LEAN MANUFACTURING PRACTICES AND PERFORMANCE OF ORGANIZATIONS LISTED AT THE NAIROBI SECURITIES EXCHANGE

BY

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DECLARATION

This research project is my original work and has not been submitted for a degree in this or any other University.

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This project has been submitted for Examination with my approval as the University Lecturer.

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My late Parents Justin Openda and Phylis Imbukwa for their moral guidance and upkeep that has seen me though up to this time of my life. Though you are gone, I thank God for the short time you inspired me here on earth.

My husband Geoffrey Auma for being there for me financially, spiritually and morally. Thank you for your overwhelming emotional support.

You are all part of this great achievement. To all who contributed in different ways not mentioned above, I am equally thankful.

God bless you all.

DEDICATION

To

My

Husband

Geoffrey Auma Wanzabasi

ABSTRACT

This study sought to study Lean manufacturing practices and performance of organizations listed at the Nairobi. This study set to achieve three objectives namely; the fist being to determine the effects of Lean manufacturing practices on the performance of organizations listed at the Nairobi Securities Exchange, to document the extent to which Lean manufacturing practices have been adopted by organizations listed at the Nairobi Securities Exchange and to find out the challenges faced by organizations listed at the Nairobi Securities Exchange in their pursuit to implement lean manufacturing practices. The goals for lean manufacturing practices are to improve quality; to stay competitive in today's marketplace, a company must understand its customers' wants needs and designs processes that meet their expectations and requirements. Among the areas highlighted include the various lean manufacturing practice models that are being adopted; the benefits derived from the adoption of these practices and the challenges encountered in the implementation of the practices

Primary data was collected by use of questionnaire with both closed and open ended questions. The closed ended questions enable the collection of qualitative data for analysis the Likert scale while the open ended questions enable the researcher to collect qualitative data on the respondents view on lean manufacturing practices in organisations in Kenya. The study found out that most Kenyan firms believe that lean manufacturing practices enhance the long term business performance and success. The study established less process waste, reduced inventory, reduced lead time, less rework financial savings and increased process understanding as the benefits emanating from the implementation of lean manufacturing practices. The study established the following hindrances to lean manufacturing practices implementation: external obstacles, logistic issues smaller supplier's difficulties and global issues. These findings should help in encouraging the widespread adoption of lean manufacturing practices in Kenya. Due to tight schedules of the top management in companies listed Nairobi Security Exchange, the study encountered difficulties in gaining access to the respondents and the researcher had to keep rescheduling their time to align with the availability of the respondents.

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INTRODUCTION

1.1 Background of the Study

Organizations today in the manufacturing, service and public sectors are faced with challenges of global competition that has forced them to look for appropriate manufacturing management strategies in order to enhance their efficiency and competitiveness. The adoption of philosophies such as LM, Total Quality Management (TQM), Business Process Reengineering (BPR), Just In Time (JIT), Bench Marking (BM), Continuous Improvement (CI). Kaizen has led to operational and strategic gains for the manufacturing and service organizations (wafa and small 2011). Lean manufacturing is meant to create high quality, flexible and smooth process that is able to produce goods that the customer desires with no wastes. Lean concept is a journey and not a destination, it is a culture that needs to be implanted in the minds of all in the organization and be understood and accepted across all levels of personal resources. As the process of becoming lean is tied together with organizational change, it is a commitment that takes time and resources to accomplish.

Taiichi Ohno (1988) relates the concept of lean manufacturing to the Toyota Production System (TPS) which is an integrated socio-technical system developed by Toyota, that comprises its management philosophy and practices. It organizes manufacturing and logistics for manufacturers, including interaction with suppliers and customers. With mass production being unable to cope with urgent or separate orders of production with special features, lean production had been generated to counter this problem. Just as mass production was the production system of the 20th century, lean production became the

production system of the 21st century. Through this system companies can be able to become vastly more flexible and responsive to customer desires. By eliminating unnecessary steps aligning all steps in an activity in a continuous flow recombining labor into cross functional teams dedicated to that activity and continually striving for improvement companies can develop, produce and distribute products with half or less of the human effort, space, tools, time and overall expense.

1.1.1 The Lean Manufacturing Concept

This concept was introduced by a Japanese automotive company, Toyota, during the 1950s. Before then it was known as 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. After world war II, Toyotas president wanted to catch up with American films in terms of productivity and quality and to support this, two major things were needed, Just In Time(JIT) and autonomation/automation with human touch.

TPS assumes that all processes are stable. Ohno (1988) does not deliver strategy to become lean if the processes of manufacturing in the organization are not stable. According to him, just in time means that in a flow process, the right parts needed in the assembly reach the assembly line at the time that they are needed and in the amounts that are needed. The goal is an implementation of a flow production with zero work in progress. According to Shingo, 1989, when trying to implement just in time, people at Toyota experienced that traditional operations management systems did not work well. A problem not detected early in the manufacturing process resulted in defects later in the process translating to huge and wasteful inventories.

The principle of automation was invented when the company founder Toyoda Sakichi created an auto-activated weaving machine at the end of the 19th century which stopped instantly when one of the warp or weft threads broke (Mildenburg, 2000). This development led to drastic three improvements in the production system of Toyota. One was whenever a defect product was produced; the machine stopped automatically which prevented the operations from producing more than one defective. Two, this fact allowed the company reduce the workforce and implement multimanning at their machines; one operator being able to run more than one machine and thirdly, trigger liens were introduced which allowed operators to stop the assembly line whenever a certain problem appeared which forced management awareness on every one. Convis, 2001, an American Toyota motor manufacturing president calls the TPS and integrated and interdependent system involving many elements being tools, the philosophy and management. He criticizes that Ohno's theories were misunderstood because of their focus on individualized elements like Automation and Just In Time instead of the entire approach. According to Convis 2001, Ohno's theory lacks the direction that the key to successful implementation is the total commitment of everyone in the organization to make it work.

Comparing Convis and Ohno's model clearly shows that TPS is a fully integrated manufacturing and management principle. Convis 2001 focuses on the human dimension is the key to success of any organization. However, Ohno (1998) and Shingo (1989) just mention these aspects but emphasizing a lot on the techniques that may have brought about the confusion that tools are tools and not the fundamental manufacturing philosophy are the most important aspects. TPS shows that excess manpower as human development is one core and is strictly not a way of creating redundancy. Drickhamer

(2004) underlines that lean still has the connotation that is a way of relieving people off their duties when in the real sense it is meant to empower shop floor personnel. There is a misunderstanding that Lean means laying off people. It should be clear that this is not so, Ohno (1988) even suggests using freed-up resources for further improvements.

Torstensson (2006) Parker (2003) considers that due to the so many different conceptual approaches of the lean term, it becomes difficult to identify the real benefits of its use. The lack of a precise definition makes it difficult to establish if the changes occurred within a company are or not in accord with the principles of the lean production which leads to a laborious evaluation of the efficiency of the concept. It is therefore necessary to estimate the success of the lean production before implementing it in order to avoid wasting time and money. Petersen (2009). In an attempt to define lean production conceptually, we can say that it uses the just in time practices and aims at the rational use of resources, the strategies to improve the production process and the elimination of waste and the use of managerial scientific techniques. It is however difficult to formulate a complete definition encompassing all the elements of lean production, which is a constant development. Thus, today's definition reflects the current image which at some point in the future will no longer be valid

According to Womack, Jones and Ross (1990), Lean production is a thought process and philosophy, not a tool, used to look at business whether it is manufacturing, service or any other activity with a supplier and a customer relation with a goal of eliminating non value added tasks. The principle of Lean production includes teamwork, communication, efficient use of resources and continuous improvement. It can be said that Womack,

Jones and Ross pioneered the idea of applying the concepts outside of manufacturing environments

1.1.2 Lean Manufacturing and Organizational Performance

A study concept cannot be complete without mentioning the term "Supply Chain Management". A supply chain is a network that includes vendors of raw materials, plants that transform those materials into useful products and distribution centers to get those products and services to customers. Without any specific effort to coordinate overall supply chain system each organization in the network has its own agenda and operates independently from the others. In managing the supply chain, the following are decision variables: Location of facilities and sourcing points, production- what to produce in which facilities, Inventory-how much to order, when to order and safety stocks, Transportation-mode of transport, shipment size, routing and scheduling(Christopher,2005).

The Bullwhip Effect-A problem frequently observed in unmanaged supply chains. This effect is an oscillation in the supply chain caused by demand variability. The problem must be addressed in order to avoid poor service and higher costs that stem from it. This phenomenon has been observed across most industries, resulting in increased costs and poorer service (Hall et al, 1997).Supply Chain Structure-The performance of a supply chain is measured in terms of profit, average product fill rate, response time and capacity utilization. Profit projections may improve if another parameter is relaxed, but one must consider the impact of all aspects of the relaxed parameters on profits.

Capacity utilization should be high enough to produce overheads sufficiently, but not so high that there is no room to grow or to handle fluctuations in demand. Higher capacity

utilization decreases downside risks since costs are reduced, but also limits the upside gains if future demand should be outstrip supply (Chopra and Meindl, 2005).

1.1.3 The Nairobi Securities Exchange

In Kenya, dealing in shares and stocks started in the 1920's when the country was still a British colony. However the market was not formal as there did not exist any rules and regulations to govern stock broking activities. Trading took place on a 'gentleman's agreement.' Standard commissions were charged with clients being obligated to honour their contractual commitments of making good delivery, and settling relevant costs. At that time, stock broking was a side line business conducted by accountants, auctioneers, estate agents and lawyers who met to exchange prices over a cup of coffee. Because these firms were engaged in other areas of specialization, the need for association did not arise. In 2008, the NSE All Share Index was introduced as an alternative index. Its measure is an overall indicator of market performance. The Index incorporates all the traded shares of the day. Its attention is therefore on the overall market capitalization rather than the price movements of select counters. Among the major initiative undertaken by NSE to support lean manufacturing practices; a process that was meant to totally eliminate delays was in September 2006 where live trading on the automated trading systems of the Nairobi Stock Exchange was implemented. The ATS was sourced from Millennium Information Technologies of Colombo, Sri Lanka, who are also the suppliers of the Central Depository System. MIT have also supplied similar solutions to the Colombo Stock Exchange and the Stock Exchange of Mauritius. The NSE ATS solution was customized to uphold the spirit of the Open Outcry Trading Rules in an automated environment. NSE is a securities market whose vision is to be a leading

securities exchange in Africa, with a global reach. Its mission is to provide a world class securities trading facilities and its core values include ethics, integrity, confidentiality, innovation and excellence. As at 31st July 2013,there were 60 firms listed at the NSE cutting across various sectors of the economy including Agricultural, Commercial & Services, Telecommunication & Technology, Automobiles & Accessories, Banking, Insurance & Investment and Manufacturing & Allied. (www.nse.co.ke).

