THE EXTENT OF IMPLEMENTATION AND CRITICAL SUCCESS FACTORS OF LEAN SIX SIGMA IN COMMERCIAL BANKS IN KENYA.

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DECLARATION

I declare that this research project is my original work and has not been presented for a degree or any other academic award in any institution of learning.

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

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DEDICATION

To my beloved husband Fred M. Musika for his perseverance and never ending encouragement to never give up. To my lovely sons; Carlton M. Musika and Victor K. Musika, you are always in my heart. May this work inspire you to excel. To my mother Elizabeth Chumo, thank you for your prayers and encouragement.

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ABSTRACT

The objectives of this study were to find out the extent to which Lean Six Sigma is implemented within commercial banks in Kenya. and to determine the Critical Success Factors (CSFs) for implementation of Lean Six Sigma in commercial banks in Kenya. The respondents were made up of managers from these commercial banks in the Kenyan banking industry.

The study adopted exploratory research. Primary data was collected using questionnaires and analyzed using descriptive statistics and factor analysis. The study found that the following application of tools and techniques of Lean and Six Sigma were used to a large extent; Voice of the Customers (VOC), Cause and effect analysis, Total Quality Management (TQM), Cross - functional work teams. Continuous Improvement (Kaizen), –Define- Measure- Analyse-Improve and Control (DMAIC) ,Total Preventive Maintenance and Plan, Do, Check, Act (PDCA). The study also found that two main ways through which the banks knew about Lean Six Sigma were through professional publications and through top management.

All commercial banks agreed on the following as the main Critical Success Factors in the implementation of Lean Six Sigma; Effective Communication, Understanding tools and techniques within Lean Six Sigma, Effective use of Technology, Top down management commitment and participation, linking Lean Six Sigma to customers, Leadership and Environment that encourages the constant improvement of product and services.

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CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Over the past decades, business organizations have embraced a wide variety of management programmes that they hope will enhance competitiveness. Currently, two of the most popular programmes are Six Sigma and Lean management. According to Wang & Chen (2010), Six Sigma approach is primarily a methodology for improving the capability of business processes by using statistical methods to identify and decrease or eliminate process variation. Its goal is reduction of defects and improvements in profits, employee morale and product quality. Six Sigma is a philosophy that employs a well-structured continuous improvement methodology to reduce process variability and drive out waste within the business processes using statistical tools and techniques, (Banuelas & Antony, 2002).

Lean production or manufacturing is a paradigm shift requiring that the organization be structured around the customer pull-value. Since the early 1980s, manufacturers have moved away from the conventional Fordist push system of mass assembly line production toward a system of Lean production. Lean manufacturing is a more capable system of production than Fordism because it stresses quality and a quick reaction to market circumstances, using technologically advanced tools and an adaptable organization of the production process.

According to Furterer & Elshennawy (2005), Lean Management originated at Toyota Motor Corporation in Japan and is an approach that eliminates waste by reducing costs in

the overall production process. in operations within that process. and in the utilization of production labor. Inventory waste is also eliminated by producing to customer order rather than to forecasted requirements. The term 'Lean' was applied by Womack and Jones in 1990 and further developed in their highly regarded book 'Lean thinking'.

1.1.1 Lean Six Sigma

In more recent times. some businesses have combined the ideas of Six Sigma and Lean management, to produce a method called Lean Six Sigma , to emphasize the quality and service improvement process offered by Six Sigma and the productivity and cost reduction tools offered by Lean management. Lean Six Sigma (LSS) is a methodology that combines Six Sigma and Lean management tools to enhance competitiveness, efficiency and agility of an organization. (De Koning et al., 2010). Thus according to Wang & Chen (2010), LSS improvement is brought out of manufacturing and into services as much of the world economy is now based on services rather than manufacturing.

Both Lean production and Six Sigma are broadly classified under the umbrella of Process improvement programmes, which also include other approaches such as business process re-engineering, theory of constraints and total productive maintenance,. (Shah et al. 2008). The concepts behind Lean and Six Sigma are based on foundational ideas that date back to Taylor (1911), and incorporate the seminal works of Ohno (1978), Shingo (1981), and Deming (1986).

Business organizations in the banking industry have been facing an increasingly competitive and global environment, which calls for enhanced firm capability in identifying new opportunities and sustaining superior performance. Strategies used by companies to avoid competitive disadvantages include the elimination of operational inefficiencies (which are large in the financial sector, on the order of 20 percent or more of total banking industry costs) and improvement of revenue by increasing the number of customers and their satisfaction, through innovation and improvement (De Koning et al.. 2008).

According to Delgado et al. (2010), Lean Six Sigma is a method that can help financial institutions to improve operational efficiency and effectiveness by combining the strengths of Lean thinking and Six Sigma . They further note that since Lean does not possess the tools to reduce variation and provide statistical control and Six Sigma does not attempt to develop a link between quality and speed, the application of the combined tool LSS offers useful solutions that can lead to greater efficiency and better quality in the financial services industry. Employing therefore a standard operational framework for implementing both Lean and Six Sigma approaches is seen as a necessary step for companies to achieve simultaneous benefits from the both strategies.

1.1.2 Critical Success Factors of Lean and Six Sigma Implementation

Critical success factors (CSFs) are tasks or attributes that should receive priority attention by management because they most strongly drive performance. CSFs have been defined as "any characteristic, condition, or variable that significantly drives business performance" Jaramillo & Marshall (2004). They further argue that due to competition, key success factors are the minimum capabilities that a company must master to enter the

competition. According Banuelas & Antony. 2002. the essential ingredients necessary for effective implementation of Six Sigma projects are cultural change, organization infrastructure. communication. training, linking Six Sigma to business strategy. Linking Six Sigma to HR. linking Six Sigma to customers, Linking Six Sigma to employees. Linking Six Sigma to business suppliers, management involment and commitment, project management skills, understanding tools and techniques with Six Sigma , project prioritization and selection.

Regarding Lean management project implementation, Achanga et al., (2006) stressed that management involvement and commitment are perhaps the most essential factors in aiding any of the desired productivity improvement initiatives, followed by financial capabilities, skills and expertise and an organizational culture of sustainable and proactive improvement. It is generally acknowledged that the factors discussed above can be equally applicable to services as they are to manufacturing (Achanga et al., 2006; Chakrabarty & Tan, 2007).

1.1.3 Commercial Banks in Kenya

Over the years, the commercial banking sector has grown into banking institutions of different types and ownership. According to the statistics by the central bank of Kenya website (www.centralbank.go.ke), currently there are there are 43 licensed commercial banks and1mortgage finance company. Out of the 44 institutions, 31 are locally owned and 13 are foreign owned. The locally owned financial institutions comprise 3 banks with significant shareholding by the Government and State Corporations, 27 commercial banks and 1 mortgage finance institution. The core businesses of most commercial banks is to offer corporate and retail banking services but a small number offer other services including investment banking.

