration and internal company integration. While external integration examines integration that occurs between the firm and its suppliers and customers, internal company integration is associated with the integration of the production and supporting functions within the organisation (Schoenherr&Swink, 2012).

External integration refers to the integration of the company with its external environment including customers and suppliers. Internal integration refers to breaking down the functional barriers and working with the different divisions within the organisation as a single unit. The organisation functional divisions are viewed as an integrated process rather than functional silos based on traditional departmentalisation and specialisation (Flynn et al., 2010).

Another type of integration involves vertical integration. Vertical integration can be described bringing various business activities under the management of a single company. It can be realised through two approaches: vertical financial ownership; and vertical contracts.Vertical financial ownership involves mergers and acquisitions, while vertical contracting, which includes exclusive dealing, resale price maintenance, and exclusive territories (Huang, Yen & Liu, 2014).

Supply Chain Responsiveness

Supply chain responsiveness is defined as the capability of promptness and the degree to which the supply chain can address changes in customer demand (Koçoglu*et al.,* 2011). This supply chain practices is central in helping firms respond quickly to changing customer needs in the competitive business environment (Muhammad, Sule, Sucherly and Kaltum, 2016). Supply chain responsiveness can be viewed in terms of operation system responsiveness, logistics process responsiveness and supply network responsiveness.

Operations system responsiveness is defined as the ability of a firm's manufacturing system to address changes in customer demand. Operations system responsiveness includes both manufacturing and service operations. Logistics process responsivenessis defined as the ability of a firm's outbound transportation, distribution, and warehousing system to address changes in customer demand. These activities include warehousing, packing and shipping, transportation planning and management, inventory management, reverse logistics, and order tracking and delivery (Thatte& Agrawal, 2017). Supplier network responsiveness is defined as the ability of a firm's major suppliers to address changes in the firm's demand both in production and in downstream. A key to responsiveness is the presence of responsive and flexible partners upstream and downstream of the focal firm. The ability of firms to react quickly to customer demand is dependent on the reaction time of suppliers to make volume changes (Thatte, Rao, & Ragu-Nathan, 2013).

Sustainable Supply Chain Performance

Sustainable supply chain management (SSCM) is the management of supply chain operations, resources, information, and funds in order to maximize the supply chain profitability while at the same time minimizing the environmental impacts and maximizing the social well-being (Hassini et al. 2012). Cetinkaya et al. (2011) used the concept of a balanced scorecard to provide measurement indicators of sustainable supply chain performance. These he categorizes into three main categories of economic, environmental, and social.

Environmental dimension (Patlitzianas et al., 2008) proposes the use of ISO 14031, part of the ISO 14,000 family of standards. They incorporate the following environmental measures: fugitive non-point air emissions, stack or point air emissions, discharges to receiving streams and water bodies, underground injection on-site, releases to land on-site, discharges to publicly owned treatment works, other off-site transfers, on-site and off-site energy recovery, on-site and off-site recycling, on-site or off-site treatment, spill and leak prevention, total electricity use, total fuel use, total materials use other than fuel, and total water use. (Patlitzianas et al. (2008); Gunasekaran*et al.*, 2001)

Economic dimension (Wang, 2012; Bai et al., 2012) relates to financial performance in a sustainable way to both environment and stakeholders. Social dimension (Norman and MacDonald, 2004) concentrates on social concerns and offer the framework. They classify social indicators into five aspects, diversity, unions/industrial relations, health and safety, child labour, and community. This paper conceptualized sustainable supply chain performance along these three components.

Supply Chain Practices

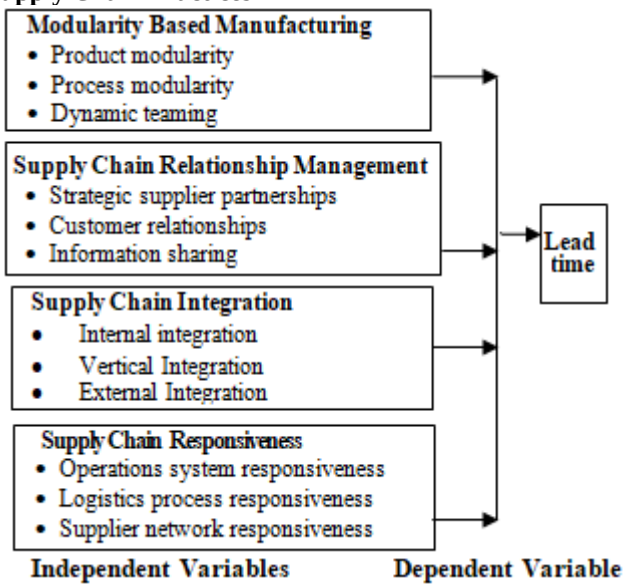

Figure 1: Conceptual Framework

Research Methodology

The study adopted a cross-sectional descriptive study design. Cross-sectional descriptive study design was selected

because it allowed for testing of relationship between supply chain practices and sustainable supply chain performance. The study target population of the study were the 59 textile and apparel firms in Kenya. These consists of twenty (20) companies that operate in Kenya's EPZ and 39 companies that operate under MUB (manufacture under bond) scheme under Kenya Association of Manufacturers of which both are under AGOA. Out of the targeted 59 firms, only 55 firms participated in the study. The study targeted one key informant from each firm thus bringing the total sample to 59. The key person was selected based on their knowledge on performance measures used in the study.The study used census to select the participating firms since the target population of the firms was small. After the selection of participating firms through census, the study used purposive sampling to select the respondents who participated in the study. This was used to select respondents who met the inclusion criteria of the study. A pilot study was undertaken on one company, with data collected from that firm used to test the reliability and validity of the questionnaire.