1.2 Problem Research

In the recent years, many manufacturing and service companies have been challenged to increase their focus on quality of products and customer satisfaction. Putting into perception the challenges of global competition, many organizations have been reduced to find ways of reducing costs, improving quality and meet the ever-changing needs of a more informed class of customers.

Wheatley (2005) discussed the reasons why organizations are trying to copy TPS and applying Lean thinking in their own environments. The top five business factors according to Wheatley are continued pressure to improve operational performance, maintain competitive advantage in price and service, pressure to improve profit, customers demanding shorter order-cycle times and customers demanding reduced prices. Womack and Jones (2003) underlined the need for strong will at the top management during the transformation process. They added that leaders should create a crisis in order to force the organization to adopt Lean thinking and that should be the company strategy. Their findings were that Lean thinking should first be applied in a troubled business unit. This should be supported by senior management demonstrating impatience during Lean

performance reports. A question then arises, how can companies drive the Lean transformation without a crisis?

Related studies that came out in Kenya focused on the operations strategies applied for the competitiveness of Kenyan large manufacturing firms (Nyamwange, 2001).Nyamwange (2001) concluded that operational strategies on which the companies compete in their order of rank include high quality, low cost and time/speed, innovativeness and flexibility which are ranked equally.(Oloko, 1999) studied the Obstacles in the implementation of Total Quality Management in the banking sector. He concluded that the three major obstacles faced the Total Quality Management implementation include resistance to change, difference in people's attitudes and poor understanding of the concept by staff at lower levels. Another study was also carried out by Osumo (2012) on the lead time variability and supply chain performance in Kenya. It was established that lead time variability has an impact on the performance of their supply chains.

This study was therefore carried out to establish the linkage between Lean manufacturing practices and organization's performance in organizations listed at the Nairobi Stock Exchange. Given the benefits of Lean manufacturing in both the manufacturing and service sectors it becomes of importance to document how the use of Lean manufacturing practices affects the performance of organizations listed at the Nairobi Stock Exchange. Therefore this study was intended to answer the following three Research Questions; what is the extent to which Lean manufacturing practices are implemented in organizations listed at the Nairobi Stock Exchange? What is the effect of lean manufacturing practices to organizations' performance in companies listed at the Nairobi

Stock Exchange? and finally, what are the challenges facing the implementation of lean manufacturing practices in organizations listed at the Nairobi Stock Exchange?

1.3 Research Objectives

i. To determine the effects of Lean manufacturing practices on the performance of organizations listed at the Nairobi Securities Exchange

ii. To document the extent to which Lean manufacturing practices have been adopted by organizations listed at the Nairobi Securities Exchange.

iii. To find out the challenges faced by organizations listed at the Nairobi Securities Exchange in their pursuit to implement lean manufacturing practices.

1.4 Value of the Study

The results of this study will provide Corporate and Operations Decision Makers with a basis from which they can make informed strategy and investment decisions in the light of increasing global competition.

To the Supply Chain Management profession**,** the findings from the study will help them to identify opportunities derived from implementing Lean Manufacturing practices that enhance acquisition of capabilities that could result in competitive advantage.

The study will have a practical significance to the Manufacturers and Distributors in the supply chain as this will enhance the improvement of costing and pricing strategies.

The findings of this study will provide more knowledge for Researchers and Academicians who may be interested in studying lean manufacturing practices and the supply chain performance.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter focuses on the literature review conducted by the researcher. It includes a review of the various studies that have been conducted by other researchers on lean manufacturing and supply chain performance .Among the areas highlighted include the various lean manufacturing practice models that are being adopted; the benefits derived from the adoption of these practices and the challenges encountered in the implementation of the practices. The chapter also provides research gaps identified and the conceptual framework to show the relationship between the dependent and the independent variables.

2.2 Overview of Lean Manufacturing

In the late 70's, the US companies had a strong interest in the NC machine tools and in the advanced automation as well as in planning the material necessary for the production process. (Mabert, V.A., 2007). Womack, J.P. et al (1990) in the machine that changed the world, uses the term Lean production in the contrast to the mass production system of the West. The Japanese companies focused on applying the Lean production principles using relatively simple technologies and lower costs automation at the expense of computer technology. The concept of Lean production is based on the Toyota production system (Spear, S. & Bowen K.H., 1999; Womack, J.P., Jones, D.T.& Roos D., 1990). The Toyota production system focused on reducing waste, considering all aspects of the production process, using a variety of techniques and tools for eliminating waste, such as; just-in-time, cellular manufacturing, Value Stream Mapping, 5S, Kanban(pull)systems,

Kaizen, synchronous manufacturing, Poka-Yoke (Bicheno, J., 2000; Rother, M. & Shook, J., 1998), which resulted in the decrease of stocks and of the execution time, an increase of the delivery performance, a rational use of space, a better resource utilization and an improved productivity and quality (Pavnaskar, S.J., Gershenson J.K. & Jambekar, A.B., 2003).Lean production can be defined as a philosophy or as a strategy which depends on a set of practices used to minimize waste in order to improve an enterprise's performance (Womack, & Roos 1990). Lean production came from the Toyota production system, a concept adopted by many major companies across the world in an attempt to remain competitive in an increasingly globalized market. (Perez M. P. & Sanchez A.M., 2000; HosseiniNasab, H., et al. 2012, 73-81)

Since the first use of the concept there have been some attempts to define the term Lean conceptually (Lewis M A 2000; Hines, P., Holweg, M. & Rich, N.,2004; Shah, R & Ward, P.T., 2007); unfortunately the definitions are vague, and the lack of a clear definition leads to communication difficulties (Boaden, R 1997) and the difficulties in implementing the lean production concept in enterprises as well as in establishing its precise objectives (Anderson R Eriksson, H & Torstensson, H, 2006). Parker (2003) considers that, due to the so many different conceptual approaches of the lean term, it becomes difficult to identify the real benefits of its use. The lack of precise definition makes it difficult to establish if the changes occurred within a company are or not in accord with the principles of Lean Production, which leads to a laborious evaluation of the efficiency of the concept. It is therefore necessary to estimate the success of the Lean Production before implementing it in order to avoid wasting time and money Pettersen. J, (2009). In an attempt to define Lean Production conceptually, we can say that it uses the

just-in-time practices and aims at the rational use of resources, the strategies to improve the production process and the elimination of waste, and the use of managerial scientific techniques. It is however, difficult to formulate a complete definition encompassing all elements of Lean Production, which is in a constant development. Thus, today's definition reflects the current image, which at some point in the future will no longer be valid.

2.3 Lean Goals and Strategy

The espoused goals of Lean manufacturing systems differ between various authors. While some maintain an internal focus e.g. to increase profit for the organization, others claim that implements should be done for the sake of the customers. Some commonly mentioned goals are to improve quality; to stay competitive in today's marketplace, a company must understand its customers' wants needs and designs processes that meet their expectations and requirements. To Eliminate Waste; waste is an activity that consumes time, resources or space but does not add any value to the product or service. To Reduce Time; reducing the time it takes to finish an activity from start to finish is one of the most effective ways to eliminate waste and lower costs. Reduce Total Costs; to minimize costs, a company must produce only to customer demand. Overproduction increases a company's' inventory costs because of storage needs. Strategic elements of Lean can be quite complex and compromise multiple elements. Four different notions of Lean have been identified; one; Lean is a fixed state or goal (being Lean.), two; Lean as a continuous change process (becoming Lean), three; Lean as a set of tools or methods (doing Lean), four; Lean as a philosophy (Lean thinking.).After formulating guiding principles of its Lean Manufacturing approach in the TPS, Toyota formalized in 2001 the

basis of its Lean Management: The key managerial values and attitudes needed to sustain continuous improvement in the long run. These core management principles are articulated around the twin pillars of continuous improvement (relentless elimination of waste) and respect for people (engagement in long term relationships based on continuous improvement and mutual trust) (Suzaki 1987)

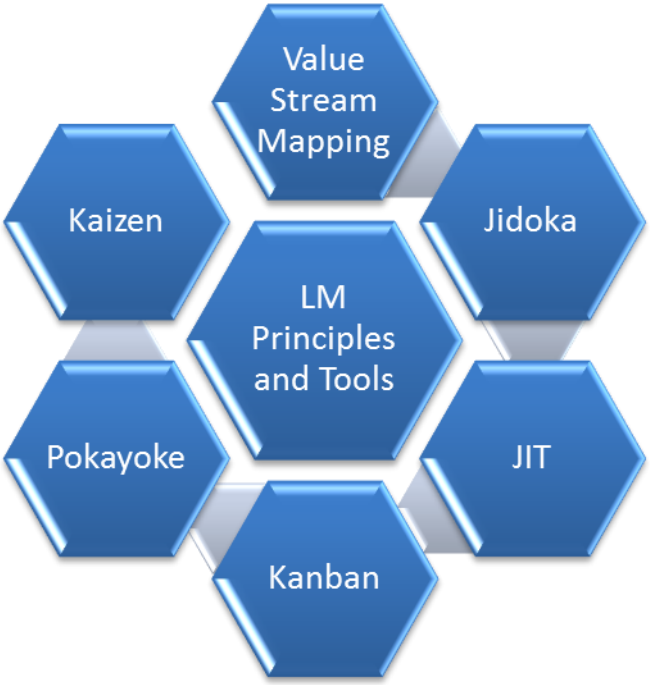
2.4 Lean Manufacturing Principles and Tools

Lean production includes, on the other hand, a strategy which depends on a set of tools and, on the other hand, the Lean thinking, which focuses both internally and reducing costs, and externally to increase customer satisfaction. The objective of this multi-dimensional approach is the reduction of costs by eliminating the non-value activities, using tools such as just-in-time, cellular manufacturing, Value Stream Mapping, 5S, Kanban (pull) systems, Kaizen (Bicheno, J., 2000; Rother M. & Shook, J. 1988; Kocakulah, M.C., Austill, D.A &Shenk D.E 2011), total productive maintenance, Production smoothing or production leveling, setup reduction for waste elimination (Abdulmalek, F.A &Rajgopal, J. 2007: Scherrer-Rathje, M., Boyle, T.A., & Deflrin, P. 2009). The implementation of the efficient production practices based on the flow of optimization is expected to lead to better operating results using for example, an inventory leanness (Hofer, C. Eroglu, C. & Hofer, A.R, 2012), which in turn should enhance the enterprise's performances (Cuatrecasas-Arbos, L. Fortuny-Santos, J. & Vintro-Sanchez, C. 2011).

The literature emphasizes the fact that the Lean production is mainly based on the just-in-time production. The just-in-time method consists of an elaborate planning of the production process and the amount of raw materials required as used exactly where they

are needed, resulting thus a reduction in the stocks of raw materials and parts. In each stage of the production process only the amount needed must be obtained and it should be done only when it is required by the next working stage, according to the technological flux.