For global competitiveness, banking industries need overall operational and service excellence and are currently engaged in Quality Circles and Cost cutting. According to Antony et al. (2009), initially the focus has been on large-scale manufacturing organizations, but after globalization and liberalization, quality improvement and cost reduction surfaced as the major areas of concern along with productivity. With the reduction of geographical barriers and the pressure of competing in the global market, overall operational and service excellence have become necessities for the industries to remain globally competitive.

1.2 Statement of the Problem

In modern economies, service sectors play very important role, absorbing huge part of national employee force and providing great part of GDP (Urban, 2009). He further observes that the size of service sector (as a percentage of total number of employees, of total added value, etc) in a particular national economy is treated as the measure of the country's development. In any service organization quality plays important role, quality causes many management problems, and it is the kind of a management challenge all over the world.

A survey done by Wang & Chen (2010), on the application of LSS approach in USA shows that most research conducted usually focus on the process improvement of manufacturing spots and seldom discusses business performance from the viewpoint of the service industry, especially in banking services, which is the most critical topic in service operations. The research further explains that Service operations now comprise more than 80% of the GDP in the United States and are rapidly growing around the world

and the cost to maintain and service an application is typically more than the initial purchase price and banking services are the most critical concern in the service industry. It is therefore necessary to find a method to improve the performance of service operations. LSS for service is a business improvement methodology that maximizes shareholder value by achieving the fastest rate of improvement in customer satisfaction, cost, quality, process speed and invested capital.

Furterer & Elshennawy, (2005), presented a case study of applying Lean and Six Sigma tools and principles to improving the quality and timeliness in a city's finance department. After implementing a LSS programme, the time to process payroll, purchasing and accounts payable were reduced by 60%, 40% and 87%, respectively.
Delgado, et al, (2010) presented the implementation of Lean Six Sigma in financial services organizations. The results show that the LSS approach can reduce the costs, cycle time, customer returns and inventory, and increase in production capacity. Githiri, (2004) in his study on 'application of Lean production techniques, a survey of large construction firms in Kenya' found out that indeed some construction firms in Kenya have adopted Lean in their operations ,but others were not aware of the techniques and tools of Lean thinking.

A research done by de koning, et al,(2008) on the application of the Lean Six Sigma methodology in two Dutch insurance companies provide illustrations of the significant benefits that can be accomplished by the combined Lean Six Sigma approach. The key lessons learned from these cases are first of all, neither Lean nor Six Sigma alone is best

suited, but that the combination can provide practical and useful solutions for financial services. Secondly, it shows that Lean Six Sigma can bring about significant results and improvements. It helps organizations to survive, directly by creating improvements in the processes (cost reductions), but also indirectly by developing the organizational ability for innovation.

From the literature review on studies on LSS implementation and its benefits in banking industry and other industries there is need to carry out a study on implementation of LSS in banking industry in Kenya in order to fill the existing knowledge gap and better understand the operations strategies employed by financial institutions in Kenya together with the critical success factors in their implementation.

This study therefore examines the status of Lean Six Sigma implementation in commercial banks in Kenya .The details, such as, the extent of familiarity of LSS by the commercial banks, their implementation process and the tools and techniques that have been employed by commercial banks in Kenya .This study further attempts to identify the critical success factors (CSFs) for LSS implementation in the Kenyan banks, followed by the common challenges encountered in the implementation process.

In order to meet the overall objective of the research, the following specific research questions are included.

i. To what extent are commercial banks in Kenya familiar with the methods, tools and techniques of Lean and Six Sigma?
ii. To what extent have commercial banks in Kenya implemented Lean Six Sigma?

iii. What are the Critical Success Factors (CSFs) for implementation of Lean Six Sigma in commercial banks in Kenya and the common challenges faced in its implementation?

1.3 Objectives of the Study

i. To examine the extent to which commercial banks in Kenya are familiar with the methods, tools and techniques of Lean and Six Sigma?

ii. To determine the extent to which Lean Six Sigma is implemented within commercial banks in Kenya.

iii. To determine the Critical Success Factors (CSFs) for implementation of Lean Six Sigma in commercial banks in Kenya and the common challenges faced in its implementation.

1.4 Significance of the Study

This study on the application of Lean Six Sigma on banks operations would be important to the management of the banks as it would equip them with methods, tools and techniques that should enable them to achieve operations excellence in delivery of all aspects of a customers' needs without necessarily obtaining trade-offs in competitive variables such as good quality at higher cost.

The findings of the study would provide information that would increase operations managers' ability to co-ordinate, control operations and deliver value to customers as

well as meet expectation of shareholders. The study would assist them put their operations strategies in order, using tried and tested methods to ensure competitiveness.

Academicians mainly researchers would appreciate this research as it would provide a better insight into understanding Lean Six Sigma concept and its implementation in Kenyan banking sector. The students of management science would also benefit greatly in understanding better linkage between Lean and Six Sigma and their application.

The study would also fill the gap between the theory behind Lean Six Sigma and the actual Lean Six Sigma applied by commercial banks. This research would also form a basis for further studies in the Kenyan Financial Sector

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Lean Thinking and Six Sigma are typically considered as separate approaches to process innovation with complementary strengths. When combined as Lean Six Sigma, this approach provides a unified framework for systematically developing innovations. Lean Six Sigma can also bring about significant results and breakthrough improvements in financial services, for instance, case studies conducted by de Koning et al, (2008) on Dutch multinational insurance companies demonstrate the importance of incremental innovations and show that there is room for improvement in the financial services industry. In this chapter, an outline of the key principles and brief history of Lean production, Six Sigma and the Lean Six Sigma (LSS) approach are described.

2.2 Lean Production

The Lean production concept was born on the Japanese manufacturing shop floor and was promoted through the success of the Toyota Motor Corporation, (Kollberg & Dahlgaard, 2007). Although the idea of Lean production was born already in the 1950s the dissemination of the new idea did not reach readers outside Japan until 1990 (Kollberg & Dahlgaard 2007). In the western manufacturing community the thinking was introduced through the book of Womack et al., "The Machine that Changed the World" (Womack et al., 1990). The authors coined the concept of Lean production as a system with a major purpose to use fewer resources compared to traditional mass production systems. The book, which was written as a result of the gaps in performance between Toyota and western carmakers using mass production systems, explores the infrastructure

and practices that support Lean production in order to facilitate a translation to non-Japanese and non-automotive industries.

In 1996 the concept of Lean production was further elaborated in Womack and Jones' book "Lean Thinking" (Womack & Jones, 2003). The concept was extended from the shop-floor techniques to include the entire organization and not only manufacturing functions.

