ANALYSIS OF SUPPLY CHAIN AS AN EFFECTIVE MANUFACTURING STRATEGY TOOL FOR A TEXTILE MANUFACTURING FIRM

S. Mhlanga¹, C.T. Mutopa², M. Mushininga³
¹Faculty of Engineering and the Built Environment
University of Johannesburg, South Africa
smhlanga126@gmail.com

²,³Department of Industrial and Manufacturing Engineering
National University of Science and Technology, Bulawayo, Zimbabwe
mutopact@gmail.com
³manfred.mushininga@gmail.com

ABSTRACT

Supply chain issues have become critical for an operation’s ability to manage raw material supply, processing of these raw materials into products and their delivery to customers in an efficient manner. As a matter of fact, supply chain management is a key attribute in a globally competitive environment because it dictates the firm’s delivery performance through the control of products or services from suppliers to processing stages up to the end customer. So it is critical for a firm to ensure that each member of the supply chain contributes to the desired mix of competitive priorities, that is, quality, speed, dependability, flexibility and cost required by the end customer. This paper sought to establish the supply chain issues pertaining to KM Textiles as well as determining any improvements which could be done to improve the system. It concludes by analysing the current suppliers, and customers; among other collaborators, and suggesting areas for improvement to reduce manufacturing costs for the Zimbabwean textile manufacturing company.

* Corresponding author
1 INTRODUCTION

According to Kurien et al. [1], organizations need to capitalize on Supply Chain (SC) capabilities and resources to bring products and services with the appropriate features to the market faster, at the lowest possible cost, and the best overall value. As a result, companies can no longer focus on optimizing their own operations to the exclusion of their suppliers’ and customers’ operations [2]. Hence, supply chain management is central to a firm’s ultimate performance on the market. Flynn et al. [3] suggested that in order to be successful in today’s competitive manufacturing environment, companies must be more responsive to the constantly changing needs of their customers and concentrate resources on their core competencies. Gunasekaran et al. [4] points out that it is pivotal for a firm to properly manage its inbound logistics (raw material supply), the processing of the raw materials at a low cost whilst meeting the quality requirements, and its outbound logistics (delivery to customers). Suwanruji et al. [5] outlines the fact that advances in manufacturing strategies like the Just-In-Time (JIT) principle have put pressure on supply chain dynamics whereby managers have to reduce raw material inventories as well as work in progress in the plant thereby placing further dependence on suppliers to meet raw material supply on time to reduce manufacturing costs. Nair et al. [6] highlighted the fact that the pace of change and the uncertainty about how markets will evolve has made it increasingly important for companies to be aware of the supply chains they participate in and to understand the roles that they play to gain competitive advantage. Rudberg et al. [7] presented that the purchasing function in a firm was traditionally viewed as a transaction oriented function but the evolution of supply chain issues in raw material supply made it to play a more strategic role in determining the overall success of the firm. A study by Ribas et al. [8] found out that Nestlé India’s supplier development department managed to cut costs by overcoming quality and food safety issues, and creating a wider, more flexible supply base through provision of technical assistance, and support to suppliers’ management systems and products. The research findings estimated that the company has saved over US$5 million in 5 years by developing over 70 new Indian suppliers who meet standards, and the initiative has been so successful such that the company replicated it in Bangladesh, Brazil, Indonesia, Iran, Malaysia, Russia and South Africa. This study sought to understand the supply chain strategy applied by KM Textiles, and how it has contributed to the success of the firm in reducing manufacturing costs, skill improvement, increase in throughput, and gain of market share in a dynamic global market. The case study textile manufacturing firm is a member of ZSW Limited a group of companies which include its spinning division. In addition, the firm produces a wide range of cotton based fabrics for industrial use, for both the local and global market.