Figure One :LM Principles and Tools



Source: Author (2013)

2.4.1Value Stream Mapping

Is a Lean production tool, used to design and analyze the production process? It is designed to create an easy way for managers to visualize the value flow. The value is defined as that thing which brings the product in the form desired by customers who are willing to pay for it (Kocakulah, M.C. Brown, J.F and Thomson, J.W. 2008). The goal of the value stream mapping is to help managers identify waste in all their processes in order to eliminate them: the waste time of the production process resulting from a faulty

organization of the working equipment (motion), waiting, the time spend when handling the products from one stage to another of the production process, from the production workshops to warehouses (transportation), a production larger than it is required for the next stage of the production process (overproduction), the undesirable characteristics that affect the product functionality or its appearance, the refuse (defects), over processing, inventory.

2.4.2 Five (5) Ss

Another basic tool for the managers who want to adopt Lean Production is the 5S. The 5S has its origins in the Toyota system and refers to the words that describe the steps to be completed for each stage or phase:

Seiri-Separate- is the first that consists of eliminating all that is not needed to complete the tasks-straighten and configure

Seiton-Sort- identifying the stages of production and the elements necessary for the performance of the tasks required in those stages, which are organized in the optimal manner in order to avoid wasting time on handling-clear out and classify

Seiso- Sweep and shine- everything must be kept clean and the production scraps and refuse should be removed.

Seiketsu- Standardize- standardization of the processes through efficient organization of the working equipment while programming them in order to have maximum efficiency-consistency and conformity

Shitsuke- Sustain- The final step consists of maintain cleanliness and order every day-custom and practice

The 5S program has a number of benefits, such as: Maintaining discipline, reducing production and handling time which leads to lower costs.

2.4.3Cellular Manufacturing and JIT

Is a Lean method which is based on the group technology principles? The workstations and equipment are organized in order to allow easy transition from one stage to another, resulting in a minimal handling of material, greater speed of working, eliminating unnecessary costs and having reduced stocks.

2.4.4The Jidoka

Principle is a process of quality control and refers to the automation of the functions of the production supervision, which means that the personnel is warned in case of an abnormal situation in order to stop the production line, thus preventing wastage, refuse and additional output, focusing on the attention on understanding why the problems occurred and how they can be avoided in future.

2.4.5Poka-yoke

Refers to any mechanism that helps staff to avoid errors. Its purpose is to eliminate product defects by preventing, correcting or drawing attention to human errors. The Lean concept is criticized in the literature from the perspective of the personnel, because this side is less known, focusing primarily on techniques for improving the performance of the system. Jidoka and Poka-yoke suggest that employees cannot be trusted in order to have good quality products, creating a need to eliminate the possibility of human error in the system.

2.4.6Kanban

Is a stock control system, and it is usually performed by the FIFO method. Kanban is an effective tool which contributed to the functioning of the production process as a whole. Sugimori (1977) stated that the Kanban system has many advantages over computer technologies, such as; reduced cost of information processing, it is easy to obtain and transmit information in a dynamic environment, the demand for materials is judiciously sized. Sugimori criticized the lack of respect for the human being of the enterprises whose production was controlled by computer systems. The Japanese consider the Kanban system more transparent, allowing staff to understand the production process without the need to use complex software.

2.4.7Flowand Pull

Cellular manufacturing is adopted by the enterprises that use Lean production, where each module has all necessary resources to manufacture a product, or, if several modules are organized in order to produce a certain product, in order to obtain a production process by which the product smoothly goes through all the stages until it reaches the final user, the client.

Hopp and Spearman (2004) defined the pull system as one that explicitly limits the quantity of product entering the production process. The traditional production methods tend to push products in the manufacturing process, without limiting their quantity in the hope that it will be a customer to buy the already made products. In a pull system not even one single production stage will be finalized until there is a demand for moving to a later stage.

Once businesses adopt the Lean principles, the improvement of processes is certain. Another principle of the Lean Production concept is the continuous improvement, so that reducing efforts, space used, costs and production time can be continuously achieved.

2.5 The benefits of being 'Lean' – Waste Elimination

The benefits of Lean manufacturing come from the elimination of waste at all stages. According to Mondem (1993) waste arrives in many ways in the production system: Stock/ Inventory- JIT replace the idea of 'Just In Case'. This meant that inventory was held only because these were problems in the production system. This made it impossible to supply within a period when customers wanted orders.

The process itself/ over processing-Some processes add no value. Fitting and other adjustments are only required because of defects in upstream processes. If a machine cannot produce to define tolerances, it should be replaced or the tolerances themselves reviewed and the design changed.

Material Movement/ Transport- The effect of excessive distances between processes is often disguised in a production system. Such movements and the associated stock that has to be in transit add no value.

People Movement/Motion- Excessive movement of people may arise from poor job layouts, their having to go and look for material for the next task. Shops crowded with inventory lengthen the search too.

Running process too early/ too fast/ Overproduction-Overproduction leads to the buildup of inventory which not only wastes investment but also space and transport resources as the stock often has to be moved several times to keep out of the way. Waiting time

between processes- This is wasteful because inability to deliver quickly loses the firm market opportunities. According to Dobler and Burt (1996) though lean manufacturing was originally pioneered by Henry Ford,

The Lean manufacturing concept has been refined and developed over the past decades in Japanese industries. The reason being to improve quality and reduce costs to help Japanese businesses grow and become more competitive in world markets for selective production lines. The US followed suit by developing and implementing modified versions of JIT systems. Later another type of waste defined by Womack et al (2003), it was described as manufacturing goods or services that do not meet customer demand or specifications. Many others have added the waste of unused human talent. The benefits seen within non-process industries as shown in the figure below; taking the example of automotive industry, are well documented; Decreased lead times for customers, Reduced inventories for manufacturers, Improved knowledge management, More robust processes (as measured by less errors and therefore less rework)This makes Lean a very real and physical concept-especially for manufacturing.

Figure Two : The Benefits of Lean Manufacturing

Source: Author (2013)

Lean production has now expanded and Lean thinking has been applied to all aspects of the supply chain. There are many well documented examples of the application of Lean thinking to business processes such as project management (Melton 2003), construction and so on. Lean can be applied to all aspects of supply chain and should be if the maximum benefits within the organization are to be sustainably realized. The two biggest problems with the application of Lean to business processes are the perceived lack of tangible benefits and the view that many business processes are already efficient. Both assumptions can be challenged. (Melton 2004) There are many tangible benefits associated with Lean business processes. A lean business process will be faster, e.g. the speed of response to a request for the business processes will be faster, and as most business processes are linked to organizational supply chains, then this can deliver

significant financial benefits to a company. The perception that a business process is already efficient is all too often an illusion. Functionally many business processes may appear very efficient, however the application of Lean Thinking forces us to review the whole supply chain in which the business process sits, and this frequently reveals bottlenecks and pockets of inefficiency.

2.6 Barriers to Lean Manufacturing Implementation

The LM production philosophies continued to gain acceptance through the late 1980s and throughout the 1990s. According to St Louis logistics consulting Firm, in 1990s, 18% of all US products were delivered JIT and in 1992, 23% and at that time, a 39% JIT delivery rate was projected for the year 2000 (Johnson, 1994). Major manufacturers are ahead of this curve according to Intel's global customer service manager, 98% of its customers expected JIT treatment, and their tolerances have progressively tightened (Wise, 1990).

Figure Three

Source: Author (2013)

2.6.1 External Obstacles

LM faces differences under certain economic environments. Both karmarkar (1989) and Aggarwal (1985) identify that LM systems cannot cope with increasing rates in demand. It assumes the production rate at final assembly is even; Aggarwal (1985) specifies that a LM master production schedule cannot tolerate load fluctuations of more than 10% and that it breaks down under large deviations from average conditions.

2.6.2 Global and Logistics issues

As could be expected, serious logistical issues impede the success of LM. The brief 1992 railroad strike is often cited as a major example of the most obvious inherent risk within JIT (Seidman, 1992).General motors' was forced to shut down certain factories involving 750,000 workers on the first day of the strike and would have experienced a total shut down without immediate resolution; as a practical matter, some safety stock is required even in the purest of LM environments.

2.6.3 Behavioral Constraints

Pre-requisite to the success of LM is adequate human capital. LM assumes that employees are motivated and perform at best when entrusted with increasing responsibility and authority. Keys (1991) uses theory z developed in the early 1980s by William Ouchi, a professor at UCLA's Anderson school of management advocates, an organization where workers are involved in all aspects of the decision making process verses Mc Gregory delineation, generally known as Theory X and Theory Y. The ideal goals of JIT are impractical under the wasteful, lazy, unmotivated worker under Theory X; Theory Y workers are motivated to reach only achievable goals. Further, Theories X

and Y focus on managerial solutions to the associated problems; only Theory Z focuses on labor oriented solutions (Keys, 1991).