According to Shah, et al., (2008) Lean production can be described at different levels of abstraction: it can be defined as a philosophy, as a set of principles and as bundle of practices. For instance, Womack et al., (1990) define Lean production as a business and production philosophy that shortens the time between order placement and product delivery by eliminating waste from a product's value-stream. The principle view of Lean production rests on a set of tenets such as those outlined by Shah, et al., (2008). However, the dominant view in describing and measuring Lean production rests on a set of practices and tools used in eliminating waste.

While researchers disagree with the exact practices and their number, there is general consensus that there are four main aspects of Lean production and frequently group related practices together into bundles. These are practices associated with quality management, pull production, preventive maintenance, and human resource management (Shah, et al., 2008).

Grath, (2007) make a distinction between "Lean thinking", "Lean enterprise" and Lean manufacturing. Lean thinking is a generic name for operation strategy. Lean manufacturing is the application of the strategy in manufacturing capacity. Lean enterprise is the total function of Lean concepts and philosophies throughout all aspects of the business. In essence "Lean" is elimination of waste and the addition of value to the process of delivering a product or a service to a customer. The "Lean" concept has often successfully allowed companies to deliver bottom-line savings in production through improved process efficiency, (Thomas et al., 2009).

2.2.1 Main Principles of Lean Production

Lean is aimed at reducing waste and adding value to production systems so that systems performance is significantly improved and a company "does more with less". The basic Lean philosophy as observed by Grath, (2007) relies on a five phase approach; Identify value (from the point of the customer), Measure the value stream, Pull on customer demand, Create flow and Achieve perfection.

The first thing that a company must do is to establish accurately what their customers recognize as value .The first principle of Lean production is Value. Value is created by the producer from the customers' stand point and it describes what the customers value from the customers' perspective and not from the perspective of individual firms, functions and departments.

The second Lean principle is Value Stream Mapping (VSM).Value stream refers to those specifics of the firms that add value to the product or service under consideration. Value stream mapping is an enterprise improvement tool to assist in visualizing the entire

production process, representing both material and information flow. The goal is to identify all types of waste in the value stream and to take steps to eliminate them .Taking the value stream viewpoint means working on the big picture and not individual processes, and improving the whole flow and not just optimizing the pieces. It creates a common language for production process, thus facilitating more thoughtful decisions to improve the value stream (Singh et al., 2010).

The suggestion of making the actions in the value stream flow is another main principle of the Lean process. Interruptions to this flow or restrictions in its channel can cause waste in the value stream. Waste in the Lean context refers to non- value added activities. There are seven wastes defined by Toyota production system. These are described by Womack and Jones, (1996) as; Overproduction, Waiting for the next production step, unnecessary transport of materials, over processing of parts (due to poor tool or product design, service design, inventory (more than the absolute minimum), unnecessary movement by employees and Production of defects.

Customer pull is a principle that advocates that no process step should produce anything unless the downstream customer (internal and external) has a requirement for it. Only make what is pulled by the customer. The final Lean production principle is continuous improvement meaning that perfection is the only goal throughout the production lifecycle. Continuous improvement involves operators helping to solve problems in order to improve the manufacturing of the production lifecycle (Grath, 2007).

2.2.2 Application of Lean Thinking in the Service Industry

Lean enhances a more effective response to the needs of customers by providing faster and more valuable services. In a very competitive environment, Lean is usually the solution to track costs while optimizing some of the repetitive and wasteful steps, so as to obtain flexible and adaptive processes. When implementing Lean it is essential to involve the staff mainly because they are the ones with the best understanding of the processes of the organization, and because their involvement will help sustain the changes made (Denyse & Benny, 2009).

2.3 Six Sigma Philosophy

Six Sigma evolved from scientific management and continuous improvement theories by combining the finest elements of many former quality initiatives. Originally, Motorola was the first to launch a Six Sigma program in the 1980s. In 1988, it was the first company awarded the Baldrige Award, which led other organizations to show an increased interest in adopting and modifying Six Sigma methodology (Aboelmaged, 2010). Companies such as Allied Signal, IBM, and General Electric adopted Six Sigma as a corporate requirement for strategic and tactical operations to produce high-level results, improve work processes, expand employees' skills and change the culture. This was followed by high profile adoption in organizations such as Sony, Dow Chemicals, Bombardier and GSK (Banuelas &Antony, 2002).

In recent years Six Sigma as a quality improvement methodology has gained considerable attention .Many service organizations such as Citibank, Bank of America, American

Express. Caterpillar, Mount Carmel Health System and Baxter Healthcare in USA and Europe have registered success by Six Sigma implementation (Chakrabarty & Chuan (2009). For the term "Six Sigma" there appears to be little consensus on its definition. Proposing an emergent definition of Six Sigma based on a grounded theory approach, Schroeder et al. (2008) concluded that Six Sigma offers a new structure that promotes both control and exploration in improvement efforts. From a statistical perspective, Six Sigma is a metric of process measurement symbolized by the Greek letter δ that represents the amount of variation with a normal data distribution. Fundamentally, Six Sigma quality level relates to 3.4 defects per million opportunities (DPMO). The focus of Six Sigma is not on counting the defects in processes, but the number of opportunities within a process that could result in defects so that causes of quality problems can be eliminated before they are transformed into defects (Antony, 2004). From a business perspective, Six Sigma could be described as a process that allows companies to drastically focus on continuous and breakthrough improvements in everyday business activities to increase customer satisfaction

According to Thomas (2009) Six Sigma can be considered both a business strategy and a science that has the aim of reducing manufacturing and service costs, and creating significant improvements in customer satisfaction and bottom-line savings through combining statistical and business process methodologies into an integrated model of process, product and service improvement. From an internal perspective, Six Sigma provides a way of improving processes so that the company can more efficiently and predictably produce world-class products and services. Traditionally under the Six Sigma

approach a five-phased DMAIC methodology is applied which tackle specific problems to reach Six Sigma levels of performance. these phases are: Define, Measure Analyze, Improve and Control (Thomas, 2009).

2.3.1 Six Sigma Tools and Techniques

They can be described as practical methods and skills employed by Six Sigma project teams to tackle quality related problems for fostering performance improvement (Aboelmaged 2010). While Six Sigma tool has a specific role and is often narrow in focus, Six Sigma technique has a wider application and requires specific skills, creativity and training (Antony, 2004). Examples of Six Sigma tools include Pareto analysis, root cause analysis, process mapping or process flow chart, Gantt chart, affinity diagrams, run charts, histograms, quality function deployment (QFD), brainstorming, etc. Examples of Six Sigma techniques include statistical process control (SPC), process capability analysis, suppliers-input-process-output-customer (SIPOC), benchmarking, etc. Moreover, a Six Sigma technique can utilize various tools. For example, statistical process control (SPC) is a technique that utilizes various tools such as control charts. histograms, root cause analysis, etc.

