LEAN MANUFACTURING AND OPERATIONAL PERFORMANCE OF MUMIAS SUGAR COMPANY LIMITED, KENYA

BY

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DECLARATION

I declare that this research project is my original work and has never been submitted to any other University for assessment or award of a degree.

Signature…….. Date……..……

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D61/76277/2012

This project has been submitted for examination with my approval as the University Supervisor.

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DEDICATION

I thank God Almighty for having given me wisdom and strength to see me through this project to the very end. This project is dedicated to my family for their support and encouragement. I wish to thank my friends and mentors who have encouraged while I undertaking this project.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

ARIMA: Autoregressive integrated moving average

COMESA: Common Market for Eastern and Southern Africa

DCS: Distribution Control System

GDP: Gross Domestic Product

ISO: International Organization for Standardization

JIT: Just In Time

KPIs: Key Performance Indicators

KSB: Kenya Sugar Board

KSI: Kenya Sugar Industry

MSC: Mumias Sugar Company

OM: Operations Management

SCADA: Supervisory Control And Data Acquisition

SPSS: Statistical package for the Social Sciences

TPS: Toyota Production System

TQM: Total Quality Management

USD: Unites States of America Dollar

ABSTRACT

Lean manufacturing focuses on creating more value for customers by eliminating activities that are considered waste. This study sought to determine the effect of lean manufacturing practices on operational performance of Mumias Sugar Company Limited, Kenya. The research methodology adopted was a descriptive case study using Mumias Sugar Company Limited as the unit of study. Data was collected by use of an interview guide and was analyzed by use of content analysis. The research findings revealed that Mumias Sugar Company Limited has averagely implemented lean manufacturing practices. The effect of lean manufacturing on operational performance was cited as being positive. There has been reduction of waste and improved quality in operations due to standardization of processes. The main driver of lean manufacturing is cited as the need to improve factory time efficiency. Benefits derived from implementation of lean include: improved housekeeping of plant, improved efficiencies and standardization of processes. The major challenge that faces Mumias Sugar Company Limited is lack of management support and resistant to culture change. In conclusion, Mumias sugar company ltd has not strictly adhered to the application of lean management practices and therefore not enjoying its full benefits. Based on the findings of the study it is recommended that Mumias Sugar Company limited adopts full implementation of lean manufacturing practices to realize the full benefits of lean manufacturing. These findings should also help in encouraging the widespread adoption of lean manufacturing practices in the Kenya Sugar Industry. It is recommended that more research be done not only in the Kenya sugar industry but in Kenya. Future researches should try to evaluate Lean management approach to business management in the Kenya sugar industry.

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CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Manufacturing organizations today face different challenges from management of waste to improving performance. As the industrial environment becomes more competitive many have over the time adopted lean systems in order to remain competitive. The adoption of lean philosophies such as Total Quality Management (TQM), Just In Time (JIT), Kaizen, has led to operational and strategic gains for the manufacturing and service organizations (Openda, 2013). Performance of a manufacturing company is greatly affected by the manufacturing practices adopted. In the 21st century, many manufacturing companies have adopted and continue to adopt lean manufacturing systems. According to Alagumurthi and Ramachandran, (2013), lean manufacturing techniques have facilitated manufacturing plants to dramatically increase their competitive edge. Ondiek and Kisombe (2012) highlight that Lean manufacturing was first developed at Toyota plant in Japan and has become a very popular production system improvement philosophy.The adoption of lean systems in manufacturing operations is seen to improve operational performance. Alagumurthi and Ramachandran (2013), notes that many companies have implemented lean manufacturing techniques to create more efficient workflows. The focus of many organizations as pointed out by Muhamad et al. (2012), has been on increasing operational efficiency, reducing costs, enhancing quality levels, ensuring steady profits, and meeting customer needs. Performance focused companies have resulted to adopting lean manufacturing as part of a performance improvement strategy. The effectiveness of lean manufacturing is the impact it has on performance of manufacturing companies. Various lean manufacturing practices have various effects on performance. Such effect is seen through indicators of performance such as; factory time efficiency, improvement of quality of products, reduction of waste, improved inventory management, improvement in productivity and reduction in lead time cost, among others.

High cost of production is partly due to inefficiencies in production and wastages. According to researches done, most of the local sugar factories have adopted some lean manufacturing systems. Despite the adoption of these lean manufacturing practices Mumias sugar company ltd performance is seen to be fairly poor. According to Mumias

sugar company ltd Annual Report & Financial Statements (2013 and 2014), Mumias sugar reported a financial loss of 1.67 billion for financial year 2012/2013 and 2.7 billion for 2013/2014. The Cost of producing sugar in Kenya is higher than those in other producing countries in East Africa and COMESA member states. The Kenya Sugar Industry Strategic plan (2010-2014) puts the cost of producing sugar in Kenya at 415-500 USD/tonne while that of Uganda 180-190 USD/tonne and Tanzania at 140-180 USD/tonne. Evidently there are underlying issues that makes the cost of production in Kenya double that of its neighbors. Various challenges as reported by The Kenya Sugar Industry Strategic plan (2010-2014) highlights the following challenges faced by the Kenya sugar industry manufacturers, which include: irregular routine factory maintenance, low crushing capacity, low sugar extraction rates, slow adoption of new and appropriate technology, lack of industrial research, high cost of sugar production, narrow product base, dilapidated processing equipment, inefficient factory operations and wastage in cane yard.

Lean manufacturing is relatively linked to theory of constraints and systems theory. According Goldratt et al. (1992), the theory of constraints takes a scientific approach to improvement. It hypothesizes that every complex system, including manufacturing processes, consists of multiple linked activities, one of which acts as a constraint upon the entire system. Systems theory talks about design, developing of systems and how they work in unity. These theories are both systematic methods for improving operational performance of an organization.

1.1.1 Lean Manufacturing Practices

Lean manufacturing is a comprehensive set of techniques that, when combined and matured, will allow you to reduce and then eliminate the seven wastes (Apreutesei et al., 2010). The concept of lean was introduced by Toyota Motor Corporation, a Japanese automotive company during the 1950s. Before then it was known as Toyota Production System (TPS) whose sole objective was to reduce costs and improve productivity by eliminating wastes and other activities that did not add value to the final product (Openda, 2013).