2 LITERATURE REVIEW

2.1 Linking corporate strategy and competitive strategy to supply chain strategy

Rudberg et al. [7] points out that fierce competition in today’s global markets, the introduction of products with shorter life cycles, and the heightened expectations of customers have forced business enterprises to invest in, and focus attention on, their supply chains. In today’s competitive market, manufacturing industries have to satisfy more diverse queries from the market, such as widening the product ranges, increasing quality and precise delivery time [6]. Datta et al. [9] suggests that manufacturing companies need to be knowledge-intensive and highly creative to develop new products. Kurien et al. [1] defines Supply Chain Integration (SCI) as the degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages intra- and inter-organization processes. The authors highlights that the ultimate goal of SCI is to achieve effective and efficient flows of products and services, information, money and decisions, to provide maximum value to the customer at a low cost and high speed (using advances in communications and transportation technologies). Datta et al. [9] presented the fact that in
a typical supply chain, raw materials are procured and items are produced at one or more factories, shipped to warehouses for intermediate storage, and then shipped to retailers or customers. Consequently, to reduce cost and improve service levels, effective supply chain strategies must take into account the interactions at the various levels in the supply chain [10]. Peidro et al. [11] points out that the Supply Chain (SC) planning problem can be decomposed according to the time horizons considered, which results in strategic, tactical and operational decision models that can be applied to SC planning. Rudberg et al. [7] outlines the fact that strategic planning models affect SC design and configuration over a relatively long time (5 to 10 years) whereas tactical planning models attempt to adopt the most optimum use of the various resources, including manufacturing plants, warehouses, suppliers, distribution centres, and transport; among others, with planning times lasting 1 or 2 years. According to Ribas et al. [8], operational planning models are related to the detailed scheduling definition, sequencing, lot size, assigning loads and vehicle routes; among others. Wilding [12] gives an overview of the corporate strategy formulation to gain competitive advantage and how it is linked to supply chain strategy as shown on Figure 1.

Figure 1: Supply Chain Innovation, Linking Corporate Strategy and Competitive Strategy with Supply Chain Strategy - Adapted from Wilding [12]

2.2 Supply Chain Performance

Cagnazzo et al. [13] proposed that a supply chain measurement system must place emphasis on three separate types of performance measures, namely: resource measures (generally costs), output measures (generally customer responsiveness), and flexibility measures (ability to respond to a changing environment). Morgan [10] addressed that these three types of performance measures have different goals and purpose. Kurien et al. [1] suggested that some of the resource measures include: inventory levels, personnel requirements, equipment utilization, energy usage, and cost; whereas output measures include: customer responsiveness, quality, and the quantity of final product produced. Rudberg et al. [7] outlines that flexibility measure a system's ability to accommodate volume and schedule fluctuations from suppliers, manufacturers, and customers. Figure 2 shows performance measures and metrics in a supply chain.
Figure 2: Measures and metrics at five basic links in a Supply Chain - Adapted from Kurien et al. [1]

2.3 The Value chain analysis as a source of competitive advantage

Chiang et al. [2] highlighted that the supply chain, also known as the logistics network, consists of suppliers, manufacturing centres, warehouses, distribution centres, and retail outlets, as well as raw materials, work-in-process inventory, and finished products that flow between the facilities. According to Porter et al. [14], competitive advantage grows fundamentally out of the value a firm is able to create for its end customers. The authors use the concept of a value chain to disaggregate buyers, suppliers and a firm into discrete but interrelated activities from which value stems as depicted on Figure 3. Suwanruji et al. [5] points out that value chain analysis is critical to supply chain in terms of recognizing and creating actions that support the selected generic strategy. That is, a firm applying a cost leadership strategy (pricing) or differentiation strategy (product characteristics) would initiate suitable activities throughout its value chain. The discrete value activities (primary and support activities) are the building blocks of the value chain and provide linkages crucial for competitive advantage through co-ordination with business partners [14]. Flynn et al. [3] suggested that linkages not only exist within a firm’s value chain, but between a firm’s chain, and the value chain of suppliers and channels (vertical linkages) thereby providing potential benefits of integration for competitive advantage.
Figure 3: Value chain as a source of competitive advantage in supply chain - Adapted from Porter et al. [14]

2.4 Factors Impacting the Supply Chain

Nair et al. [6] and Rudberg et al. [7] summarize the factors impacting on supply chain strategy formulation as follows:

- Reduced number of suppliers - the concept of supply chain has forced firms to reduce the number of vendors they deal with in order to reduce costs and establish long term relationships with a few highly reliable suppliers.
- Increased competition - the increase in the number of competitors that offer similar products in the market put pressure on firms to clearly focus and develop robust supply chains which reduce cost and offer the best value to the end customer.
- Shorter product life cycles - as competition introduces new products, firms are forced to shorten product life cycles and this call for flexible processes that can be converted easily to new product requirements.
- Increase in supplier managed inventories - most firms empower their suppliers to replenish low cost components whenever they are needed in the production system. Hence, suppliers have direct access to the manufacturing plant and usually restock items at the workstations where they will be used.
- Advances in technology - the advent of technology have a significant impact on supply chains where Electronic Data Interchange (EDI) is used to link the firm’s database to supplier and customer databases. Quick response strategies are supported by technology advancement.
- Shared or reduced risk - the rise of shorter product life cycles expose firms to risk associated with new product developments. Hence, firms share this risk with their suppliers and customers whenever a new product is introduced on the market.
3 RESEARCH METHODOLOGY

3.1 Research design

In this study a case study research design was used to tap data on the supply chain strategies applied by the textile manufacturing firm. The unit of analysis in this study is KM Textiles. Furthermore, this study applied both quantitative and qualitative data collection methods. Interviews were used as the main research instrument complimented by observations and archival records to extract key data for the research. Stratified random sampling was used in selecting research participants in order to ensure representation.

3.2 Data collection

The research interviews were carried out on 10 head of departments and 20 supervisors (2 employees from each department) selected on the basis of work experience, covering a range of 5 to 10 years. Furthermore, the General Manager (GM) of the organization was also interviewed on key issues affecting the supply chain and the future plans to develop the value chain. During these interviews the researcher wanted to extract data on the different types of raw materials used by the firm in its processes and the suppliers of these raw materials. The interviews were also focusing on the processing stages that the raw materials pass through until delivery to the end customer, and the various customers directly linked to the firm. In this study the researcher wanted to understand the level of integration between the firm and its suppliers as well as customers. The interview response was encouraging and provided key data required for the study. It was found that 8 out of 10 (80 percent) interviewed head of departments were at least 5 years old at the company whilst 17 out of 20 (85 percent) interviewed supervisors were at least 8 years old at the company. This provided the researchers with the necessary data about the supply chain issues related to the firm and the various collaborations involved. Observations and archival records were used to show production sequence, and to provide data on various production stages that the different products manufactured by the company go through.

3.3 Data analysis and presentation procedures

In analysing the research data, both qualitative and quantitative methods were used. A qualitative approach was applied on explanation of the supply chain issues applied by the firm and the quantitative approach was used through statistical and graphical illustrations of the data collected to provide key information for the study. The study results explains the current supply chain strategy applied by the firm and the improvements which can done in order to come up with an optimum result to help reduce production costs, improve production flow and ultimately reduce cost for the end customer.

4 DATA PRESENTATION AND DISCUSSION OF RESULTS

This section outlines the research findings on supply chain strategies applied by the textile manufacturing firm in its quest to gain competitive advantage in a volatile global market. More so, the discussion of the results was done to bring about key information about the company’s key suppliers, production processes and customers; among others. The study results further outlines the strength and weaknesses of the firm’s supply chain system and how it can use other strategies to improve its supply chain to gain competitive advantage over its rivals.

4.1 The major inputs, processes and outputs for the firm

The research interviews, observations and archival records provided key information on the major inputs, processes, and outputs of the textile manufacturing firm in order to highlight issues of supply chain management. The information depicted on Table 1 shows how the organization sources its major inputs. That is, the firm acquires most of these inputs from
local retailers (39 percent) and South African suppliers (43 percent), with only a few from global suppliers (18 percent) as shown on Figure 4. It is vital to note that local retailers and South African retailers are middlemen accordingly, and it is expensive to buy from middlemen.