2.3.2 Six Sigma Methodologies (DMAIC and DFSS)

There are two major improvement methodologies in Six Sigma. The first methodology, DMAIC, is used to improve already existing processes and can be divided into five phases; define measure, analyze, improve and control.

In contrast, the second methodology, design for Six Sigma (DFSS), is used for new processes or when the existing processes are unable to achieve business objectives such

as customer satisfaction. DFSS methodology can also be divided into five phases (DMADV); define measure, analyze, design and verify (Banuelas & Antony, 2002).

2.3.3 Six Sigma Belt System

A part of Six Sigma structure is the role of Six Sigma leaders who initiate, support and review improvement projects. Most Six Sigma organizations adopt the hierarchical level of black belt and green belt systems. A black belt is a full-time team leader dedicated to the Six Sigma initiative. Black belts are equipped with expertise in using the Six Sigma methodology and statistical analysis techniques for process improvement. Individuals at the highest level of expertise in Six Sigma methodologies are called master black belts. They teach, coach and mentor the lower-level black belts and green belts. Green belts are project leaders and/or process experts who integrate Six Sigma into their daily job duties. The key attributes of Six Sigma black belts in manufacturing companies include effective communicators, change agents, customer advocators, team builders, results-driven mindset personnel and positive thinkers (Aboelmaged, 2010).

2.3.4 Six Sigma and Quality Approaches

Six Sigma literature has linked Six Sigma to quality approaches through two pivotal perspectives. The first perspective links Six Sigma to TQM, while the second treats Six Sigma as a continuous improvement approach. Even though most Six Sigma tools and techniques are already being applied in the TQM field and both approaches preach that continuous improvement of quality is essential to business success, there is a vital distinction between them. While authors regard TQM as a soft management system consisting of values, methodologies and tools that aims to improve customer satisfaction,

they consider Six Sigma as a more structured methodology that foster product and process improvement so that the defects are never produced in the first place. Contrary to TQM, Six Sigma allows organizations to measure process capability and improvement efforts internally and externally. (Aboelmaged, 2010),identifies four core advantages of Six Sigma over TQM. These advantages involve the focus on financial and business results, use of a structured method for process improvement or new product introduction, use of specific metrics such as DPMO (defect per million opportunities), critical-to-quality (CTQ), and use of a significant number of full-time improvement specialists. According to Antony & Banuelas (2002), Ford found that Six Sigma is more profit orientated, while TQM focuses on fixing the quality problem regardless of the cost.

2.4 The Lean Six Sigma Approach

According to Shah et al., (2008) both Lean production and Six Sigma are broadly classified under the umbrella of process improvement programmes. Lean and Six Sigma are the most recent manifestations of the process improvement evolution programmes

In the past, Six Sigma and the principles behind Lean management have often seemed more like competitors than co-conspirators (Shah et al 2008) and the recent Lean Six Sigma (LSS) approach in general is a powerful action plan for dramatically improving quality, increasing speed and reducing waste. Arnheiter & Maleyeff (2005) suggested that a LSS organization would capitalize on the strengths of both Lean management and Six Sigma .

To remain competitive, efficient and agile, companies in services need, increasingly a constant investment in the innovation processes. According to Delgado et al. (2010), LSS is a methodology that combines two of the most popular tools for improving performance of organizations; its advantages include the cost control and capital investment, and improvements in the quality of service and customer satisfaction. It is considered an accurate and efficient methodology to support the development of a system of integrated quality management in any business in order to perform virtually free of errors and waste of time.

Services are by nature very often bound by time in terms of the processes that are run and lead to the delivery of an outcome that benefits a customer. In services organizations, Lean comes in as a methodology to reduce waste (in terms of time) and to allow the process to become more efficient. It requires the examination of the process from the client's perspective, in order to eliminate the waste and inefficiency. Six Sigma however, focuses on refining the process, reducing the variability, to obtain the same result at least 99.9997 percent of the time (Delgado et al. 2010)

2.4.1 Similarities and Differences Between Lean and Six Sigma

It is evident from the above review that both Lean and Six Sigma can be characterized in terms of their underlying philosophy and a set of practices, tools/techniques, implementation orientation, unit of analysis, and performance measures associated with them. Philosophy is implemented through a set of activities/practices and tools/techniques. The implementation orientation is the focus of how practices and

techniques are implemented. The unit of analysis is where the process improvements take place. And, finally, the performance measures spotlight what is typically improved upon.

According to Shah,et al. (2008),examining the philosophy, practices, and techniques of Lean and Six Sigma suggest striking similarities and some important differences between the two approaches .The most significant overlap is in the area of quality management. Proponents of Lean frequently include quality practices such as statistical process control and process capability measurements when defining and measuring it .Similarly, advocates of Six Sigma embrace quality management with a focus on advanced statistical method as the cornerstone of its definition.

Lean practices and techniques focus on streamlining processes, whereas Six Sigma practices and techniques help identify and eliminate root causes of problems. Lean emphasizes process flow and Six Sigma concentrates on process defects. In addition, ·Lean production addresses the visible problems in processes, for example, inventory, material flow, and safety. Six Sigma is more concerned with less visible problems, for example, variation in performance.

Most researchers agree that there is more commonality between Lean and Six Sigma tools and practices than differences. Even so, the employee involvement during their deployment differs considerably. Six Sigma deploys the practices through a parallel organizational structure that includes black belts and master black belts. In contrast Lean directly engages workers involved in the process to also improve it.

Both Lean and Six Sigma underscore the value of management and employee involvement to improve performance, but the nature of involvement differs considerably in the two approaches. Lean is a bottom up approach where management plays a supportive and facilitating role in engaging shop-floor workers to form cross-functional self-directed work teams and apply Lean tools. In Six Sigma, management plays a more active role often selecting improvement projects based on financial and strategic goals, and championing and monitoring the improvement projects.

2.4.2 Lean Six Sigma Approach to Process Improvement

The manufacturing industry has invested in the systematic exploration of the opportunities for process improvement, cost reduction and efficiency improvement for many years. To do so, a large arsenal of tools and innovation approaches were deployed. Of these, Lean Thinking and Six Sigma are the two programmes that are currently popular (de Koning 2010).Both Lean Thinking and Six Sigma provide systematic approaches to facilitate the process of stimulating the innovations needed to improve the operational efficiencies and the quality. Lean Thinking and Six Sigma have gone through parallel developments in recent years.