The concept of lean is regarded to have been originated by Womack and Jones (1990). They developed five core principles to represent lean which includes identifying the value stream for each product and providing that value while challenging all of the waste steps; specifying the value desired by the customer; making the product flow continuously; introducing pull between all steps where continuous flow is impossible and managing toward perfection so that the number of steps and the amount of time and information needed to serve the customer continually falls. The effect of these techniques is what is seen to be the impact derived out of their adoption. Lean manufacturing is a philosophy of manufacturing that focuses on delivering the highest quality product on time and at the lowest cost (Apreutesei et al., 2010).There are various lean manufacturing tools and practices such as; Kaizen, Kanban ("pull" production), Poka –yoke (mistake proofing), just-in-time (JIT), total productive maintenance (TPM), Value stream mapping (VSM), total quality management (TQM), production smoothing, standardization of work, 5S and visual systems. These tools have different effectiveness on performance of a manufacturing company.

The elimination of waste as explained by Ondiek and Kisombe (2012) is the basic principle of lean. Lean manufacturing production systems were pioneered in Japan (Apreutesei et al., 2010). When the philosophy of lean is embraced production flow follows a simplistic approach and waste eliminated. Apreutesei et al., further note that with elimination of waste, quality improves while production time costs are eliminated. Womack and Jones (1996) observe that the principles of 'lean' focus on eliminating waste and non-value added activities in a process while maximizing the value-added tasks as required by the customer.

The main idea behind lean manufacturing is maximizing customer value while minimizing the seven deadly wastes (Alagumurthi and Ramachandran, 2013). Waste is an activity that does not add value to the product. In addition, a company can produce quality products at low-cost through elimination of waste along the entire manufacturing process.

1.1.2 Operational Performance

Voss et al., (1997) explains that operational performance is the measurable aspect of an organization's process. It most encompasses production reliability and defect rates, production cycle time, on time delivery, cost of quality and scrap minimization, productivity, and inventory.

Birech, (2011) outlines various performance measures as within operations area namely (i) standard individual performance measures include: productivity measures, quality measures, inventory measures, lead-time measures, preventive maintenance, performance to schedule, and utilization. (ii) Specific measures include: Cost of quality - measured as budgeted versus actual, variances - measured as standard absorbed cost versus actual expenses, period expenses - measured as budgeted versus actual expenses, safety - measured on some common scale such as number of hours without an accident, profit contribution - measured in dollars or some common scale.

Elisa, et al., (2013) comment that for those organizations that have adopted the Total Quality Management (TQM) approach, they have been shown to be positively associated with the improvement of general performance with higher operation efficiency and with better financial results. Elisa et al. (2013) conducted extensive empirical test on various OM practices effect on performance. Benefits in economic performance deriving from improved efficiency in operations, waste reduction and a new shared vision for continuous improvement were observed from test carried out on JIT. Hence Lean systems are seen to have a positive effect on organization operational performance.

1.1.3 Kenya Sugar Industry

According to The Kenya Sugar Industry Strategic plan (2010-2014), industrial sugarcane farming was introduced in Kenya in 1902. The first sugarcane factory was set-up at Miwani 10km north of Kisumu in 1922 and later at Ramisi in the Coast Province in 1927. After independence, five state-owned sugar factories namely: Muhoroni (1966), Chemelil (1968), Mumias (1973), Nzoia (1978) and South Nyanza (1979) were established. Later, West Kenya (1981), Soin Sugar Factory (2006) and Kibos Sugar & Allied Industries (2007) were established bringing the total number of milling companies to ten (10). The

two older factories later ceased operations. Butali Sugar Company was registered in the year 2005 and started producing sugar in 2011. Other private mills which include Transmara Sugar Company (2006), Kwale International Sugar Company (2007) and Sukari Industries (2007) have since been registered (The Kenya Sugar Industry Strategic plan (2010-2014)).

The sugar industry is a major contributor to the agricultural sector. The Kenya Sugar Industry Strategic plan (2010-2014) highlights that the sugar sector is the mainstay of the economy and supports livelihoods of at least twenty five percent of the Kenyan population. The subsector accounts for about fifteen percent of the agricultural GDP, is the dominant employer and source of livelihoods for most households in Western Kenya comprising Nyanza, Rift Valley and Western Provinces. The Kenyan sugar industry is protected by COMESA safeguard measures. The safeguards were first granted in 2004 and were to expire in February 2008. Kenya sought and was granted an additional four years of protection from March 2008 to February 2012. Sugar prices in Kenya need to drop by at least thirty nine percent to be in line with COMESA levels (The Kenya Sugar Industry Strategic plan (2010-2014).

1.1.4 Mumias Sugar Company Ltd

Mumias Sugar Company ltd (MSC ltd) was established in 1973 by the government of Kenya according to Kenya Sugar Industry Strategic plan (2010-2014). MSC ltd is a leading sugar producer in Kenya and a public company listed on the Nairobi Stock Exchange (Superbrands East Africa, 2008). Superbrands East Africa further reports that MSC ltd accounts for 60 percent of all sugar produced in the country. MSC ltd was the pioneer of branding in the sugar industry. MSC ltd is currently undertaking a feasibility study in Tana River, in conjunction with Tana and Athi Rivers Development Authority (TARDA) (Superbrands East Africa, 2008). Mumias Sugar Company ltd in its leadership role in the industry has diversified into power, water and ethanol production. The company has a capacity to produce 34MW of electricity of which 26MW is exported to the national grid. It also has the capacity to produce 24 million liters of water and 22 million liters of Ethanol annually. Mumias still maintains its dominance in the sugar

manufacturing sector. MSC ltd is a public company listed on the Nairobi Stock Exchange (Mumias Sugar Company ltd).

1.2 Research Problem

In the current millennia, firms are operating in highly competitive environments where resources are scarce and where uncertainty in business opportunities is common. Elisa et al., (2013), comment that the market imposes high efficiency standards and firms that fail to meet them are quickly marginalized. Lean manufacturing techniques have facilitated firms to dramatically increase their competitive edge (Alagumurthi and Ramachandran, 2013). Ondiek and Kisombe (2012) note that implementation of lean practices is frequently associated with improvements in operational performance measures. According to Ondiek and Kisombe (2012), the most common benefits related to lean practices are improvement in labor productivity and quality, along with reduction in customer lead time, cycle time and manufacturing cost.

A survey of the sugar sector in Kenya done by Ondiek and Kisombe (2012) aimed to examine the extent to which lean manufacturing tools and techniques have been adopted by sugar processing companies in Kenya and their impact on factory time efficiency. Ondiek and Kisombe (2012) recommended further research in the area of lean manufacturing, not only in the sugar sector but also in other areas of the Kenyan economy.