Table 1: Results on inputs, processes and outputs of the firm

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Major Inputs</th>
<th>Primary Source</th>
<th>How the company acquire the resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sizing agents</td>
<td>Asia</td>
<td>Imports from South Africa</td>
<td></td>
</tr>
<tr>
<td>Dyes</td>
<td>Asia and Europe</td>
<td>Local retailers, South Africa and Global sources</td>
<td></td>
</tr>
<tr>
<td>Sodium Hydroxide</td>
<td>Asia</td>
<td>Local retailers</td>
<td></td>
</tr>
<tr>
<td>Hydrogen Peroxide</td>
<td>Asia</td>
<td>Asia</td>
<td></td>
</tr>
<tr>
<td>Other chemicals</td>
<td>Asia</td>
<td>Local retailers and Asia</td>
<td></td>
</tr>
<tr>
<td>Auxiliaries</td>
<td>Asia and Europe</td>
<td>Local retailers</td>
<td></td>
</tr>
<tr>
<td>Finishing chemicals</td>
<td>Asia and Europe</td>
<td>Local retailers and also from South Africa</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Processes</th>
<th>Major Processes</th>
<th>Resource Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinning</td>
<td>Cotton lint, Lubrication and gearbox oils, and imported machine spares</td>
<td></td>
</tr>
<tr>
<td>Sizing and Weaving</td>
<td>Sizes, oils, yarn, and imported machine spares</td>
<td></td>
</tr>
<tr>
<td>Pre-treatment</td>
<td>Chemicals, greige fabric, oils, and imported machine spares</td>
<td></td>
</tr>
<tr>
<td>Dyeing</td>
<td>Bleached fabric, dyes and auxiliaries, oils and imported machine spares</td>
<td></td>
</tr>
<tr>
<td>Finishing</td>
<td>Bleached or Dyed fabric, finishing chemicals, oils and imported machine spares</td>
<td></td>
</tr>
</tbody>
</table>

All Wet processes need coal for boilers to generate steam for production machines

<table>
<thead>
<tr>
<th>Outputs</th>
<th>Major Outputs</th>
<th>Target Market</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Fabrics (Greige, bleached, white or dyed)</td>
<td>Local, Export and Global</td>
<td></td>
</tr>
<tr>
<td>Medical Textiles (Theatre gauzes, bandages, swabs)</td>
<td>Local, Export and Global</td>
<td></td>
</tr>
<tr>
<td>Napkins</td>
<td>Local</td>
<td></td>
</tr>
<tr>
<td>Sheets</td>
<td>Local, Export and Global</td>
<td></td>
</tr>
<tr>
<td>Other Products</td>
<td>Local</td>
<td></td>
</tr>
</tbody>
</table>

It was highlighted during interviews that although South African suppliers manufacture some chemicals like sizing agents and reducing agents, the raw materials used are sourced from Asia. Therefore, it could be better if the firm considers bulk purchasing of major raw materials (inputs) directly from source. The firm’s major processes use dyes and chemicals, gearbox oils, and machine spares; among other key components which are imported which need cash flow to acquire. It is critical to note that the rise of global manufacturing champions call for the firm to consider long term synergies with reliable global suppliers of
key dyes and chemicals used in the textile manufacturing process. This will provide an impetus against world leaders in textile manufacturing like China, India and other Asian countries. Although these raw materials come from China and Asia in general; the creation of long term strategic alliances with these global suppliers will mean reduced prices of raw materials through bulky purchases or purchasing as a consortium.

Figure 4: Sources of raw materials for the textile manufacturing firm

The collected data for the research provided key information on contribution of raw materials to manufacturing costs. It was highlighted that dyes and chemicals (used in pre-treatment and dyeing processes) as depicted on Figure 5 are the major contributors to cost with 47 percent, followed by machine spares with 17 percent, auxiliaries with 9 percent, finishing chemicals with 8 percent and hydrogen peroxide with 7 percent; among others.

Figure 5: Contribution of various raw materials to manufacturing costs
4.2 Market for the firm’s products

It is pivotal to note that firms initially desire to saturate the Zimbabwean market and as it learns the manufacturing system it goes into the regional export market and lastly global market as economies of scale are realised. That is, the goal is to increase shareholder value as the firm matures in the industry. Generally, most of the products from the firm are sold locally (48 percent) with 37 percent going into the SADC region, and the remaining 15 percent into the global market as depicted on Figure 6. The African Growth and Opportunity Act (AGOA) eliminated tariff and quota restrictions to the United States market for sub-Saharan Africa countries that managed to get their visa systems approved. However, the Zimbabwean textile manufacturing sector failed to access the American markets due to failure by the government to meet AGOA standards on corporate governance. This revealed the requirement for the firm to come up with marketing strategies to manage their supply chains effectively to provide a viable market for the firm’s products globally.