There are many examples of implementing the LSS approach in the manufacturing and service industries. For instance, Toyota Motor Company's high productivity and quality performance is routinely attributed to practices associated with Lean production. Similarly, firms implementing Six Sigma have reported significant financial gains from their deployment efforts. For example, in 1999 General Electric (GE) reported $2 billion

of net income benefits from Six Sigma initiatives (Shah et al., 2008). Wang et al., (2010), presented the application of LSS and TRIZ methodology in banking services, Thomas et al..(2009) presented the application of LSS in small engineering company. Carleysmith et al.,(2009) looked at the implementation of Lean sigma in pharmaceutical research and development, Furterer & Elshennawy. (2005) presented a case study of applying Lean and Six Sigma tools and principles to improving the quality and timeliness in a city's finance department, he observed that after implementing a LSS programme, the time to process payroll, purchasing and accounts payable were reduced by 60%, 40% and 87%, respectively.

2.4.2.1 Conceptual Framework of Lean Six Sigma

De Koning et al, (2008) proposed a framework for the integration of Lean and Six Sigma, consisting of a project organization structure based on Six Sigma (black belts (BB), green belts (GB), and champions) and in extensive training programs and a define, measure, analyse, improve and control (DMAIC) approach, with Lean analysis tools and improvement models embedded and concepts/classifications of both Lean and Six Sigma combined.

According to Thomas et al., (2009), the DMAIC process is used as the main functional system for the implementation of Lean Six Sigma (LSS) approach. Figure 2.0 shows the conceptual development of the LSS framework. The main phases of the integrated LSS approach are: Define, Measure, Analyze, Improve, Control, Implement 5S technique, application of Value Stream Mapping (VSM), Redesign to remove waste and improve value stream, Redesign manufacturing system to achieve single unit flow (SUF) and apply total productive maintenance (TPM) to support manufacturing functions.

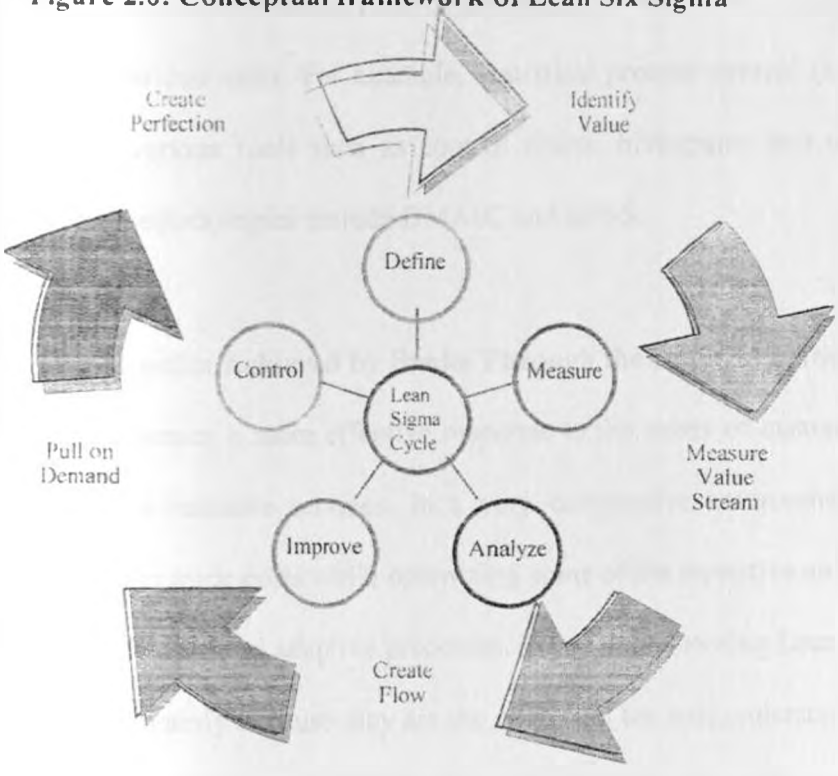
2.4.3 Critical Success Factors (CSF) of Lean and Six Sigma Implementation Projects

Several authors (Banuelas & Antony, 2002; Antony, 2004; Chakrabarty & Chuan, 2009; Aboelmaged, M.G., (2010) have studied the CSF for Six Sigma implementation. The following factors are among the more important; Top-down top management commitment; Extensive education and training in Six Sigma and project management and certification processes that result in GB, BB, and master black belts (MBB);Change in organizational culture and structure and change in communication plan and channels, and measure the success in terms of financial benefits.

Delgado,et al, (2010), have broadened the list and presented 13 key CSF for continuous improvement initiatives; Management commitment, Customer management, Supplier management, Quality data, measurement and reporting, Teamwork, Communication, Process management, Ongoing evaluation, monitoring, and assessment, Training and learning, Employee empowerment, Goal management culture, Product design and Organizational structure.

Other factors suggested included recognition and reward systems, effective use of technology, cultural change, trust in organization and project selection, and prioritization. Regarding Lean management project implementation, Achanga et al., (2006) stressed that management involvement and commitment are perhaps the most essential factors in aiding any of the desired productivity improvement initiatives, followed by financial capabilities, skills and expertise and an organizational culture of sustainable and proactive improvement. It is generally acknowledged that the factors discussed above can be equally applicable to services as they are to manufacturing (Achanga et al., 2006; Chakrabarty & Tan, 2007).

Figure 2.0: Conceptual framework of Lean Six Sigma



Source: (Thomas et al. 2009)

2.4.4 Tools and Techniques

In Lean Six Sigma, the tools of both Six Sigma and Lean are combined (De Koning, 2010) .Lean typically offers simple tools without much mathematical refinement. Examples of Lean tools are; value stream mapping (VSM), Single Unit Flow (SUF), Total Productive Maintenance (TPM), Kaizen, Continuous Improvement, Failure Mode and Effect Analysis (FMEA), and Just In Time (JIT) among others .Six Sigma on the other hand provides tools such as Pareto analysis, root cause analysis, process mapping or process flow chart, Gantt chart, affinity diagrams, run charts, histograms, quality function deployment (QFD), brainstorming, etc. Examples of Six Sigma techniques include statistical process control (SPC), process capability analysis, suppliers-input-process-

output-customer (SIPOC), benchmarking, etc. Moreover, a Six Sigma technique can utilize various tools. For example, statistical process control (SPC) is a technique that utilizes various tools such as control charts, histograms and root cause analysis. Six Sigma methodologies include DMAIC and DFSS.

2.4.5 Benefits Achieved by Banks Through the Implementation of Lean Six Sigma

Lean enhances a more effective response to the needs of customers by providing faster and more valuable services. In a very competitive environment, Lean is usually the solution to track costs while optimizing some of the repetitive and wasteful steps, so as to obtain flexible and adaptive processes. When implementing Lean it is essential to involve the staff mainly because they are the ones with the best understanding of the processes of the organization, and because their involvement will help sustain the changes made (Denyse & Benny, 2009).