In Kenya, research on lean systems has majorly highlighted what lean systems have been adopted in both service and manufacturing industries. A case study of Bamburi cement limited by Rono (2013) looked at lean manufacturing practices in a continuous process industry. He pointed out that few scholars have investigated application of the lean manufacturing tools and techniques to a continuous process industry. His study reveals that lean manufacturing is not well implemented. Openda (2013) in his study on lean manufacturing practices and performance of organizations listed at the Nairobi Securities Exchange (NSE) revealed that most Kenyan firms believe that lean manufacturing practices enhance the long term business performance and success. The study concluded that most manufacturing companies in Kenya had adopted the concept of lean manufacturing in their operations. The study did not clearly point out the impact of these

systems on performance of manufacturing organization. The previous studies have not clearly detailed the impact of lean practices on operational performance. There is very little related research work done on effect of lean manufacturing on operational performance in the Kenya sugar sector. Therefore this study will seek to determine the effect lean manufacturing systems have on performance of sugar manufacturing companies specifically in Mumias Sugar Company ltd.

The research will answer the following questions in order to meet the objective of the study; What is the effect of lean manufacturing practices on the operational performance of Mumias Sugar Company ltd?,;What is the level of implementation of lean manufacturing practices at Mumias Sugar Company ltd? And lastly, what are the drivers, benefits and challenges of implementation of lean manufacturing practices at Mumias Sugar Company ltd?

1.3 Research Objectives

The objective of the study is to determine the effect of lean manufacturing practices on the operational performance of Mumias Sugar Company ltd.

1.4 Value of the Study

The findings of this study shall assist Mumias Sugar Company ltd make decisions that will make them more competitive in the market. The study will help determine to what extent lean manufacturing techniques are utilized and what other lean manufacturing tools and techniques can be employed to enable improvement of the company's operations and financial performance.

The study will aid other manufacturing companies understand the lean practices necessary to apply to grow and improve their performance.

The findings will assist government policy makers with insight into the practices of lean manufacturing in the sugar sector in Kenya. This will add value during formulation of strategies and polices that will help regulation of sugar sector.

Researchers in the area of lean manufacturing will equally benefit from the findings of this study. They will be able to find material for reference as they conduct their study.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter provides information on topics related to the research problem. It examines the input provided by various authors on the concept of lean. It also covers on lean manufacturing, operational performance and effects of lean practices adoption on operational performance of an organization.

2.2 Theory Underlying The Study

Lean Manufacturing practices and theory of constraints are both systematic methods for improving operational performance of an organization that have received a great deal of attention in recent years. Systems theory and lean manufacturing practices both incorporate design, developing of systems and how they work in unity towards a common goal.

According Goldratt et al. (1992), the theory of constraints takes a scientific approach to improvement. It hypothesizes that every complex system, including manufacturing processes, consists of multiple linked activities, one of which acts as a constraint upon the entire system. Goldratt et al. (1992), explains that the ultimate goal of most manufacturing companies is to make a profit and that The Theory of Constraints provides a powerful set of tools for helping to achieve that goal, including: the five focusing steps which is a methodology for identifying and eliminating constraints, the thinking processes which are tools for analyzing and resolving problems and lastly throughput accounting which is a method for measuring performance and guiding management decisions. Goldratt et al. (1992) further outlines that successful implementation of the theory of Constraints will have the following benefits: increased profit, fast improvement, improved capacity, reduced lead times, reduced inventory which means less work-in-process inventory.

Systems theory is the interdisciplinary study of systems in general, with the goal of elucidating principles that can be applied to all types of systems at all nesting levels in all fields of research (bertalanffy, 1956). Theory of systems has relevance to this study since lean manufacturing practices are components of lean systems employed with an aim at

improving the manufacturing process. Systems theory can reasonably be considered a specialization of systems thinking or basically in depth scrutiny of how systems are devolved interconnect and work together. In relation to manufacturing, Thome, (1993) explains that systems engineering is an interdisciplinary approach and means for enabling the realization and deployment of successful systems. It can be viewed as the application of engineering techniques to the engineering of systems, as well as the application of a systems approach to engineering efforts.

2.3 Lean Manufacturing

The concept of lean was born by Womack and Jones (1996). Lean principles enable companies to deliver with lesser resources resulting in lesser scrap and wastage Muhamad et al., (2012). The principles of lean, as explained by Ross and A.E.C, (2004), are founded on understanding of customer needs and demands, eliminating non-value added activities from the production process, involving the workforce in resolving operational issues, define metrics for measuring organizational performance, assist in the decision making process and problem solving

The manufacturing sector is increasingly becoming competitive. Globalization has affected the environment for many manufacturing industry players. Lean manufacturing provides a new management approach for manufacturers managed under traditional push systems Apreutesei et al., (2010). Those who have adopted lean systems have realized benefits. Lean manufacturing is associated with elimination of wastes. The benchmark of lean manufacturing is embodied by Toyota Production System, whose goal was reduction of cost by eliminating waste through two methods: just – in - time and automation (automation with a human touch) which are the pillars of Toyota Production System (Ohno, 1978). Lean manufacturing combines the capabilities of the workforce with organizational techniques to achieve high outcomes with few resources (Katayama, 1996). Womack and Jones (1996) present value specification, value stream waste elimination, flow, pull, and continuous pursuit of perfection as the core lean principles.

2.4 Lean Manufacturing Practices

Lean manufacturing practices are used to identify and remove wastes from the system continuously. There are various lean manufacturing practices employed by organization such as the following; 5Ss, Value stream mapping, just in time, poka yoke, kanban, Kaizen and total quality management.

5S is a productivity method whose name is derived from the five first letters of Japanese words: Seiri, Seiton, Seiso, Seiketsu and Shitsuke. The method was originally intended to organize a workspace for efficiency (Parker, 2012). The 5S has the following meaning according (Parker, 2012). Seiri means sorting**.** Keep the necessary in work area, dispose or keep in a distant storage area less frequently used items, discard unneeded items while Seiton is to arranging neatly and identifying things for ease of use. Seiso means always clean up, maintain tidiness and cleanliness and to clean your workplace thoroughly. Seiketsu means standardizing. Work practices should be consistent and standardized. Work stations for a particular job should be identical. Finally Shitsuke means Sustaining all the 4 s above. Maintain focus on this new way and do not allow a gradual decline back to the old ways.

Value Stream Analysis or Mapping is often cited as a technique that can be used in order to decide which tools to use to reduce waste in specific circumstances (Hines and Rich, 1997). VSM tool can be used to reduce costs through improving production flow, reduce inventory and saving time. The goal of the value stream mapping is to help managers identify waste in all their processes in order to eliminate them.