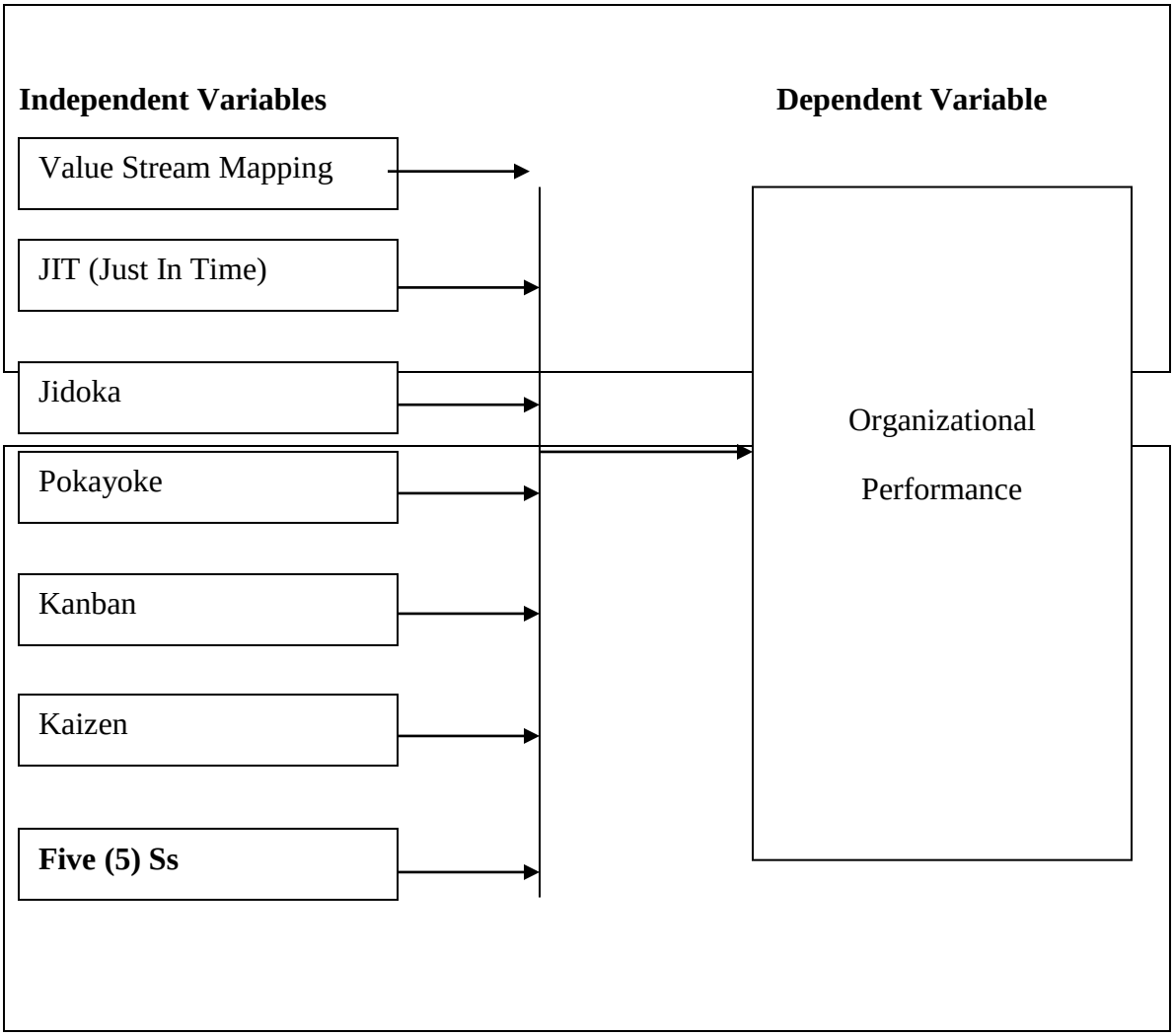
2.6.4 Intractable Accounting Systems

Traditional accounting and financial measures generally tend to defeat LM objectives. Goldratt and Fox (1986) provides an intuitive example in the Race; as diminishing static returns are reflected by standard cost accounting, it will eventually reject a capital expenditure to implement perpetual zero inventory (Zengwill, 1992). Cost accounting identifies variances for managerial inspection, but does not attempt to identify causal factors (Wise, 1990) nor communicate them in a worker orientation, both key LM tenets. Such measures are cycled monthly or quarterly; however quicker feedback loops e.g. hourly or daily are far more supportive or Just in Time (Keys, 1991; Wise, 1990).

2.6.5 Small Supplier Difficulties

Small supplier companies report tremendous difficulties and resistance to LM. A survey of such suppliers says that only half believe they can ever hope to take advantage of the efficiencies attributed to LM (Sheridan 1989). Small companies cannot reap the same scale of benefits from LM since they lack the economies of scale that their high volume, repetitive manufacturing customers posses (Sheridan, 1989). They are forced to purchase in much smaller quantities and hold far less influence over their suppliers to reciprocate LM policies, and so view themselves as whipping boys (Sheridan, 1989) for LM. In the case of Allen-Edmonds, its hide supplier refused to cooperate with LM efforts requiring the company to tolerate $1,000,000 of raw materials inventory (Marsh, 1993).

2.7 Conceptual Framework



Source: Author (2013)

An efficient and effective lean sensitive organization will depend on value stream mapping; cellular manufacturing and JIT; jidoka; pokayoke; kanban; flow; pull; 5S and Kaizen-continuous improvement. A well implemented JIT system for instance whose core objective is to eliminate waste at every stage of production will translate into an improved organizational performance, and so is value stream mapping, cellular manufacturing, jidoka, pokayoke, kaizen and 5s.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Research Design

This research was a cross sectional study exploring the Lean Manufacturing practices in companies listed at the NSE. Across sectional survey was carried out to make measurements at a specific point in time (Lewis, Saunders and Thornhill 2011)

3.2 Population

The population of the study was companies listed at the NSE as at 31st Aug 2013. There are sixty firms listed at the NSE (see appendix III) for the list; and are spread all over the country in all major towns and classified into eight major sectors. 1, Energy, 2, Finance, 3, Investment, 4, Agricultural, 5, Automobiles and accessories, 6, Manufacturing and allied, 7, Construction and allied, 8, Commercial and services.

This study was a census of Blue Chip companies operating in Kenya under the manufacturing and allied sector and therefore sampling was not necessary.

3.3 Data Collection

The study made use of primary and secondary data. Data collection was by use of questionnaire. The questionnaire was structured to contain open and closed ended questions. Closed ended questions were used to enable the collection of quantitative data for analysis using a Likert-scale, while the open ended questions were used to enable the researcher to collect qualitative data on the respondent's view of LM practices in organizations in Kenya. According to Mgenda and Mgenda (2003) questionnaires are

suitable to obtain important information about the population. Orodho (2004) said that this method reaches a large number of subjects able to read and write independently.

The questionnaire was self-administered. It comprised of four sections; Section one was designed to collect data which described general information of the company, Section two designed to address the impact, section three gathered data relating to the extent to which LM practices have been adopted by companies, and four addressed the challenges of LM implementation.

A 5 point Likert scale was used to determine reasons for LM implementation. Respondents were individuals reasonably assumed to be subject matter experts in LM practices specifically Operations Managers, Procurement Managers and their equivalent best placed to provide details regarding the operation of companies.

3.4 Data Analysis

Data collected was edited for accuracy, uniformity, consistency and completeness and arranged to enable coding and tabulation before final analysis.

Data was analyzed through descriptive statistics that are an indication of LM practices in companies operating in Kenya. The findings were presented using tables, pie charts, percentages, proportions and frequency distribution. Frequency distributions and percentages were used to analyze data in part one. Mean scores and standard deviations were used to analyze the extend of the use of LM practices in Blue Chip companies operating in Kenya. Frequency distribution and percentages were used to measure barriers to LM implementation.

The following model was used to show the relationship between LM practices and the organizational performance:

$Y=a+(b1x1)+(b2x2)+(b3x3)+(b4x4)+(b5x5)+(b6x6)+(b7x7);$

Where Y=Organizational Performance, a = the Y intercept when x = zero;

b1, b2, b3, b4, b5, b6 and b7 are the regression weights attached to the variables;

x1=Value Stream Mapping, x2 = JIT, x3= Jidoka, x4 = Pokayoke, x5 = Kanban, x6= Kaizen, and x7 = Five Ss.

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

This chapter provides an analysis of data collected from the field. The results have been presented in tables, figures and content delivery to highlight the major findings. They are also presented sequentially according to the research questions of the study. Mean scores and standard deviations analyses have been used to analyze the data collected. The raw data was coded, evaluated and tabulated to depict clearly the lean manufacturing practices and performance of organizations listed at the Nairobi securities exchange

4.2 General Information of the Company

The study sought to establish the General Information of the Company and the respondents employed in the study with regards to the gender, age, length of service in the current position, academic levels, Position of Respondent, Description of company ownership and Annual company turnover. This bio data points at the respondents' appropriateness in answering the study questions.

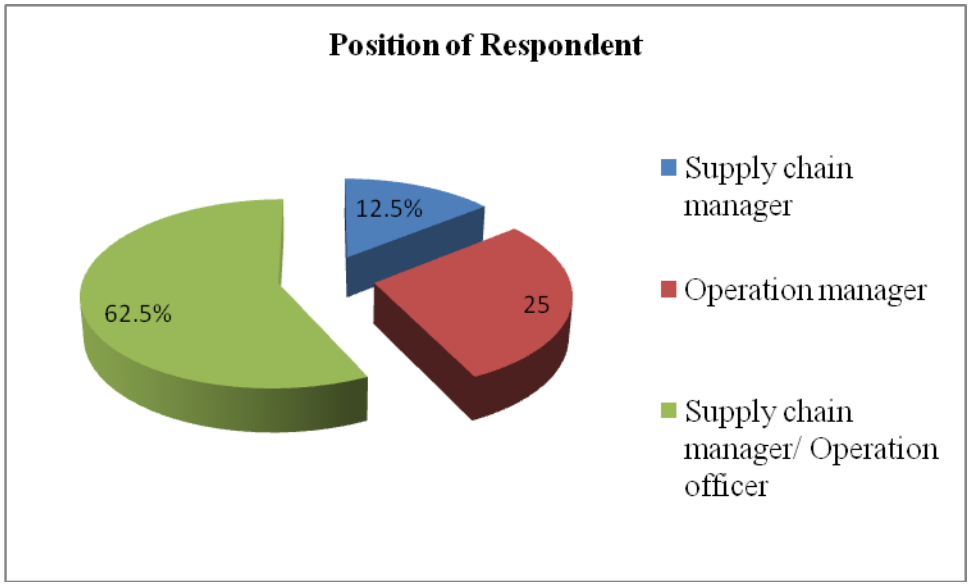
4.2.1 Position of Respondent

The respondents were asked to indicate their current working Position in the company. Figure 4.1 shows the results of the research question

Table 1: Position of Respondent

Position of Respondent	Frequency	Percentage
Supply chain manager	1	12.5
Operation manager	3	25
Supply chain manager/ Operation officer	4	50

Figure 4.1: Position of Respondent



From figure 4.1 shows majority of the respondents 62.5% of the respondents rates indicated that they work interactively in supply chain management and operation department, 25% of the respondent rates indicated that they work in operation department, 12.5% of the respondent rates indicated that they work in supply chain management department. Therefore respondents are rich in supply chain management knowledge.

4.2.2 Length of Service in the current Position

The respondents were asked to indicate the number of years worked in their current position firm. Figure 4.2 shows the results of the research question.