The study relied on primary data, with data collected through questionnaires. Questionnaire was self-administered to the senior executives and middle level managers of the textile and apparel industries. Both descriptive statistics and inferential statistics were used in analysis of data through SPSS version 24. Before carrying out inferential statistics, diagnostics tests were carried out. ANOVA was used to test the relationship between supply chain practices and lead time in the study.

Regression Analysis between Supply Chain Practices and Lead time

From the table 1 below, the study indicated that supply chain practices contributes to 57% of change in lead time. The R^2 value of 0.5746 implies that the supply chain practices explained 57% percent of the variance in lead time of textile firms while 43% of the change in lead time firm can be explained by other study variables excluded in the model.

Table 1: Model Summary

Model	R	R Squared	Adjusted R Squared	Std. Error of the Estimate
1	0.758	0.5746	0.5145	3.2890

Table 2: ANOVA

Model	Sum of Squares	DF	Mean of Square	F	Sig
Regression	9.381	1	9.381	4.6795	0.029
Residual	108.258	54	2.0047		
Total	129.822	55			

The F value of 4.6795 shows that the association between supply chain practices and lead time measures was significant at $p<0.05$. Thus it can be concluded that the model is appropriate in analyzing the relationship between supply chain practices and lead time in textile and apparel industry.

Table 3: Regression Coefficients

Model	Unstandardized Coefficients		Standard Coefficients	t	Sig.
	B	Standard Error	Beta		
Constant	0.145	0.267		1.18	0.043
Modularity Manufacturing	-0.133	1.362	-0.892	2.345	0.033
Supply relationship management	-0. 103	4.953	-.059	2.748	0.027
Supply chain integration	0.0513	0.6033	0.624	0.885	0.321
Supply chain responsiveness	-0.046	0.4972	-0.582	3.773	0.012

From table 3 above, results shows that modular manufacturing X1 with (β =-0.133, $p< 0.05$) has the strongest relationship with lead timeof textile firms in Kenya, then followed by Supply relationship management X2 (β =-0.103, $p< 0.05$) and finally supply chain responsiveness X4(β =- 0.046, $p< 0.05$). However, supply chain integration was established to have no significant relationship with lead timeof textile firms in Kenya.

From the study findings it was revealed modularity based manufacturing negatively influences the lead time of textile firms. The results show that a unit change in dynamic teaming leads to change of 0.133 on lead time of textile firms. This demonstrates that that dynamic teaming holds potential in reducing lead time in textile firms. According to Sudarshan& Rao (2013) argues that team approach has the advantage of pushing garments faster while enabling the operators to respond to customer requirement much faster. It allow employee to take responsibilities for their processes therefore ensuring quality output. This therefore contributes to manufacturing agility and reduction in lead time. Process modularity and product modularity enables textile firms to produce products based on order requirement. In addition, product modularity ensures iimproved component availability there by reducing cycle time (Jacobs et al., 2007). This results support the findings of Vickery et al.,(2016) who established that product modularity has a negative effect on manufacturing lead time.

Concerning the effect of supply relationship management on lead time the study revealed that supply relationship management reduces lead time in textile firms. The study indicated that an increase in unit of supply chain relationship lowers lead time by 0.103 units. This suggests that product modularity leads to reducing in cycle time. Supply relationship management allows partners in supply chain cooperate and gain commitment on delivery of supplies. As a result firms which have strong supply relationship management are more likely to experience lower lead time(Hassini, Surti, & Searcy, 2012). These results concur with the results of Chiu &Okudan (2014) who established that supply relationship management reduces cycle's times in manufacturing firms.

On supply chain integration, the study findings indicated that there exists no relationship with lead time. This demonstrates that supply chain integration does not necessarily reduce lead time in textile firms. Although many companies desire to fully integrate supply chain process, the

reality is that this does not happen an envisaged thereby limiting the potential impacts on operational performance of firms (Bai, Sarkis, Wei, & Koh, 2012). Organizations do not perform better when they fail to develop better configurations of interconnected elements (Drazin and Van de Ven 1985; Sinha and Van de Ven 2005).These results contradict the findings of Saleh (2015) who found out that supply chain integration leads to improved operational performance in manufacturing firms.

Finally, the study results also revealed that there exists a negative relationship between supply chain responsiveness and lead time. This implies that level of supply chain responsiveness is associated with shorter order cycle time. This is attributed to existences of flexibility across the supply chain in textile firms (Zelbst et al., 2009). These findings support the results in study by Hsu et al. (2009) who concluded that supply chain responsiveness leads to reduction in lead time.

6. Conclusion and Recommendation

The study findings highlight the importance that supply chain practices play on operational performance of textile and apparel firms. The findings show that supply chain practices significantly affects the lead time of textile firms. Thus it can be concluded from the study that supply chain practices holds great potential in reducing lead time in the textile industry. Further the findings showed that modularity and supply relationship management reduces lead time greatly. This demonstrates that modularity manufacturing and supply chain relationship are of highest importance in enhancing the social sustainable supply chain performance in textile industry. It is recommended that textile and apparel firms should work to adopt modular based practices, establish strategic collaboration with suppliers and buyers and establish ensure supply chain flexibility in order to reduce leads times in textile industry. It is advisable for the managers in textile industry to pay more attention to the adopting best supply chain practices as a way to improve the operational performance of the textile and apparel firms.

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