Just-in-time is based on the concept that inventories are not valuable and should be regarded as waste; accordingly, units should be available only when required. It involves having the right items with the right quality and quantity in the right place at the right time (Paneru, 2011).

The application of Just-in-Time supply in construction requires activities to be coordinated by pulling. Push techniques controlled by the central plan, even in the more stable world of manufacturing, are unable to time the arrival of resources at the work face with enough precision to assure a reliable flow.

Poka-yoke is a Japanese term that means "mistake-proofing". A poka-yoke is any mechanism in a lean manufacturing process that helps an equipment operator avoid (yokeru) mistakes (poka). The concept was formalized, and the term adopted, by Shigeo Shingo as part of the Toyota Production System. Shingo (1978) argued that errors are inevitable in any manufacturing process, but that if appropriate poka-yokes are implemented, then mistakes can be caught quickly and prevented from resulting in defects

Kanban simply means “signboard” in Japanese. According to Kumar and Panneerselvam, (2007) Kanban is basically a plastic card containing all the information required for production/assembly of a product at each stage and details of its path of completion. The Kanban system is a multistage production scheduling and inventory control system. Bednar et al., (2012) explains that application of KANBAN supports decreasing of production batches. They further point out that lower production batches mean fewer semi-products in production. This minimizes the requirement for space (warehouse).

Kaizen is method and a word that was created in Japan after World War II. The word Kaizen means continuous improvement. The method and the word have become part of the Toyota Production System (TPS), where it means small, continuous improvements on everyone’s part. However, in lean manufacturing, quality circles provide an opportunity for workers to actively participate in process improvement (Salem et al., 2006). Kaizen involves setting standards and then continually improving those standards. According to Parker (2012), in order to support higher standards, Kaizen also involves providing the training, materials and supervision that is needed for employees to achieve the higher standards and maintain their ability to meet those standards on an on-going basis.

Total Quality Management (TQM) is a structured and comprehensive approach to organizational management that seeks to improve quality and performance through ongoing refinements which will meet or exceed customer expectations. TQM looks at the overall quality measures used by a company including managing quality design and development, quality control and maintenance, quality improvement, and quality assurance Parker (2012).

2.5 Operational Performance

Performance measurement is a quantifying process for the efficiency and effectiveness of an action. The main performance metrics in relation to a manufacturing company performance is based on: quality, speed, dependability and cost (Ferdows and DeMeyer, 1990). Performance of Lean can be measured through various indicators which are: quality, productivity, costs, capacity and inventory. In the case of lean manufacturing the specific performance indicators include: factory time efficiency, flow time, through put and work in process inventory (WIP).

Throughput simply means the amount of material that enters and goes through a machine or system. In the case of manufacturing it is basically the conversation rate of raw material to finished product per certain period of time. Business dictionary defines throughput as General Productivity of a machine, procedure, process, or system over a unit period, expressed in a figure-of-merit or a term meaningful in the given context, such as output per hour, cash turnover, and number of orders shipped.

According to Ondiek and Kisombe (2012) factory time efficiency in the context of the sugar industries in Kenya is the index that measures the ability of a factory to sustain operations throughout the year without interruptions.

This is the time taken from when customers make an order to the time they receive their order. How efficient a system is will determine the flow time of a particular process. Presence of waste in a system increase flow time. By eliminating wastes in a system, the customer is able to receive their orders in time. Shortening flow time reduces inventory. Business knowledge center (2010) points out that according to Little's law, flow time = WIP inventory x cycle time. The flow time also known as flow rate is the length of the longest path through the process and includes both processing time and any time the unit spends between steps (Business knowledge center, 2010).

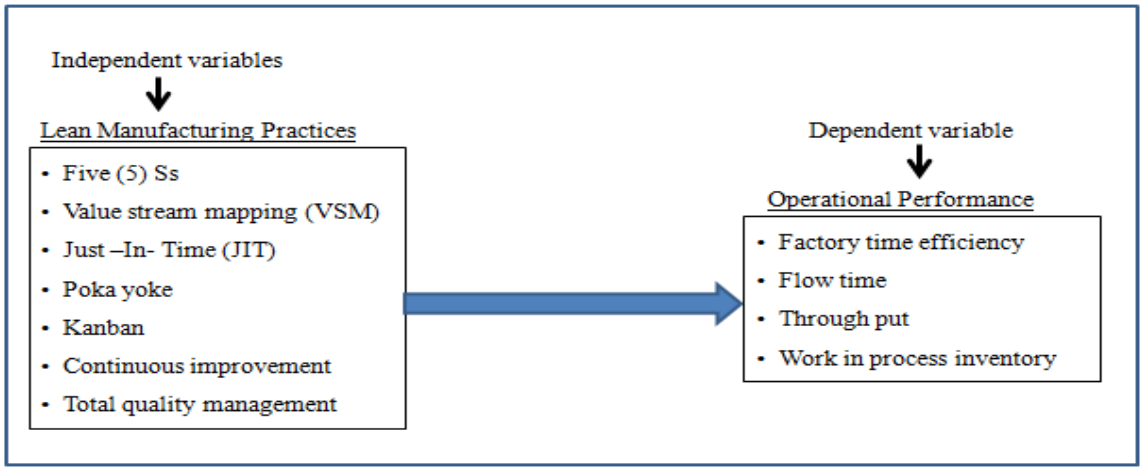
Work-in-process (WIP) materials are Inventory items, or units, that are released for manufacturing. These materials may include units currently being processed on equipment, units in transit within a manufacturing facility, and units waiting processing on equipment in the facility. In Carlos (1995) model, he point out that the amplification effects between WIP and quality defaults are evaluated under the assumption that

defective items are reworked or substituted by good ones. The rework is waste that increases the cost of goods. Carlos (1995) makes a main conclusion that under quite general conditions the inventory between two stations will keep growing without limit for any failure rate. Carlos (1995) further points out that this result provides a rationale for the Just-in-time practice of limiting the inventory and indicates that the expected throughput not always increases by increasing the WIP inventory buffer. According to Business knowledge center (2010) Little's law expressed as WIP inventory = through put rate x flow time.

2.6 Conceptual Framework

In order to achieve the objective of the study, the conceptual framework to be adopted will comprise of the following: lean manufacturing practices as independent variables and operational performance indicators as dependent variables. Independent variable also known as a predictor variable is a variable that influences or explains the dependent variable either in a positive or negative way. A dependent variable, also known as a criterion variable, is a variable or construct the researcher hopes to understand, explain and/or predict during the study. The schematic representation of the conceptual framework is shown in Figure 1.0

Figure 1.0: Conceptual Model



Source author (2014)

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the research methodology employed to answer the research questions of the study. It provides a full description of research design, data collection and data analysis.