Six Sigma is a systematic, highly disciplined, customer-centric and profit-driven organization-wide strategic business improvement initiative that is based on rigorous process focused and data-driven methodology (Antony & Desai,2009).). It drives customer satisfaction and bottom-line results by systematically reducing variation in processes and thereby promoting a competitive advantage. Six Sigma is considered a strategic corporate initiative to boost profitability, increase market share and improve customer satisfaction through statistical tools and techniques that can lead to breakthrough quantum gains in quality (Antony,J. & Desai, D.A.,(2009). Six Sigma blends management, financial and methodological elements to make improvement to

process and products concurrently and Six Sigma provides business leaders and executives with the strategy, methods, tools and techniques to change the culture of organizations (Antony et al., 2004). Six Sigma as a philosophy seeks to measure current performance and determine how desired or optimum performance can be achieved. Any deviation in the performance of any critical-to-quality characteristic may be considered a defect (Antony & Desai,2009).

According to De Koning et al (2010), Lean Six Sigma (LSS) is a method that helps publishing companies to deal with some of the strategic challenges by improving its operational efficiency and effectiveness. The improvements are performed in a project-by-project fashion and the projects are managed strictly according to five phases called define-measure-analyze-improve-control (DMAIC).

2.4.6 Key Performance Indicators (KPI)

KPI is a measure of performance in terms of cost, quality, yield and capacity, such as asset utilization, customer satisfaction, cycle time from order to delivery, inventory turnover, operations costs, productivity and financial results (Chakrabarty & Chuan, 2009).

2.5 Financial Services Institutions

Financial services institutions face increasing competition, primarily because of globalization. Companies have to compete with domestic competitors as well as with the best-in-class firms in a global context. Moreover, the competitors from abroad usually play the strategy game according to different rules, making it harder to respond

effectively (de Koning et al, (2008). Thus, to compete, it is imperative to improve operational efficiency and effectiveness. Improving operational efficiency and effectiveness includes quality improvement, cycle time reduction, productivity improvement, waste reduction and the elimination of rework. Financial services companies need to eliminate their operational inefficiencies, not just to gain competitive advantage, but even more fundamentally, to avoid competitive disadvantages and to stay in business (de Koning et al, 2008).

2.5.1 Commercial Banks in Kenya

The commercial banks under the survey provide a complete range of services, including savings deposits, loans, guarantees, foreign exchange, overseas banking unit (OBU), trusts, credit cards, cash cards, securities, bonds, financial derivatives, electronic banking, among others. The Kenyan commercial banking system is dominated largely by commercial banks and a small number of non-bank financial institutions which concentrate mainly on mortgage finance, insurance and other related financial services. The Kenyan commercial banking sector has only 43 financial institutions (Source: Central Bank of Kenya Website)

2.5.2 A Concept of Service Quality

Service quality is an increasingly important priority for companies that wish to differentiate their services in a highly competitive and often cut-throat environment. Aided by innovative and pervasive communication technologies, even the old manufacturing facilities have largely turned into "service factories" (Nakhai, and Neves, 2009).According to Aldlaigan & Buttle, (2002), the perceived quality of a given service will be the outcome of an evaluation process, where customers compares his expectations

with the service he perceives he has received, i.e. he puts the perceived service against the expected service. They further claim that a customer's perception of the service encounter considers three dimensions; process, or functional quality; outcome, or technical quality and the image of the service provider. The technical quality is the outcome of the exchange process i.e. what is received by the customer. The functionality quality of the exchange process is how the service is provided, including all interactions between the organization and customer

Hence to most service firm managers the awareness that quality superiority provides significant performance related advantages such as customer loyalty, responsiveness to demand, market share growth and productivity is of key importance. In addition, service managers must realize that to successfully leverage service quality as a competitive edge, they first need to correctly identify the antecedents of what the consumer perceive as service "quality" (Glaveli, et al. 2006).

2.6 Conclusion

In today's global economy, financial services companies face fierce competition. Indeed, the competitive pressure is steadily growing. To remain competitive, the financial services companies must therefore continuously innovate and improve. As in any other business, the status quo is no longer an option. The application of a wide spectrum of classical principles of industrialization, including Lean and Six Sigma , offer useful solutions that can provide a better economy, greater efficiency and better quality in the financial services industry de Koning et al (2008). Indeed, contrary to conventional wisdom, the industrialization of services can simultaneously increase the quality and reduce the cost of service delivery.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the methodology and design used in the study to determine the extent to which LSS are applied in commercial banks in Kenya. It presents the research design, describes the population, data collection and analysis.

3.2 Research Design

This was exploratory research. Exploratory research is chosen because research in LSS and its implementation in service organization are still at a very early stage. According to Delgado et al, (2010), this methodology offers advantages not found in more quantitative research tools because qualitative data allow researcher to explore more fully complex relationships difficult to capture in a quantitative study.

3.3 The Population and Sampling

The target population of this study were banking institutions in Kenya. The Kenyan commercial banking system is dominated largely by commercial banks and a small number of non-bank financial institutions which concentrate mainly on mortgage finance, insurance and other related financial services. The Kenyan commercial banking sector has only 43 financial institutions (Source: Central Bank of Kenya Website).Due to the size of the banking industry, the whole population on banking institutions is included in this study, thus it is a census study. It was also noted that in comparison to similar studies conducted elsewhere, the size of the population in this study was small.

3.4 Data Collection

A questionnaire was used to collect information for this study. The correspondence containing the questionnaire and a cover letter was addressed to top-level corporate managers heading the operations function in the institution, usually referred to as the Head of operations, or the General Manager - operations at most banks. The head of the operations function were identified as the most suitable person to comment on the LSS implementation process in the bank.

The survey questionnaire had five parts to collect the following details, Company background and preliminary data, LSS implementation details, Knowledge and usage of quality and process improvement tools, and techniques as used within Lean Six Sigma initiatives. CSFs of Lean and Six Sigma deployment and Key benefits from LSS implementation.

3.5 Data Analysis

The data was collected and analyzed using descriptive statistics (pie charts, tables, mean and standard deviation) and factor analysis. Factor analysis attempts to identify underlying variables, or factors that explain the pattern of correlations within a set of observed variables. The goal of factor analysis is to try to identify factors which underlie the variables to discover simple patterns in the pattern of relationship among variables (Richard, 1973). The data was analyzed according to themes and presented in pie charts and frequency distribution tables.

CHAPTER FOUR: DATA ANALYSIS, FINDINGS AND INTERPRETATION

4.1 Introduction

This chapter presents the analysis and findings of the study. Data was collected from 43 commercial banks in the Kenyan banking industry. The findings are presented in percentages, Frequency Distributions. Pie charts, Scree plots, Mean and Standard Deviations.