Table 2: Length of service

Length of service	Frequency	Percentage
Less than 10 years	1	12.5
5 to 10 years	3	50
10 to 15 years	2	25
Above 15 years	1	12.5

Figure 4.2: Length of service

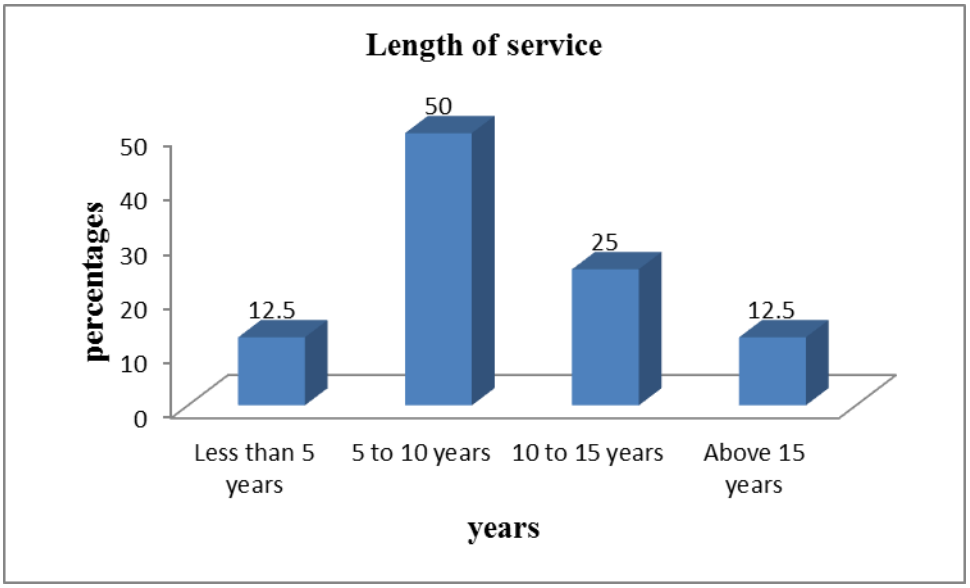


Figure 4.2 presents the findings on length of service of the respondents. From the figure, 50% respondent rates indicated that they had been in the present firm for 5 to 10 years. 25% respondent rates indicated a period of 10 to 15 years, 12.5% respondent rates

indicated a period of less than 5years, while another 12.5% respondent rates indicated they had worked for over 15years current position. This implies that majority of respondents are appropriate to answer the research question.

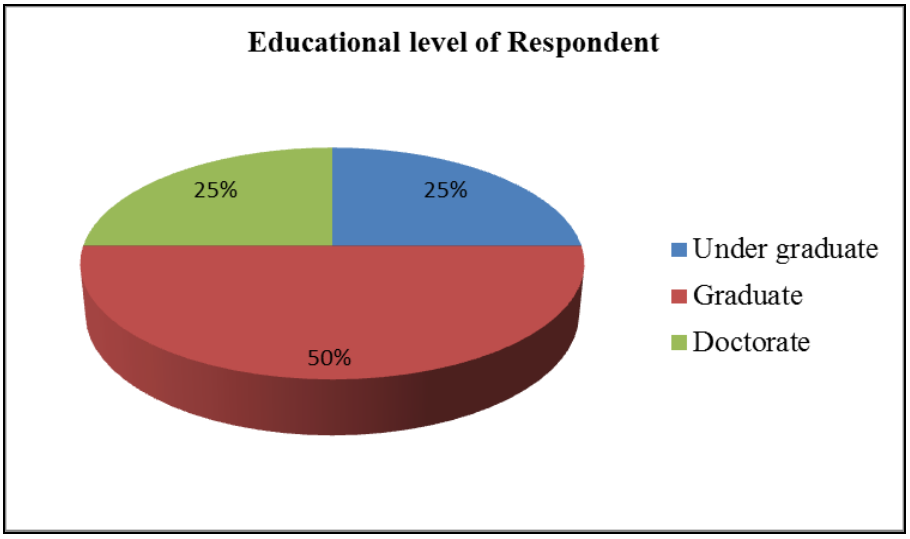
4.2.3 Educational level of Respondent

The respondents were asked to indicate their academic highest attained levels. Figure 4.3 shows the study findings.

Table 3: Educational level of Respondent

Educational level	Frequency	Percentage
Undergraduate	2	25
Graduate	4	50
Doctorate	2	25

Figure 4.3: Educational level of Respondent



From figure 4.3 shows majority of the respondents 50% indicated they are graduate degree holders. This was followed by an equivalent number of both doctorates and

undergraduate who indicated 25% of the respondents that they are doctorates and undergraduate. This indicates that there is high literacy level in Nairobi Security Exchange.

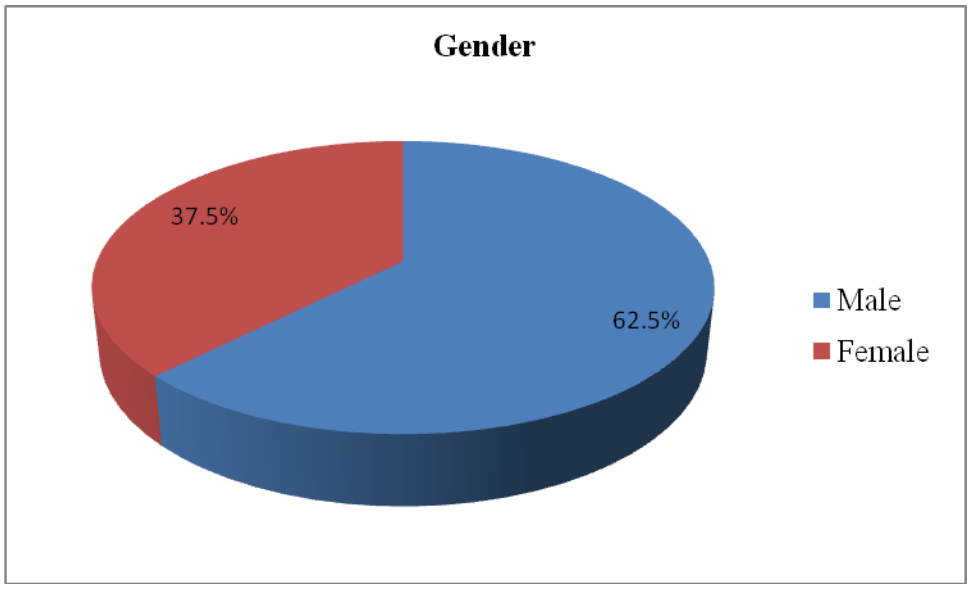
4.2.4 Gender

The respondents were asked to show their gender, this was expected to guide the researcher on the conclusions regarding the degree of congruence of responses with the gender characteristics. Figure 4.4 shows the study finding.

Table 4: Gender

Gender	Frequency	Percentage
Male	3	62.5
Female	5	37.5

Figure 4.4: Gender



The results as in the figure 4.4 show that majority of the respondent were male at 62% while female was 38% implying that most of the workers were male. This shows that majority of staff in companies trading in NSE are men compared to women.

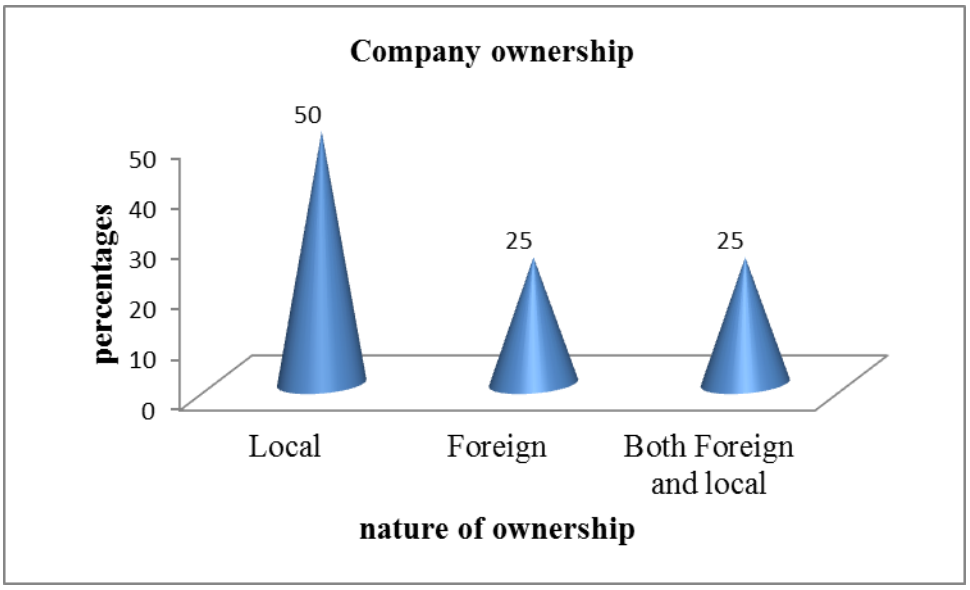
4.2.5 Description of company ownership

The respondents were asked to indicate the nature of ownershiship of the company they they are working while while drawing attention to shareholders and central location of their company. Figure 4.5 shows the study findings.

Table 4.5: Company ownership

Company ownership	Frequency	Percentage
Local	4	50
Foreign	2	25
Foreign and local	2	25

Figure 4.5: Company ownership



From figure 4.5 shows majority of the respondents 50% indicated that the companies are locally owned, 25% of the respondents indicated that the companies are foreign owned while another 25% of the respondents indicated that the companies are both local foreign owned. This indicated that local ownership of companies trading in NSE is dominant in compare to foreign ownership and to those with both local and foreign ownership.

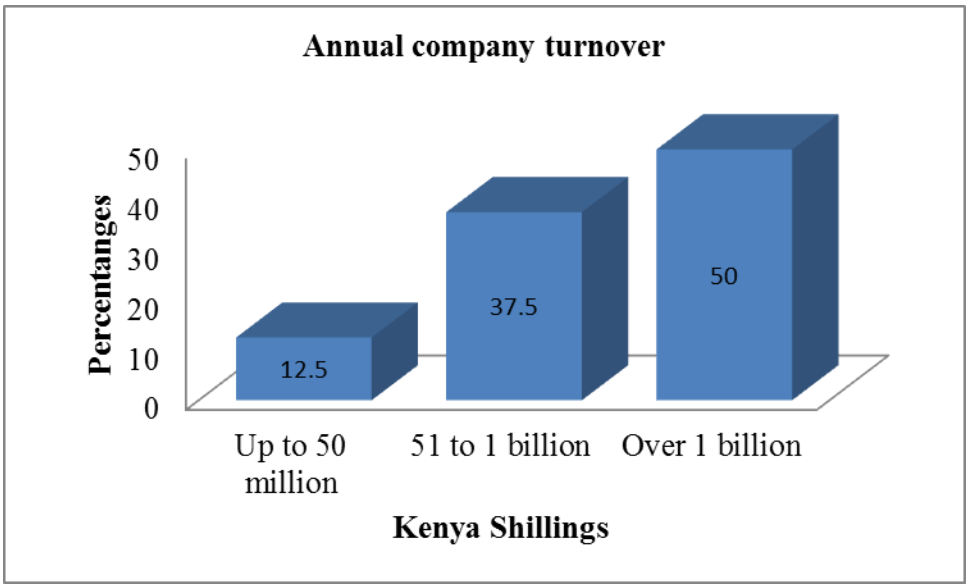
4.2.6 Annual company turnover

The respondents were asked to indicate the rate of annual company turnover in terms of kenya shillings. Figure 4.6 shows the study findings.

Table 4.6: Annual company turnovers

company turnovers in Kshs	frequency	Percentage
Up to 50 million	1	12.5
51 million to 1 billion	3	37.5
Over 1 billion	4	50

Figure 4.6: Annual company turnovers



From figure 4.6 shows majority of the respondents 50% indicated that the Annual company turnovers is over one billion, 37.5 % of the respondents indicated that the Annual company turnovers ranges between fifty one million to one billion while 12.5 % of the respondents indicated that the Annual company turnovers is below fifty million. This shows that majority of companies enlisted and trading in NSE are multibillion companies and large in terms of revenue.