3.2 Research Design

The Research design adopted was a descriptive case study. Mumias Sugar Company Limited was the unit of study. According to Zainal (2007) a case study is a valuable method of research with distinctive characteristics that make it ideal for many types of investigations and enables examination of data at a micro level. A case study generally aims to provide insight into a particular situation and often stresses the experiences and interpretations of those involved (Yin, 2004). Barkley (2006) notes that case study methodology is commonly used in evaluation of business and government programmes with the goal of identifying potential explanations for their successes or failures. The research study was longitudinal.

Kothari (2004) explains that the major purpose of descriptive research is description of the state of affairs as it exists at present. A descriptive study is one in which information is collected without changing the environment. Singh (2007) notes that descriptive research, as the name suggests, enumerates descriptive data about the population being studied and does not try to establish a causal relationship between events. The research design was to permit the researcher to establish the effect of lean manufacturing practices on operational performance of Mumias Sugar Company ltd.

3.3 Data Collection

A quantitative and qualitative approach was used to collect data for the study. The study used both primary and secondary data. Primary data was collected by carrying out interviews with; general managers, plant managers, production managers, engineers, technicians, some shop floor employees and director of factory operations by use of an interview guide (see Appendix II). The variables covered in the literature review together

with the research objectives formed the basis of the interview schedule design. Mcgrath (2007) argued that use of in-depth interviews is effective in case studies as superior depth of information and detail can be obtained as compared to other techniques.

Secondary data was obtained from annual operation reports and published annual financial reports at Mumias Sugar Company Limited. Secondary data was collected by use of a data collection form (see Appendix III). Secondary data was used to show trends of key performance indicators over a period of ten years to supplement analysis and inference to primary data to be collected.

3.4 Data Analysis

Qualitative data collected was analyzed using content analysis. According to Krippendorff (2012), content analysis is indigenous to communication research and is potentially one of the most important research techniques in the social sciences. The secondary quantitative data was analyzed by use of time series analysis. Singh (2007) defines time-series as a sequence of data collected over a period of time that analyzes the pattern of ordered data for interpretation and projection. According to Singh (2007), it identifies the nature of the phenomenon represented by the observations and after identifying the pattern it forecast the future values of the time-series variable.

CHAPTER FOUR: DATA ANALYSIS FINDINGS AND DISCUSSIONS

4.1 Introduction

This chapter presents the data analysis and interpretation which draws from the objectives of the study. The analysis was both qualitative and quantitative. The main objective of this research was to establish effect of lean manufacturing practices on operational performance of Mumias Sugar Company Limited. This research is to also determine the level of implementation of lean manufacturing at Mumias sugar company ltd. The research will also determine the benefits and challenges to effective implementation of lean manufacturing.

4.2 Level of implementation of Lean Manufacturing at MSC Ltd.

One of the objectives of this research was to determine the level of adoption of lean manufacturing practices adopted at Mumias sugar company Ltd. All the informants interviewed acknowledged the fact that lean manufacturing has not been fully implemented. Those interviewed highlighted that level of implementation is below average. They explained that the systems and structures are in place but are not adopted as required. According to all respondents 5S, JIT and Kanban have been averagely adopted throughout the production process, VSM and Poka yoke have been highly adopted and their adoption levels are well above average while TQM and Kaizen adoption have been below average.

5S has been applied averagely to maintain good housekeeping in the plant. Sugar manufacturing process generates a lot of bagasse a byproduct of the fiber after juice extraction from the sugar cane stalks. Fine particles of bagasse which are blown all over the plant by wind have been a challenge towards maintaining plant cleanliness. The company has done averagely well to ensure the factory plant is kept clean. Work place organization in terms of tools being kept in order is yet to reach high level standards. The company instituted standardization of processes to ensure consistency in product specification. Sustaining cleanliness and workplace standardization has been a challenge.

The company is yet to fully implement 5S in other areas. Mumias Sugar Company still has a journey and policies to implement in order to realize the full impact of 5S.

Value stream mapping has been extensively implemented. The value stream has been well documented. The value stream has been displayed inform of process flow diagrams in each production section. This assist the organization in analyzing the current state and designing a future state for the series of events that shows how sugar production process from its beginning through to the customer. The value stream has been well communicated to staff, who understand each step of the production stage and has ensured that consistency is maintained in the production line. Its easier to make analyze and make adjustments that will improve the production process and flow of materials

Just In Time – JIT technique implementation has been average. This is based on the concept that inventories are not valuable and should be regarded as waste. Accordingly, units should be available only when required. Throughout the production system, MSC Ltd endeavors not to store inventory particularly work in process inventory. Production process is smooth and material flow continuous from each production stage to another. Where JIT is not implemented is in mechanical section, where spares are ordered in advance and stored. This is due to the fact that is difficult to predict when critical areas or machines may fail. Hence spare motors and equipment can be stored up to a year before being used. In addition, packaging material for sugar is ordered in large quantities in batches in order to prevent interruption at the packaging plant.

Poka yoke has been greatly applied to eliminate defects and correct mistakes along the value chain. This has been done through automation of the process. Mumias Sugar Company limited has employed the use of distribution control system (DCS) to manage and automate most parts of the production system. DCS generates alarms and even stops certain process when faults are detected to allow for corrective action. Another one that has been implemented is the SCADA (supervisory control and data acquisition) system. A SCADA system gathers information, such as where a leak on a pipeline has occurred, transfers the information back to a central site, alerting the home station that the leak has occurred, carrying out necessary analysis and control, such as determining if the leak is

critical, and displaying the information in a logical and organized fashion. The company has also employed tradition, signage to prevent accidents in danger zones.

Kanban implementation has been averagely adopted, instead of using plastic cards, the company has developed work instruction for each process and work. This works instruction booklets have instruction for each single independent process that a staff can follow in order to start a process to completion including specifications and measurements. Some Processes in the mechanical maintenance programs have not implemented Kanban. This process depends on knowledge and experience that is passed down to other employees who join the section.

Continuous improvement has been adopted has been below average. There are a number of ways in which it has been adopted. There are daily meetings done to discuss the performance of the plant. These meetings are attended by all section and department heads or representatives and actions are generated and followed up. Tracking of auctioned items is done through followed meetings to ensure an issue is closed. Various respondents stated that continuous improvement implementation is below average in implementation. A number of issues take long before being resolved. Processes are not improved on time until significant inefficiencies are observed.