4.2 Profiles of the Respondents

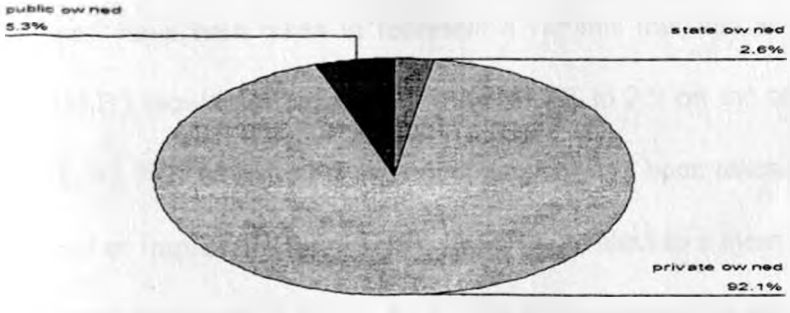
4.2.1 Response Rate

A total of 43 questionnaires were issued out. The completed questionnaires were edited for completeness and consistency. Of the 43 questionnaires used in the sample, only 38 were returned. The returned questionnaires' represented a response rate of 88.4%, which the study considered adequate for analysis.

4.2.2 Legal Status of the Company

The respondents were asked to state legal status of their companies. The findings are given in figure 4.2

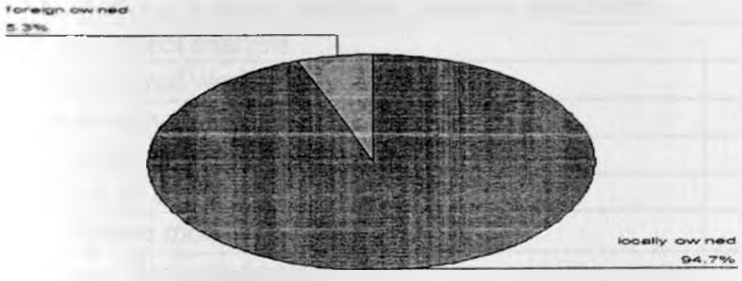
Figure 4.1: Legal Status of the Company



4.2.3: Nature of Ownership

The respondents were asked to state nature of ownership of their companies. The findings are given in figure 4.3

Figure 4.2: Nature of Ownership



The results above (figure 4.2 and figure 4.3) show that most of the banks in Kenya are locally owned (94.7%) while 5.3% of the banks are foreign owned. Out of the respondent companies of 92.1% are privately owned, 5.3% are publicly owned and 2.6% state owned.

4.3: Usage of Quality and Process Improvement Methods, Tools and Techniques Within Lean Six Sigma

The respondents were asked to rate the application of tools and techniques of Lean and Six Sigma in their banks. A four point Likert scale ranging from 'never used' (1) to 'used continuously' (4) was used. The scores of 'never used' and 'used once' have been taken to present a variable which had an impact to a small extent (S.E) (equivalent to mean score of 0 to 2.2 on the continuous Likert scale ;($0 \leq$ S.E <2.2). The scores of 'to used sometimes' have been taken to represent a variable that had an impact to a moderate extent (M.E.) (equivalent to a mean score of 2.3 to 2.9 on the continuous Likert scale: $2.3 \leq$M.E. <2.9). The score of 'used continuously' has been taken to represent a variable which had an impact to a large extent (L.E.) (equivalent to a mean score of 3.0to 4.0 on a continuous Likert scale; $3.0 \leq$ LE. <4.0). The findings are as shown in table 4.1

Table 4.1: Application of Tools and Techniques of Lean Six Sigma

	Mean	Std. Dev
PDCA(Plan ,check,do,act)	3.4211	.62106
Continuous improvement (Kaizen)	3.4189	.62154
VOC(voice of the customers)	3.3947	. 63798
TQM(total quality management)	3.3821	. 64886
DMAIC (define, measure, analyze, improve and control)	3.3421	.67941
Cause and effect analysis	3.3158	.68378
Cross -functional work teams	3.2368	.68511
Total preventive maintenance	3.0000	.69749
Team problem solving tools	2.9221	.69912
VOE(voice of employee)	2.8947	.70036
FMEA (failure mode and effect analysis)	2.8947	.70036
Continuous flow production	2.8947	.70036
Benchmarking	2.8684	.70408
Input -output analysis	2.8684	.70408
Statistical process control (SPC)	2.8684	.70408
process flow chart/ mapping	2.7895	.71358
VSM (value stream mapping)	2.7632	.74252
Process capability analysis	2.7105	.75182
bottleneck constraint removal	2.6842	.82318
Histogram	2.6579	.84530
Quick Change Overs	2.6316	.85172
SIPOC (Suppliers, Inputs, Process, Outputs, Customers)	2.6053	.86549
Brainstorming	2.5263	.87870
Gantt chart	2.5263	.87870
DoE(design of experiment)	2.5000	.90269
Just in time (JIT)	2.2895	.96968
Quality function deployment (QFD)	2.2895	.96968
Pareto analysis	2.2632	.97897
Quality -costing analysis	2.1632	.98083
Error proofing methods	2.1053	.99004
Fishbone diagram	1.8684	.99107

The study found that the following application of tools and techniques of Lean and Six Sigma were used to a large extent; VOC-voice of the customers (mean of 3.3947), Cause and effect analysis (mean of 3.3158), TQM (total quality management) (mean of 3.3821), Cross -functional work teams (mean of 3.2368),Continuous improvement (Kaizen) (mean of 3.4189).DMAIC(mean of 3.3421).Total preventive maintenance(3.000) and PDCA-

Plan. check. do. act (mean of 3.4211). it was also noted that some of the application of tools and techniques of Lean and Six Sigma are only used to a small extent for instance; Fishbone diagram (mean of 1.8684). and Error proofing methods (mean of 2.1053).

From these findings it can be concluded that majority of banks in Kenya have implemented Lean Six Sigma tools and techniques. The most common tools applied across the banks are; Plan- Do- Check- and Act (PDCA), Continuous Improvement (Kaizen), Voice of the Customers (VOC), Total Quality Management (TQM), Define Measure Analyse Improve and Control (DMAIC), Cause and Effect Analysis, Cross-functional work Teams, and Total Preventive Maintenance. It was also noted that most responding companies have implemented Lean Six Sigma tools and techniques relating to operational efficiency and customer satisfaction, for instance Continuous improvement (Kaizen), Plan, Check, Do, Act (PDCA), the Voice of Customer and TQM have the highest application rates .