4.3 Effects of Lean Manufacturing Implementation on Organizations Performance

The respondents were asked to indicate their views of the attributes of the Lean Manufacturing practices adopted by firms that were presented to them. They were asked to rate the nature and extent to which they consider Value Stream Mapping, Just In Time, Flow and pull production, Pokayoke/Jidoka-Error Proofing/Automation, Kanban - Information Transparency, Kaizen/Continuous Improvements and Five (5) Ss attributes significant in Lean Manufacturing practices. The study findings are presented in Table 4.7 to Table 4.13

4.3.1 Value Stream Mapping

Table 4.7: Value Stream Mapping

Value Stream Mapping	**mean**	**Standard deviation**
Production smoothing	4.3750	.74402
Waste reduction	4.1250	.99103
Reduced lead time	3.3750	.74402
Enhanced quality of output	3.3750	.51755
Reduced production time	3.7500	1.03510

The results in table 4.7 above show that majority of the respondents with large extent indicated that production smoothing is significant in Value Stream Mapping in Lean Manufacturing practices m=4.3750. The respondents also with large extent indicated that waste reduction is significant in Value Stream Mapping in Lean Manufacturing practices m=4.1250. The respondents with Moderate extent indicated that Enhanced quality of output is significant in Value Stream Mapping in Lean Manufacturing practices m=3.3750. The respondents with Moderate extent indicated that Reduced lead time is significant in Value Stream Mapping in Lean Manufacturing practices m=3.3750. The respondents also with Moderate extent indicated that Reduced production time is significant in Value Stream Mapping in Lean Manufacturing practices m=3.3750.

4.3.2 Just In Time

Table 4.8: Just In Time

Just In Time	Mean	Standard deviation
Reduced manufacturing costs	4.0000	.75593
Waste reduction	3.8750	.64087
Reduced inventory	3.3750	.51755
Reduced changeover time	3.0000	.53452
Short setup time	2.7500	.70711

The results in table 4.8 above show that majority of the respondents with large extent indicated that Reduced manufacturing costs is significant in Just in Time in Lean Manufacturing practices m=4.0000. The respondents with Moderate extent indicated that

waste reduction is significant in Just in Time in Lean Manufacturing practices m=3.8750. The respondents with Moderate extent indicated that Reduced inventory is significant in Just in Time in Lean Manufacturing practices m=3.3750. The respondents with Moderate extent indicated that Reduced changeover time is significant in Just in Time in Lean Manufacturing practices m=3.0000. The respondents with Small extent indicated that Short setup time is significant in Just in Time in Lean Manufacturing practices m=2.750

Table 4.9: Flow and pull production

Flow and pull production	**Mean**	**Standard deviation**
Production smoothing	4.2500	.70711
Decreased lead time	4.0000	.75593
Demand driven production	3.1250	.83452
Enhanced quality of output	2.3750	.74402

The results in table 4.9 above show that majority of the respondents with large extent indicated that Production smoothing is significant in Flow and pull production in Lean Manufacturing practices m=4.2500. The respondents with large extent indicated that Decreased lead time is significant in Flow and pull production in Lean Manufacturing practices m=4.0000. The respondents with Moderate extent indicated that Demand driven production is significant in Flow and pull production in Lean Manufacturing practices m=3.1250. The respondents with Small extent indicated that Enhanced quality of output is significant in Flow and pull production in Lean Manufacturing practices m=2.3750

4.3.3 Pokayoke/Jidoka-Error Proofing/Automation

Table 4.10: Pokayoke/Jidoka-Error Proofing/Automation

Pokayoke/Jidoka-Error Proofing/Automation	**Mean**	**Standard deviation**
Reduced lead time	3.8250	.74402
Waste elimination	3.3750	.74402
Enhanced quality of output	3.6250	.73402
Reduced errors	2.8750	.83452

The results in table 4.10 above show that majority of the respondents with Moderate extent indicated that Reduced lead time is significant in Proofing/Automation in Lean Manufacturing practices m=3.8250. The respondents with Moderate extent indicated that Enhanced quality of output is significant in Proofing/Automation in Lean Manufacturing practices m=3.6250. The respondents with Moderate extent indicated that Waste elimination is significant in Proofing/Automation in Lean Manufacturing practices m=3.3750. The respondents with Small extent indicated that Reduced errors is significant in Proofing/Automation in Lean Manufacturing practices m=2.8750.

4.3.5 Kanban - Information Transparency

Table 4.11: Kanban - Information Transparency

Kanban - Information Transparency	**Mean**	**Standard deviation**
Reduced cost of information processing	4.5000	.53452
Increase production process transparency	2.6250	.74402
Smooth information transmission	2.2500	1.03510

The results in table 4.11 above show that majority of the respondents with Large extent indicated that Reduced cost of information processing is significant in Information Transparency in Lean Manufacturing practices m=4.5000. The respondents with Small extent indicated that Increase production process transparency is significant in Information Transparency in Lean Manufacturing practices m=2.6250The respondents with Small extent indicated that Smooth information transmission is significant in Information Transparency in Lean Manufacturing practices m=2.2500.

4.3.6 Kaizen/Continuous Improvements

Table 4.12: Kaizen/Continuous Improvements

Kaizen/Continuous Improvement	mean	Standard deviation
Enhanced quality of output	4.0000	.75593
Production smoothing	3.3750	.91613
Waste elimination	3.2500	.70711
Reduced errors	2.2580	.75711

The results in table 4.12 above show that majority of the respondents with Large extent indicated that Enhanced quality of output is significant in Continuous Improvements in Lean Manufacturing practices m=4.0000. The respondents with Moderate extent indicated that Production smoothing is significant in Continuous Improvements in Lean Manufacturing practices m=3.3750. The respondents with Moderate extent indicated that Waste elimination is significant in Continuous Improvements in Lean Manufacturing

practices m=3.2500. The respondents with Small extent indicated that Reduced errors is significant in Continuous Improvements in Lean Manufacturing practices m=2.2500.

4.3.7 Five (5) Ss

Table 4.13: Five (5) Ss

Five (5) Ss	**mean**	**Standard deviation**
Sweeping/seiso	4.4444	.72648
Self discipline	4.0000	.86603
Sorting/seiton	3.5556	.72648
Standardization/seiketsu	3.3750	.74402
Simplifying	2.6250	.91613

The results in table 4.13 above show that majority of the respondents with large extent indicated that Sweeping/seiso is significant in Five (5) Ss in Lean Manufacturing practices m=4.4444. The respondents with Large extent indicated that Self discipline of output is significant in Five (5) Ss in Lean Manufacturing practices m=4.0000. The respondents with Moderate extent indicated that Sorting/seiton is significant in Five (5) Ss in Lean Manufacturing practices m=3.5556. The respondents also with Moderate extent indicated that Standardization/seiketsu is significant in Five (5) Ss in Lean Manufacturing practices m=3.3750. The respondents also with Small extent indicated that Simplifying is significant in Five (5) Ss in Lean Manufacturing practices m=2.6250.

4.3.8 Impact of Lean manufacturing implementation

The respondents were asked to rate the nature and extent of Impact of Lean manufacturing implementation to the provided statements. Table 4.14 shows the study finding

Table 4.14: Impact of Lean manufacturing implementation

Impact of Lean Manufacturing implementation	Mean	Standard deviation
Profitability improvement	4.4444	.52705
Product and service quality improvement	4.4444	.72648
Improved material flow and through put	4.3333	.50000
Productivity improvement	4.0000	.86603
Lead time reduction	3.5556	.72648
Labor requirement reduction	3.4444	.72648
Work in process reduction	3.3750	.74402
Sales volume improvement	3.0000	.50000
Wastage reduction	2.8660	.52705
Inventory reduction	2.6250	.91613
Set up time reduction	2.0000	.70711
Manufacturing cost reduction	1.5556	1.5556

The results in table 4.14 above show that majority of the respondents with large extent indicated that Profitability improvement has significant in impact of lean manufacturing implementation in Lean Manufacturing practices m=4.4444. The respondents also with large extent indicated that Product and service quality improvement has significant in impact of lean manufacturing implementation in Lean Manufacturing practices m=4.4444. The respondents with Large extent indicated that Improved material flow and

through put has significant in impact of lean manufacturing implementation in Lean Manufacturing practices m=4.3333. The respondents with Large extent indicated that Productivity improvement has significant in impact of lean manufacturing implementation in Lean Manufacturing practices m=4.0000.

The respondents also with moderate extent indicated that Lead time reduction has significant in impact of lean manufacturing implementation in Lean Manufacturing practices m=3.5556. The respondents with moderate extent indicated that Labor requirement reduction has significant in impact of lean manufacturing implementation in Lean Manufacturing practices m=3.4444. The respondents with moderate extent indicated that Work in process reduction has significant in impact of lean manufacturing implementation in Lean Manufacturing practices m=3.3750. The respondents also with Moderate extent indicated that Sales volume improvement has significant in Value Stream Mapping in Lean Manufacturing practices m=3.0000. The respondents also with small extent indicated that Inventory reduction has significant in impact of lean manufacturing implementation in Lean Manufacturing practices m=2.6250. The respondents with small extent indicated that Set up time reduction has significant in impact of lean manufacturing implementation in Lean Manufacturing practices m=2.0000. The respondents with very small extent indicated that Manufacturing cost reduction has significant in impact of lean manufacturing implementation in Lean Manufacturing practices m=1.5556.