Total quality management has also been adopted at an average level at MSC Ltd. First level inspection of the equipments is done by both the production and mechanical departments. This is the inspection done using the five common senses of hearing, touching, smelling, seeing and feeling any abnormal condition of the equipment. This helps in arresting the problems before the equipment fails. Preventive Planned maintenance is done as per the schedule so as to maintain the equipment at its optimum productive level. Quality control is done through regular quality checks throughout the production process to ensure consistency in the quality of the products; samples are picked and tested for quality parameters along the production line. Quality assurance has been implemented thorough documentations of each and every process through a ISO a quality management system. MSC Ltd was awarded ISO 9001:2008 certificate on 8th November 2011. Respondents attributes that the ISO standards guarantee advantageous characteristics of MSC Ltd goods, such as quality, ecological friendliness, and safety, at

an economical. Company has a adopted and automated system to address how it handles and addresses customer queries and complains. The company also does customer satisfaction survey by getting customer feedback in order to make corrections and incorporate customer requirements into products. MSC Ltd involvement in shop floor staff in innovation and process improvement is poor. There is no reward system for innovation and most staff are not motivated to incorporate innovative ways. Most process takes long before they can be improved. Staff development is below average. The company tries to address this through training but only a small percentage get external training.

4.3 Operational Performance Indicators of MSC Ltd.

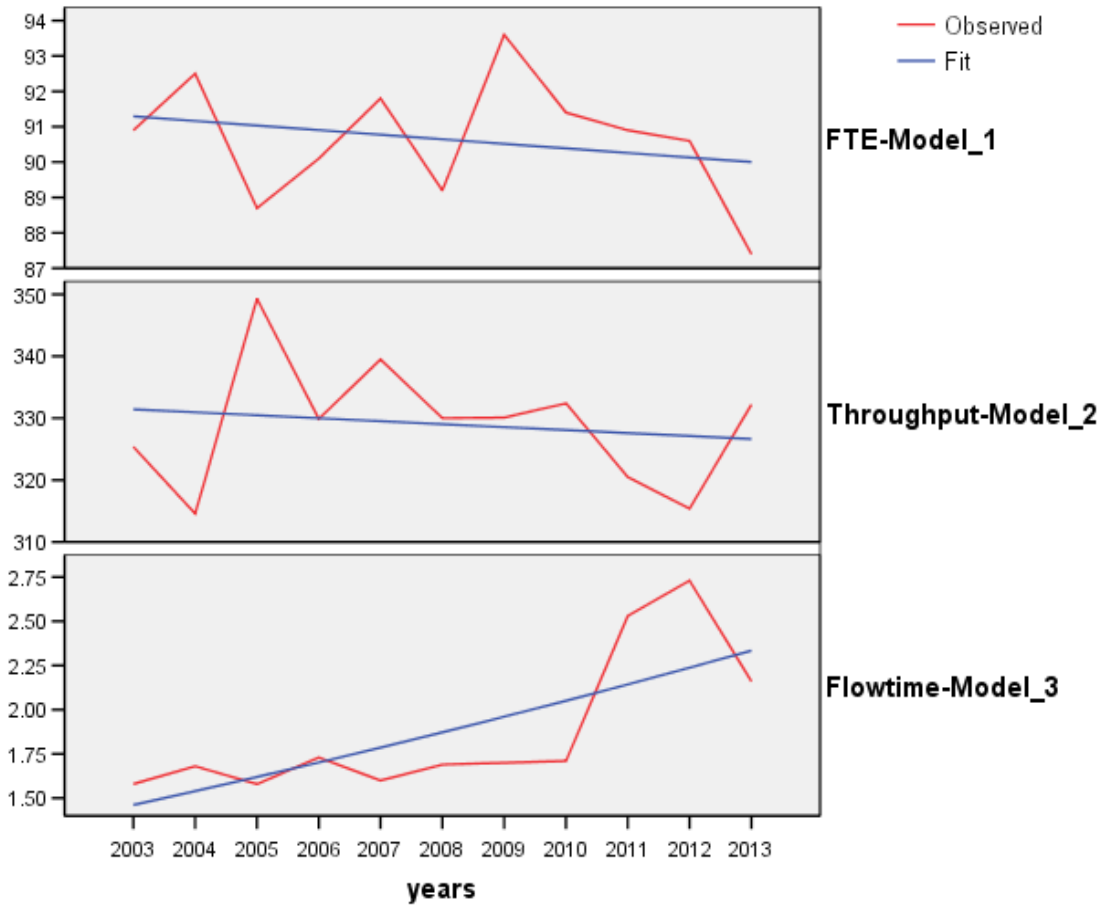
Operational performance indicators data obtained collected is as shown in Appendix III. This data was collected by use of data collection form (see Appendix II). Analysis of this data was done through Autoregressive-Moving Average (ARIMA) a time series analysis by use of SPSS software. Data was obtained for Factory time Efficiency (FTE), Throughput and flow time. Data that was not obtained was work in process inventory. This was because it was not well documented for the entire process. Analysis results are show in Table 1.0 which shows the model parameters and Figure 2.0 shows the trend analysis is obtained through use of SPSS software.

Table 1.0: Operational performance time series analysis ARIMA model results

Model	Number of Predictors	Model Fit statistics	Ljung-Box Q(18)			Number of Outliers
		Stationary R-squared	Statistics	DF	Sig.	
Factory time efficiency FTE (%)-Model_1	1	.059	.	0	.	0
Throughput TCH-Model_2	1	.025	.	0	.	0
Flow time-Model_3	1	.572	.	0	.	0

Factory time Efficiency – FTE as show in Figure 2.0 shows that FTE performance of the factory has been on a decline from year 2011 to 2013. From Figure 2.0 the throughput trend also shows a decline indicating the tons of cane milled per house also reduced. Flow time also shows an increase in time taken process a ton of sugar. All these operational performance indicators show a decline in factory performance from year 2011 to 2013. Respondents indicate decline lack of full implementation of lean manufacturing practices to this. They also state that staff development has not been taken into consideration for a long time. There have been no form of reward systems to reward innovation and hence staff motivation has been poor. Process has remained stagnant for long periods in time without improvement.

Figure 2.0: Operational performance time series analysis trends



From Figure 2.0 initial average levels of FTE at ninety percent from year 2003 to 2011. These were the years when MSC Ltd was brand giant and maintained brand dominance.