![Figure 6: Distribution of customers for the textile manufacturing firm’s products](image)

4.3 Use of information technology (IT) by the firm to provide quick response

Global competition forces companies to opt for an extended enterprise within the framework of supply chain to provide a link within the firm’s value chain as well as linking with suppliers and buyers of the firm’s products. The study found out that the organization has only departmental systems which do not integrate the whole company, that is, it has Manufacturing Information Systems (MIS) as standalone systems. For example, most of the firm’s manufacturing systems have SCADA systems, accounting department uses ACCPAC package which is also linked to the purchasing department and human resources department uses e-business Skillset Enhancement Tool (ESET) for employee database and payroll management. The interview results on 10 managers and 20 supervisors depicted on Figure 7, pertaining to their opinion on the current Information Technology (IT) used by the firm revealed that 53 percent advocates for staying with the current system, 27 percent wants a system upgrade and the remaining 20 percent wants the firm to purchase a new IT system. Generally, the results show a reluctant desire by the firm’s management to acquire a new Enterprise Resource Planning (ERP) system, to aid its supply chain.
It was found out that the organization is using Outlook Express for Intranet (departmental links) communications and Internet to link with business partners. However, there are no database linkages with suppliers for stock replenishments and customers for checking finished product availability; among other issues. As a matter of fact, these systems need to be fully integrated with suppliers and customers through the use of Enterprise Resource Planning (ERP) systems such as SAP, Oracle, People-Soft, BAAN, and SAGE; among other packages. The extended enterprise demands commercially available tools for the integration of applications in a supply chain. This poses a challenge to the firm to adopt modern IT system in order to achieve responsiveness in the supply chain.

4.4 Value chain analysis (future plans)

In this study it was found out that value chain analysis is pivotal to supply chain strategy implementation and provides the basis for carrying out a resource audit. During interview with the company’s General Manager it was highlighted that the firm has future plans to effectively use the value chain to support its linkages with suppliers and customers as shown Figure 8.
5 Recommendations

In order to keep pace with global manufacturing standards, supply chain management must be the top priority for KM Textiles, and the following need to be done by the firm to improve its supply chain:

- To create synergies or long term relationships with global suppliers of key raw materials like dyes and chemicals, machine spares and auxiliaries; among others so as to reduce manufacturing costs related to raw material sourcing.
- To partner companies in the global textile industry in order share data on sales trends, forecasting data, and production schedules, promotional plans, engineering changes, new product development plans and global product enhancements. Data sharing benefits a company’s operations and helps it better understand the needs of its customers.
- To purchase new Information Technology (IT) systems such as acquiring ERP systems which provide a link to all departments as well as linking with business partner databases. This provides a basis for rapid response and real time information provision for quick decision making.
- To carry out benchmarking (internal, external, competitive and performance) in order to determine the gap between the current and the required performance.
- To train employees in order to develop skills so that the workers become the drivers of supply chain strategy. Training is critical to support customer service excellence.
• To carry out a marketing drive to increase global market share for the firm’s products by focusing on developing robust delivery and communication systems with customers.

6 CONCLUSIONS

The study found out that the challenge in today’s global business is to identify the appropriate supply chain solutions to meet the different needs of the different product or market characteristics. Value chain analysis was found to be critical to a manufacturing firm because it provides a basis for a resource audit to determine the gap that need to be filled-in to create a competitive supply chain system. The study found out that well managed supply chains reduce manufacturing costs through synergies thereby creating value for the end customer. It was observed that in order to achieve a robust supply chain, a suitable information system integrating Enterprise Resource Planning (ERP), Electronic Data Interchange (EDI), and the Internet is important for improving communication and ensuring a smooth flow of materials along the value chain. The effective implementation of Information Technology (IT) by manufacturing firms is highly desirable if a supply chain is to be responsive and flexible. In addition, it is also appropriate to carry out benchmarking, to determine performance measures, and metrics to build a competitive supply chain. With the dynamism in the world market today, it is clear there is still room for improvement in managing raw material supply and delivery of products to end customers by KM Textiles that will keep it with a competitive edge over its rivals.

7 REFERENCES