4.4 The Extent of Adoption of Lean Manufacturing Practices

The respondents were asked rate the extent of adoption by your organization for each of the following Lean Manufacturing Practices presented to them. Table 4.15 shows the study finding

Table 4.15: Principles or Tool

Principle/Tool	Mean	Standard deviation
Jidoka-Automation	4.4096	.78174
JIT (Just In Time)	4.2222	.44096
Pokayoke - Error proofing	4.0000	.70711
Value Stream Mapping	3.9876	.60093
Five (5) Ss	3.6667	.50000
Kaizen - Continuous Improvement	3.4444	.72648
Kanban – Information Transparency	3.0000	.70711

The results in table 4.15 above show that majority of the respondents with large extent indicated that Jidoka-Automation is adopted in Lean Manufacturing practices m=4.4096. The respondents with large extent indicated that JIT (Just in Time) is adopted in Lean Manufacturing practices m= 4.2222. The respondents with large extent indicated that Pokayoke - Error proofing is adopted in Lean Manufacturing practices m= 4.2222. The respondents with moderate extent indicated that Value Stream Mapping is adopted in

Lean Manufacturing practices m= 3.9876. The respondents with moderate extent indicated that Five (5) Ss is adopted in Lean Manufacturing practices m= 3.6667. The respondents with moderate extent indicated that Kaizen-Continuous Improvement is adopted in Lean Manufacturing practices m= 3.4444. The respondents with moderate extent indicated that Kanban – Information Transparency is adopted in Lean Manufacturing practices m= 3.0000

4.5 Correlation Analysis

Two predictor variable are said to be correlated if their coefficient of correlations is greater than 0.5. In such a situation one of the variables must be dropped from the analysis. As shown in table 4.16, none of the predictor variables had coefficient of correlation between themselves of more than 0.5 hence all of them were included in the model. The matrix also indicated high correlation between the response and predictor variables, that is, Value Stream Mapping, JIT (Just In Time), Jidoka-Automation, Pokayoke - Error proofing, Kanban – Information Transparency, Kaizen - Continuous Improvement, Five (5) Ss,

Table 4.16: Pearson Correlation Correlations

	Organisation performance	Value Stream Mapping	JIT (Just In Time)	Jidoka-Automation	Pokayoke - Error proofing	Kanban – Information Transparency	Kaizen - Continuous Improvement	Five (5) Ss
Organisation performance	1.000							
Value Stream Mapping	.236	1.000						
JIT (Just	.352	.118	1.00					

In Time)			0					
Jidoka-Automation	.467	.128	.247	1.000				
Pokayoke - Error proofing	.307	.254	.254	.380	1.000			
Kanban – Information Transparency	.454	.306	.343	.342	.189	1.000		
Kaizen - Continuous Improvement	.456	.453	.432	.153	.245	398	1.000	
Five (5) Ss	.334	276	.353	432	.178	.123	.443	1.000

Source: Researcher (2013)

4.6 Regression Analysis

A multivariate regression model was applied to determine the significant of each of the seven independent variables with respect to the organizational performance in adopting lean manufacturing practices.

Table 4.17: Significance of the Regression Coefficients

The data for this is summarized in tables 4.17

		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
(Constant)		.260	.460		0.565	.231
Value Stream Mapping	X_1	.131	.048	.254	2.729	.001
JIT (Just In Time)	X_2	.170	.045	-.300	3.778	.000
Jidoka-Automation	X_3	.051	.023	.113	2.217	.002

Pokayoke - Error proofing	X_4	.048	.022	.093	2.182	.000
Kanban – Information Transparency	X5	.054	.076	.098	3.451	.003
Kaizen - Continuous Improvement	X6	.143	.045	.143	2.347	.020
Five (5) Ss	X7	.068	.056	.094	2.198	.043

Source: Researcher (2013)

The regression model found is;

$Y = 0.260 + 0.131X_1 + 0.170X_2 + 0.051X_3 + 0.048X_4 + 0.054X_5 + 0.143X_6 + 0.068X_7$

It is observed that all the coefficients are positive meaning that a change in any one of them affects organizational performance in the same direction. Using a significance level of 5% any variable having a p-value(sig.) less than 5% is statistically significant and this is the case for all the independent variables in this model (x1 = 0.1%, x2 = 0%, x3 = 0.2%, x4 = 0%, x5 = 0.3%,x6=2% and x7=4.3%).

This means that that all the independent variables in this model are suitable predictors of organizational performance.

4.7 The Full Model

Analysis in table 4.18 shows that the coefficient of determination (the percentage variation in the dependent variable being explained by the changes in the independent variables) R squared equals 84.3%, that is, Value Stream Mapping, JIT (Just In Time), Jidoka-Automation, Pokayoke - Error proofing, Kanban – Information Transparency, Kaizen - Continuous Improvement, Five (5) Ss, leaving only 15.7% unexplained

variance. The P- value of 0.000 (Less than 0.05) implies that the model of organization performance is significant at the 5% significance hence it's a suitable prediction model. Anova P value of 0.00 in table 4.19 corroborates these findings.

Table 4.18: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.918(a)	.843	.805	.51038	84.3	1.242	1	7	.000

Source: Researcher (2013)

Table 4.19: ANOVA

	Sum of Squares	Df	Mean Square	F	Sig.
Regression	.852	1	.213	1.242	.000
Residual	6.173	7	.171		
Total	7.025	8	.384		

Source: Researcher (2013)

4.20 Discussion

In this study all the independent variables (Value Stream Mapping, Just In Time Jidoka-Automation, Pokayoke-Error proofing, Kanban-Information Transparency, Kaizen-Continous Improvement Five Ss**)** are found to be significant in the prediction of Organisational Performance. The full model is also significant .These findings are consistent with those of Bicheno, (2000); Rother & Shook, (1988); Kocakulah, Austill,

& Shenk (2011) who found out that lean production includes, on the other hand, a strategy which depends on a set of tools and, on the other hand, the Lean thinking, which focuses both internally and reducing costs, and externally to increase customer satisfaction. The objective of this multi-dimensional approach is the reduction of costs by eliminating the non-value activities, using tools such as just-in-time, cellular manufacturing, Value Stream Mapping, 5S, Kanban (pull) systems, Kaizen.

4.21 Challenges to Lean Manufacturing Implementation

The respondents were asked to rate the challenges/ barriers which prevent firms from adopting Lean Manufacturing practices. Table 4.20 shows the study finding

Table 4.18: Challenges to Lean Manufacturing implementation

Challenges to LM implementation	Mean	Standard deviation
Lack of top management commitment	3.7778	.44096
Poor infrastructure	3.6667	.50000
Lack of political goodwill	3.6667	.50087
Lack of interface with existing systems	3.5557	.52705
Poor information/data accuracy	3.2222	.83333
Lack of continuing education/training	2.8889	.92796
Government policies	2.4444	.52705
Power outages/blackouts	2.0000	1.11803
Lack of vendor support	1.7778	.83333
Lack of appreciation of resulting benefits	1.5566	.52715
High cost of electricity	1.5557	.52705
Employees resistance to change	1.5556	.52705
Lack of internal expertise	1.3333	.50000

The results in table 4.20 above show that majority of the respondents with moderate extent indicated that Lack of top management commitment is the challenges to Lean Manufacturing Implementation m=3.7778. The respondents with moderate extent indicated that poor infrastructure is the challenges to Lean Manufacturing Implementation m=3.6667. The respondents with moderate extent indicated that lack of political goodwill is the challenges to Lean Manufacturing Implementation m=3.6667. The respondents with moderate extent indicated that lack of top management commitment is the challenges to Lean Manufacturing Implementation m=3.5557. The respondents with moderate extent indicated that poor information/data accuracy is the challenges to Lean Manufacturing Implementation m=3.2222. The respondents with small extent indicated that lack of continuing education/training is the challenges to Lean Manufacturing Implementation m=2.8889.

The respondents with small extent indicated that government policies is the challenges to Lean Manufacturing Implementation m=2.4444. The respondents with small extent indicated that power outages/blackouts is the challenges to Lean Manufacturing Implementation m=2.0000. The respondents with very small extent indicated that Lack of vendor support is the challenges to Lean Manufacturing Implementation m=1.7778. The respondents with very small extent indicated that lack of appreciation of resulting benefits is the challenges to Lean Manufacturing Implementation m=1.5566. The respondents with very small extent indicated that high cost of electricity is the challenges to Lean Manufacturing Implementation m=1.5557. The respondents with very small extent indicated that Employees resistance to change is the challenges to Lean Manufacturing Implementation m=1.5556. The respondents with

very small extent indicated that lack of internal expertise is the challenges to Lean Manufacturing Implementation m=1.3333.

CHAPTER FIVE:

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents summary of findings as discussed in chapter four and interpretations of the results, conclusions, recommendations based on the findings and suggestions for further research.

5.2 Summary of the Findings

This study sought to achieve three objectives namely; to determine the effect of lean manufacturing practices on the performance of organizations listed at the Nairobi Securities Exchange, to document the extent to which lean manufacturing practices have been adopted by organizations listed at the Nairobi Securities Exchange and to find out the challenges faced by organizations listed at the Nairobi Securities Exchange in their pursuit to implement lean manufacturing practices. It was found out from the study that all the independent variables (Value Stream Mapping, Just In Time Jidoka-Automation, Pokayoke-Error proofing, Kanban-Information Transparency, Kaizen-Continous Improvement Five Ss**)** are significant in the prediction of Organizational Performance.

The study confirmed that most manufacturing companies in Kenya had adopted the concept of lean manufacturing in their operations ranking the tools of lean manufacturing from the highly adopted to the least adopted in the following order; Jidoka-Automation, Just In Time, Pokayoke-Error Proofing, Value Stream Mapping,Five Ss,kaizen-Continous Improvement and Kanban-Information Transparency.

The research also looked into the challenges facing the implementation of lean manufacturing practices and confirmed that lack of top management commitment, poor infrastructure, lack of political good will, lack of interface with existing systems, data inaccuracy, lack of training, government policies, power outages, lack of vendor support, lack of appreciation of resulting benefits, high cost of electricity, employees resistance to change and lack of internal expertise affect organizational performance in that order.

5.3 Conclusions

Critics of lean in the early days pointed out that its promotion of learning was based on assumptions of the unproblematic diffusion of uncontested objective knowledge that was codifiable from standardized work processes (Berggren, et al 2000). Indeed, the logic of learning under lean production, with its emphasis on standardization, could be said to hinder certain types of learning as the encouragement of conformity to norms was clearly in conflict with the challenging of such norms.

A rising from the finding of the study, some pertinent issues in Lean Manufacturing is aimed improving the state of Lean Manufacturing Practices and Performance of Organizations Listed at the Nairobi Securities Exchange. Lean is becoming the next quality or e-Business practice area. In the 1980s, companies with superior quality were able to more easily enter new markets and command higher prices for their products and services than companies with inferior quality. Now, quality is the price of admission for entering the business environment. E-Business was the 1990s equivalent; an e-Business strategy and presence is required in many markets. Today, many large manufacturers are demanding that suppliers adopt lean practices. Lean organizations are able to be more

responsive to market trends, deliver products and services faster, and provide products and services less expensively than their non-lean counterparts. Lean crosses all industry boundaries, addresses all organizational functions, and impacts the entire system – supply chain to customer base. Additionally the findings from the research showed the need for establishing lean performance parameters and the use of a strategic tool like just-in-time delivery of materials, minimization of inventories and Lean's dependence upon high quality products and services and policy deployment for top-down planning.

The focus over value creating activities towards the final customer is still missing in most of the companies implementing lean. Lean value system is evolving throughout the implementation process and involves series of value adding network of operations between the companies taking part in the value chain. What is more is the last tendency is how to lean value systems can be created in Nairobi Securities Exchange in their pursuit to implement lean manufacturing practices.