During the same period the average throughput is at an average of three hundred and thirty tones of cane per hour by use of the line of best fit. The company has aimed to operate at three thirty since it's the peak is set at a design capacity of three fifty tones cane per hour. Flow time has had a steady average up to the year 2011. There are indications of other underlying factors that seem to be causing the company to perform poorly after year 2011 to 2013. From Figure 2.0 all operational performance indicators take a sudden decline.

4.4 Effect of Lean Manufacturing on operational performance of MSC Ltd

The effect of lean manufacturing on operational performance was cited as being generally positive. Quality has since improved since the earlier years when lean implementation started. There has been a positive effect on operational performance during the period that MSC Ltd has implemented and continued to implement lean manufacturing. There has been reduction of wastages in operations due to standardization of process and plugging leaks in the systems. Operations have been made smoother and predictable with much fewer bottle necks.

4.5 Drivers and Benefits of Lean Manufacturing adoption at MSC Ltd

The interviewees highlighted that main driver is improvement of factory time efficiency and reduction of production costs. Increased competition was also a concern as one of the key drivers to adoption of lean manufacturing. There has been increased competition in the industry from new entrants such as west Kenya and Butali sugar companies on raw materials supply. This has forced prices and margins to stay low as all sugar producers compete on the basis of price. In addition COMESA is set to expire in 2015. This has followed several extensions. This will open up the Kenya sugar industry to cheap imports. MSC Ltd will have to compete with sugar imports that are cheaper. Improvement in financial performance is also a key driver of lean manufacturing implementation that has been mentioned by interviewees. This will be through reduction of production cost. Improve company's performance will attract and retain employees, avoid worst case scenario of retrenchment due to rising costs. This will also make their

pay home attractive and enjoy bonus benefits when the company does well financially. Another driver is to be able to achieve targets and increase production capacity

There are several benefits of practicing lean manufacturing practices at MSC Ltd as explained by the interviewees. Lean manufacturing helps in improving the reliability of the equipment. It also results to improved housekeeping in the plant. Implementation of poka yoke has helped reduce costly mistakes and accidents in the plant. There has been reduction in litigation issues where work injury benefit is concerned as a result of poka yoke. Automation of various process in the plant has seen a reduction in production cost in some areas since staff cost have reduced due to a leaner work force. Work process has become more standardize due to work process due to adoption of ISO Quality management system. Product consistency has been achieved in most of the parameters. Rework of materials and products has been minimized in the value stream. Condition monitoring of plant, process and equipment is being achieved due to automation and lean manufacturing implementation. Lean manufacturing has also helped in maintaining good relationship with the customers by producing high quality product.

4.6 Challenges Faced in Implementation of Lean Manufacturing By MSC Ltd.

Challenges faced in implementation of lean manufacturing include lack of management support. This was stated as the main factor. Interviewees reported that management has not clearly stated policies to ensure that a culture of lean is instilled in all staff hence not achieving full potential of lean manufacturing implementation. Another challenge is lack of financial support has been a major factor in implementation. This could partly be due to MSC Ltd recent poor financial performance. MSC Ltd has had poor financial performance from the year 2012 to 2014. According to Mumias sugar company ltd Annual Report & Financial Statements for 2013 and 2014, MSC Ltd reported a financial loss of 1.67 billion for financial year 2012/2013 and financial loss 2.7 billion for year 2013/2014.

Another challenge is Skill gaps among staff. This was attributed as an impediment to lean implementation. A good number of the work force is due to retire. Those left don’t have

the necessary skill set to implement some of the lean manufacturing practices. MSC Ltd is not doing much to develop and nurture talent to ensure that staffs are equipped with relevant skills. Also noted was lack of reward systems to encourage staff to come up with innovations that can improve production system and improve efficiencies.

MSC Ltd resistance to change culture among staff was noted as a major challenge to lean implementation. Most staff think that this will take away their jobs by making process leaner and hence reduction in staff number. This is due to lack of total acceptance of lean culture among staff that would otherwise bring about full realization of benefits of lean manufacturing. Lack of consistency in the follow up of objectives by staff, an organizational culture of ‘know it all’ also limits learning across the entire value stream.

Finally lack of commitment among all various departments and management was highlighted as a challenge, this due majorly due to lack of good team work among the cross functional teams to ensure there is synergy which is required in lean manufacturing implementation. This has been lacking since each team wants to outshine the other in performance resulting in other sectors suffering and pulling down the entire performance of the organization.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter presents a summary discussion on lean manufacturing practice and operational performance of Mumias sugar company Ltd. This chapter summarizes the drivers, benefits and challenges faced in the effective implementation of lean manufacturing at MSC Ltd including the effect of lean manufacturing on operational performance. A conclusion discussing the general findings of the research is highlighted followed by recommendation based on the findings of the study. The limitations of the study and suggestions on areas of further research are discussed at the end of the chapter.

5.2 Summary of Findings

The research findings revealed that Mumias sugar company Ltd has implemented the following lean manufacturing practices to the following levels. 5S, JIT and Kanban have been averagely adopted throughout the production process, VSM and Poka yoke have been highly adopted and their adoption levels are well above average while TQM and Kaizen adoption have been below average. MSC Ltd has the systems and structures of lean manufacturing practices in place; however, they are not well implemented thus hindering the organization from reaping full benefits of lean manufacturing.

Operational performance indicators have had a steady level. Factory Time Efficiency has been at an average of ninety percent from year 2003 to 2011. During the same period the average throughput is at an average of three hundred and thirty tones of cane per hour while Flow time on average u to 2011 has been steady These were the years when MSC Ltd was brand giant and maintained brand dominance.. All operational performance indicators are seen to take a sudden dip after year 2011 due to other underlying factors not necessarily related to lean manufacturing.

The effect of lean manufacturing on operational performance was cited as being generally positive. There has been reduction of wastages and improvement quality in operations due to standardization of process and plugging leaks in the systems. Operations have been made smoother and predictable with much fewer bottle necks.

The main drivers for lean manufacturing implementation have been improvement of factory time efficiency and reduction of production costs. Others include increased competition which is a concern. This has been born from completion for raw materials in the sugar belt and completion from cheap sugar imports from COMESA producing countries. Lastly an aim to improved company's performance has been a driver since its looked as a focus for improved financial performance which will improve company bottom-line.

Benefits of practicing lean manufacturing practices at MSC Ltd include; improved housekeeping in the plant. There has been reduction in litigation issues where work injury benefit is concerned as a result of poka yoke. Automation of various processes in the plant has seen a reduction in production cost. Work processes have become more standardize. Product consistency has been achieved in most of the parameters. Rework of materials and products has been minimized in the value stream. Condition monitoring of plant has being achieved. Lastly good relationship with the customers by producing high quality product has been fostered.

Challenges faced in implementation of lean manufacturing include lack of management support. This has mainly been lack of driving and setting lean policies in place to ensure compliance. Another challenge is Skill gaps among staff due to lack of proper training. There is lack of reward systems to encourage staff to come up with innovations that can improve production system and improve efficiencies. Resistance to change culture among staff was noted as a major challenge to lean implementation and lastly lack of commitment among all various departments.

5.3 Conclusion

The findings of this research are consistent with the research done by other scholars. The study aimed to answer the following questions: What is the effect of lean manufacturing practices on the operational performance of Mumias Sugar Company ltd? And what is the level of implementation of lean manufacturing practices at Mumias Sugar Company ltd? And lastly, what are the drivers, benefits and challenges of implementation of lean manufacturing practices at Mumias Sugar Company ltd? These questions were answered through the

objective of the study which was: To determine the effect of lean manufacturing practices on the operational performance of Mumias Sugar Company ltd.

The study found out that lean manufacturing practices had a positive effect on operational performance. There has been improved operational performance through reduction on waste, improved efficiency and reduced lead times between processes. According to Tourki (2010), many organizations have realized the need to adopt lean manufacturing in order to survive in the global competitive environment. The level of implementation of lean manufacturing is average. Mumias sugar company ltd is yet to fully implement lean manufacturing practices with some of the lean practices employed noted as below average.

The main driver for lean manufacturing implementation has been improvement of factory time efficiency, reduction of production cost and completion from rivals and cheap sugar imports. The company is yet to fully realize this due to lack of full implementation of lean manufacturing practices. The main benefits derived from implementation of lean are improved housekeeping of plant, improved efficiencies and standardization of processes. The major challenge that faces MSC Ltd is lack of management support and resistant to culture change. Mumias sugar company ltd has not strictly adhered to the application of lean management practices which are compatible to the organizations and therefore not enjoying the full benefits of application of lean management practices.

5.4 Limitations Of The Study

The study was largely constrained by the short time available. The interviewees also had tight schedules and could only manage limited time to provide the required data. In addition there were a lot of interferences during the interview due to the nature of their work. The concept of lean manufacturing was also not well understood and this posed challenges in getting feedback and gathering information on its implementation. The dynamic nature of the production management may change after a period of time and the views provided are limited to a given time period .These findings may not be applicable across time.

5.5 Recommendations

Based on the findings of the study it is recommended that Mumias Sugar Company limited adopts full implementation of lean manufacturing practices to realize the full benefits of lean manufacturing. The management of Mumias Sugar Company limited will have to set up clear policies on lean implementation and communicate to the same to staff. The aim of this will be to embrace acceptance of lean manufacturing at Mumias Sugar Company limited which is the first step to a culture of lean among staff. Lean manufacturing techniques what will greatly benefit Mumias Sugar Company limited if properly implemented properly are as follows; Total Quality Management, Just in time, 5s and Kaizen

Implementation of lean management practices in sugar manufacturing firms in Kenya sugar industry is highly recommended. This is because of the benefits that can be realized if fully implemented. Firms shall benefit out of implementation of lean management practices by increasing their factory efficiency and reduction of waste in their production cycle. The firms which apply lean management practices should do it in a holistic manner rather than in an isolated way to enjoy the great benefits of full implementation. Firms should build a culture of lean within cross functional teams in among staff. The implementation of lean management practices should be driven in a manner that it is strictly adhered to enjoy the true benefits of implementation. Management should drive the lean culture by setting up firm policies and communicating the intended benefits of lean to the staff. There is a general lack of understanding of lean manufacturing concepts hence training on lean manufacturing is recommended. This shall result in better understanding of the concept among the employees.

There is little research done in the area of lean manufacturing in the Kenya sugar industry. It is therefore recommended that more research be done not only in the Kenya sugar industry but in the various sectors in Kenya.

5.6 Suggestions For Further Research

Future researches should try to evaluate Lean management approach to business management in Kenya sugar industry. Lean implementation in the public sector can also be explored in future studies. This study can also be replicated after five or more years to ascertain whether the situation would have changed.

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APPENDICES

Appendix I: Introductory Letter

Anthony Mutua
MBA student
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To Whom It May Concern:

RE: PERMISSION TO CARRY OUT A RESEARCH IN YOUR FIRM

I am a student at The University of Nairobi (UON), pursuing a Master of Business and Administration (MBA). I am undertaking a research project in partial fulfillment of the academic requirements. The topic of research is 'LEAN MANUFACTURING AND OPERATIONAL PERFORMANCE OF MUMIAS SUGAR COMPANY LTD, KENYA' Your firm has been selected to form part of the study. I will be very grateful if you would spare sometime from your busy schedule, to respond to the questions listed on the attached interview guide and data collection form.

Your response will be treated with uttermost confidentiality. The findings of this research may be availed to you upon completion of the research if you so request. Your assistance and co-operation will be highly appreciated.

Yours faithfully,

Anthony Mutua

Appendix II: Interview Guide

Demographic

Interview date: _____

Job Title: _____

Section: _____

Interview Questions

1. What lean manufacturing techniques has Mumias sugar company (MSC) ltd employed?
2. What is the level of implementation of each lean manufacturing technique?
3. What is the effect of lean implementation on operational performance?
4. What are the driving forces behind implementing lean manufacturing?
5. What benefits have you gained by implementing lean manufacturing?
6. What challenges have you faced when implementing lean manufacturing?
7. What are the employees' opinions to lean manufacturing?

THANK YOU FOR YOUR TIME

Appendix III: Data Collection Form

Operational performance	**Timeline in years (annual report figures)**										
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Factory time efficiency. FTE (%)											
Throughput											
Flow time											
Work in process inventory											

Appendix III : MSC Ltd Operational Performance indicators data

Operational performance	**Timeline in years (annual report figures)**										
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Factory time efficiency. FTE (%)	90.9	92.5	88.7	90.1	91.8	89.2	93.6	91.4	90.9	90.6	87.4
Throughput TCH (Tons cane per hour)	325.4	314.6	349.3	329.9	339.5	330	330.1	332.4	320.5	315.4	332.2
Flow time (Mins per tons sugar)	1.58	1.68	1.58	1.73	1.6	1.69	1.7	1.71	2.53	2.73	2.16
Work in process inventory. (tones)	Data not available from 2003- 2012										3105