5.4 Recommendations

Lean manufacturing practices should be utilized to improve quality; to stay competitive in today's marketplace, a company must understand its customers' wants needs and designs processes that meet their expectations and requirements. To Eliminate Waste; waste is an activity that consumes time, resources or space but does not add any value to the product or service. To Reduce Time; reducing the time it takes to finish an activity from start to finish is one of the most effective ways to eliminate waste and lower costs. Reduce Total Costs; to minimize costs, a company must produce only to customer demand. Overproduction increases a company's' inventory costs because of storage needs. Strategic elements of Lean can be quite complex and compromise multiple

elements. Four different notions of Lean have been identified; one; Lean is a fixed state or goal (being Lean), two; Lean as a continuous change process (becoming Lean), three; Lean as a set of tools or methods (doing Lean), four; Lean as a philosophy (Lean thinking.).After formulating guiding principles of its Lean Manufacturing approach in the TPS, Toyota formalized in 2001 the basis of its Lean Management: The key managerial values and attitudes needed to sustain continuous improvement in the long run. These core management principles are articulated around the twin pillars of continuous improvement (relentless elimination of waste) and respect for people (engagement in long term relationships based on continuous improvement and mutual trust) (Suzaki 1987).

Lean production is mainly based on the just-in-time production. The just-in-time method consists of an elaborate planning of the production process and the amount of raw materials required as used exactly where they are needed, resulting thus a reduction in the stocks of raw materials and parts. In each stage of the production process only the amount needed must be obtained and it should be done only when it is required by the next working stage, according to the technological flux. Before starting with the introduction of lean implementation actions it is strongly recommended to first of all make sure that the whole workforce understands that lean is more than just a toolbox, the use of teamwork and the elimination of non value adding tasks. Conducting lean training and explaining that a fully integrated management philosophy like the TPS does not seek tom reduce headcount but is a way to create new work and business which can clearly be proved by looking at actual Porsche figures.

5.5 Limitations of the Research

Due to tight schedules of the top management in companies listed Nairobi Security Exchange, the study encountered difficulties in gaining access to the respondents and the researcher had to keep rescheduling their time to align with the availability of the respondents.

Information relating to Lean manufacturing practices is always treated with sensitivity. This caused difficulties in convincing the respondents of the importance of giving sincere answers to the asked questions evidenced through reluctance of accepting invitation to participate in the study to counter the challenge, the research had to inform the respondents in advance the purpose for the research study being carried out, that it was meant for academic purpose only and not for other investigations.

5.6 Suggestions for Further Research

This study concentrated on the study of lean manufacturing practices and the performance of organizations in the manufacturing sector and listed at the Nairobi Securities Exchange. The researcher recommends further research on the same topic but in other organizations other than manufacturing companies, both within the country and outside the country. This will help to establish whether the same effects will be held true in organizations other than manufacturing organizations and in other parts in and out of the country. This will also assist in providing concrete facts upon which reliable conclusions can be made.

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APPENDICES

APPENDIX I: RESEARCH QUESTIONNAIRE

This research is aimed at getting an understanding of the impact, challenges and benefits of implementing Lean Manufacturing practices in companies listed at the Nairobi Securities Exchange. The responses to this questionnaire will be purely used for academic purposes and will be treated with strict confidence.

Thank you for your assistance.

SECTION ONE: GENERAL INFORMATION OF THE COMPANY

1. Position of Respondent

   ( ) Supply Chain Manager ( ) Operations Manager ( ) Supply Chain/Operations Officer

   Other (specify)……

2. How long have you been in this position?

   ( ) Less than 5 years ( ) 5 to 10 years ( ) 10 to 15 years

   ( )Above 15 years

3. Educational level of Respondent

   ( ) Under graduate ( ) Graduate ( ) Doctorate

   Other (specify)…….....

4. Gender

   ( ) Male ( )Female

5. How can you describe ownership of your company: please tick appropriately inside the box.

   Local ( ) Foreign ( ) Both ( )

6. Annual company turnover (ksh)

   Up to 50 million ( ) 51 to 1 billion ( ) Over 1 billion ( )

SECTION TWO: IMPACT OF LEAN MANUFACTURING IMPLEMENTATION

1) Listed below are some of the attributes of the Lean Manufacturing practices adopted by firms. Please rank by a tick in the appropriate box the nature and extent to which you consider these attributes significant using the following rating; 5 = to a very large extent, 4 = Large extent, 3 = Moderate extent, 2 = Small extent, 1 = Very small extent

Value Stream Mapping	**5**	**4**	**3**	**2**	**1**
Waste reduction					
Reduced production time					
Reduced lead time					
Enhanced quality of output					
Production smoothing					
Any other (please indicate)					
Just In Time					
Reduced inventory					
Short setup time					
Reduced changeover time					
Reduced manufacturing costs					
Waste reduction					
Any other (please indicate)					
Flow and pull production					
Enhanced quality of output					
Decreased lead time					
Demand driven production					
Production smoothing					
Any other (please indicate)					
Pokayoke/Jidoka-Error Proofing/Automation					
Reduced errors					
Waste elimination					
Enhanced quality of output					

Reduced lead time					
Any other (please indicate)					
Kanban - Information Transparency					
Reduced cost of information processing					
Smooth information transmission					
Increase production process transparency					
Any other (please indicate)					
Kaizen/Continuous Improvement					
Production smoothing					
Waste elimination					
Enhanced quality of output					
Reduced errors					
Any other (please indicate)					
Five (5) Ss					
Standardization/seiketsu					
Simplifying					
Sorting/seiton					
Sweeping/seiso					
Self discipline					
Any other (please indicate)					

2) Please rank by a tick in the appropriate box the nature and extent to which the implementation of Lean Manufacturing practices has impacted to your company using the following ratings; 5 = To a very large extent, 4 = Large extent, 3 = Moderate extent 2 = Small extent 1 = Very small extent

Impact of Lean Manufacturing implementation	**5**	**4**	**3**	**2**	**1**
Work in process reduction					
Inventory reduction					
Lead time reduction					
Product and service quality improvement					

Productivity improvement						
Wastage reduction						
Manufacturing cost reduction						
Set up time reduction						
Profitability improvement						
Sales volume improvement						
Labor requirement reduction						
Improved material flow and through put						
Any other (please indicate)						

SECTION THREE: THE EXTENT OF ADOPTION OF LEAN MANUFACTURING PRACTICES

1) Indicate the extent of adoption by your organization for each of the following Lean Manufacturing Practices. On a scale of 1 to 5 where 5 = to a very large extent, 4 = large extent, 3 = moderate extent, 2 = small extent, 1 = very small extent),

	Principle/Tool	**5**	**4**	**3**	**2**	**1**
1	Value Stream Mapping					
2	JIT (Just In Time)					
3	Jidoka-Automation					
4	Pokayoke - Error proofing					
5	Kanban – Information Transparency					
6	Kaizen - Continuous Improvement					
7	Five (5) Ss					
8	Any other (please indicate)					

SECTION FOUR: CHALLENGES TO LEAN MANUFACTURING IMPLEMENTATION

1) Listed below are some of the challenges/ barriers which prevent firms from adopting Lean Manufacturing practices. Please rank by a tick in the appropriate box the extent to which you agree with these challenges using the following rating;

5 = stronglyagree, 4 = Agree, 3 = Undecided 2 = Disagree, 1 = Strongly Disagree.

Challenges to LM implementation	**5**	**4**	**3**	**2**	**1**
Lack of interface with existing systems					
Lack of internal expertise					
Government policies					
Lack of political goodwill					
Poor infrastructure					
Poor information/data accuracy					
Employees resistance to change					
Lack of vendor support					
Lack of appreciation of resulting benefits					
Power outages/blackouts					
High cost of electricity					
Lack of continuing education/training					
Lack of top management commitment					
Any other (please indicate)					

I sincerely thank you for the time you have taken to complete this questionnaire.

APPENDIX II: COMPANIES LISTED AT THE NSE AS AT 31ST OF AUGUST 2013

AGRICULTURAL SECTOR	**SHARE PRICE**
Eaagads ltd	Ord 1.25
Kapchorua Ltd	Ord 5.00
Kakuzi	Ord 5.00
Limuru Tea Company LTD	Ord 20.00
Rea Vipingo Plantations Ltd	Ord 5.00
Sasini Ltd	Ord 1.00
Williamson Tea Kenya ltd	Ord 5.00
COMMERCIAL AND SERVICES SECTOR	
Express ltd	Ord 5.00
Kenya Airways ltd	Ord 5.00
Nation Media Group	Ord 2.50
Standard Group Ltd	Ord 5.00
TPS Eastern Africa (Serena) ltd	Ord 1.00
Scan Group Ltd	Ord 1.00
Uchumi Supermarket Ltd	Ord 5.00
Hutchings Biemer Ltd	Ord 5.00
Longhorn Kenya Ltd	Ord 1.00
TELECOMMUNICATION AND TECHNOLOGY SECTOR	
Access Kenya Group Ltd	Ord 1.00
Safaricom Ltd	Ord 0.05
AUTOMOBILES AND ACCESSORIES SECTOR	
Car and General Kenya Ltd	Ord 5.00
CMC Holdings Ltd	Ord 0.50
Sameer Africa Ltd	Ord 5.00
Marshals E.A Ltd	Ord 5.00
BANKING SECTOR	
Barclays Bank Kenya Ltd	Ord 0.50
CFC Stanbic Holdings Ltd	Ord 5.00
I & M Holdings ltd	Ord 1.00

Diamond Trust Bank Kenya ltd	Ord 4.00
Housing Finance co. Ltd	Ord 5.00
Kenya Commercial Bank Ltd	Ord 1.00
National Bank of Kenya Ltd	Ord 5.00
NIC Bank Ltd	Ord 5.00
Standard Chartered Bank Ltd	Ord 5.00
Equity Bank Ltd	Ord 0.50
The Co-operative Bank of Kenya Ltd	Ord 1.00
INSURANCE SECTOR	
Jubilee Holdings Ltd	Ord 5.00
Pan African Insurance Holdings Ltd	Ord 5.00
Kenya Re-Insurance Cooperation Ltd	Ord 2.50
CFC Insurance Holdings	
British American Investments Company (K) Ltd	Ord 0.10
CIC Insurance Group Ltd	Ord 1.00
INVESTMENT SECTOR	
Olympia Capital Holdings Ltd	Ord 5.00
Centum Investment Co. Ltd	Ord 0.50
Trans-century Ltd	
MANUFACTURING AND ALLIED SECTOR	
B.O.C Kenya Ltd	Ord 5.00
British American Tobacco Kenya Ltd	Ord 10.00
Carbacid Investment Ltd	Ord 5.00
East African Breweries Ltd	Ord 2.00
Mumias Sugar Co. Ltd	Ord 2.00
Unga Group Ltd	Ord 5.00
Eveready East Africa Ltd	Ord 1.00
Kenya Orchards Ltd	Ord 5.00

Source: Nairobi security exchange (2013)