4.3.1: How the Banks Came to be Aware of Lean Six Sigma

The respondents were asked to state how their bank's came to be aware of Lean Six Sigma. The findings are given in figure 4.2

Table 4.2: How your Company came to be Aware of Lean Six Sigma

	Frequency	Percent	Cumulative Percent
Professional publications	24	63.2	63.2
Top management	12	31.6	94.7
From customers	1	2.6	97.4
Have not heard of Lean Six Sigma in any context	1	2.6	100.0
Total	38	100.0	

As shown in table 4.2, majority of the responding bank's (63.2%) knew about Lean Six Sigma through professional publications, 31.6% knew about it through top management

and 2.6% knew about it from customers while 2.6% had not heard of Lean Six Sigma in any context.

4.3.2: Specific Reasons which prompted the Banks to Kick-off a Lean Six Sigma Initiative

The respondents were asked to state the specific reasons which prompted the banks to kick-off a Lean Six Sigma initiative. The findings are given in figure 4.3

Table 4.3: Reasons Which Prompted Banks to Kick-off a Lean Six Sigma Initiative

	Frequency	Percent	Cumulative Percent
To enhance operational excellence	9	23.7	23.7
To increase efficiency	11	28.9	52.6
To reduce costs	8	21.1	73.7
To optimize operational capacity	2	5.3	78.9
To improve customer satisfaction	4	10.5	89.5
To become world-class institution	3	7.9	97.4
To solve chronic problem	1	2.6	100.0
Total	38	100.0	

It was apparent that key reasons which prompted the banks to kick-off a Lean Six Sigma initiative were; to increase efficiency (28.9%), to enhance operational excellence (23.7%) and to reduce costs (21.1%).Customer satisfaction was also another driving factor for Lean Six Sigma implementation by some banks.

4.4: Factor Analysis

Factor analysis was used because of the concern of decomposing the information content in a set of variables into information about an inherent set of latent components/factors. This assisted in reducing a number of variables into fewer factors which are of similar characteristics. The analysis was carried out and the results presented in terms of: KMO

and Bartlett's Test, Scree Plot, Total Variance Explained /Eigen values, Initial Component Matrix and Rotated Component Matrix (Varimax)

Table 4.4: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.439
Bartlett's Test of Sphericity	Approx. Chi-Square	753.216
	df	253
	Sig.	.000

In order to use factor analysis for further analysis it was important to test the significance of the technique. This was done by the use of P value (the smallest level at which null hypothesis can be rejected. P-value = 0.000 < 0.05 thus there is correlation between the variables and they can be reduced into fewer factors (Factor Analysis)

Table 4.5: Communalities

	Extraction
Effective communication	.901
Understanding tools and techniques within LSS	.878
Effective use of technology	.876
Top down management commitment and participation	.871
Linking LSS to customers(understanding customer requirements)	.855
Leadership	.849
Environment that encourages the constant improvement of product and services	.844
Measure the success in terms of financial benefits	.836
Effective service/ product design	.832
Ongoing evaluation, monitoring and assessment	.830
Proper planning prior to implementation	.824
Goal management culture	.818
Trust in organization and project selection, and prioritization	.816
Project management skills	.811
Linking LSS to suppliers	.809
Recognition and reward systems	.803
Training and learning LSS methodologies	.803
Teamwork	.792
Financial capabilities of the company	.783
Linking LSS to employees (human resources)	.768
Addressing the root cause of a problem	.757
Linking LSS to business strategy	.754
Organizational structure and culture	.678

Extraction Method: Principal Component Analysis.

Total percentage of variance explained in any variable accounted for by this seven factor model known as the communality of the variable are as shown in table 4.5 above. For example Total percentage of variance explained in the key variables was; Effective communication (90.1%), Understanding tools and techniques within LSS(87.8%), Effective use of technology (87.6%), Top down management commitment and participation (87.1%), Linking LSS to customers(understanding customer requirements)-(85.5%), Leadership (84.9%) and Environment that encourages the constant improvement of product and services (84.4%).

The results therefore indicates that critical factors in the implementation and utilisation of Lean Six Sigma are; Effective communication, Understanding tools and techniques within Lean Six Sigma and Top down Management commitment and participation.

Table 4.6: Total Variance Explain

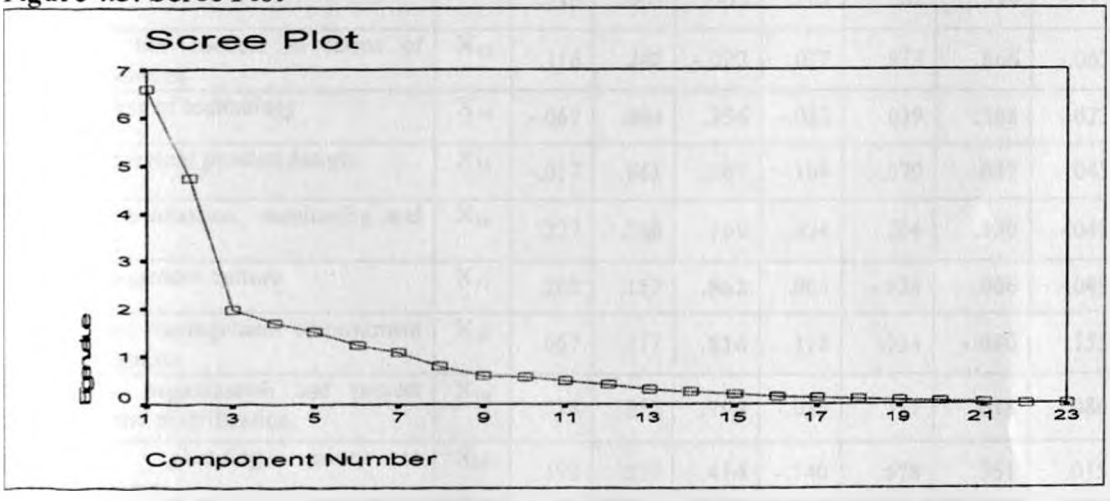
Component	Initial Eigen values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.586	28.636	28.636	6.586	28.636	28.636
2	4.738	20.600	49.236	4.738	20.600	49.236
3	1.987	8.639	57.875	1.987	8.639	57.875
4	1.705	7.413	65.288	1.705	7.413	65.288
5	1.510	6.567	71.855	1.510	6.567	71.855
6	1.229	5.342	77.197	1.229	5.342	77.197
7	1.078	4.685	81.882	1.078	4.685	81.882
8	.794	3.454	85.336			
9	.595	2.585	87.922			
10	.570	2.480	90.402			
11	.492	2.141	92.543			
12	.400	1.741	94.284			
13	.316	1.374	95.658			
14	.245	1.067	96.725			
15	.203	.881	97.606			
16	.158	.687	98.293			
17	.127	.554	98.847			
18	.111	.483	99.330			
19	.071	.309	99.639			
20	.048	.210	99.849			
21	.022	.094	99.942			
22	.007	.031	99.973			
23	.006	.027	100.000			

Extraction Method: Principal Component Analysis.

As shown in table 4.6. total variance explained/Eigen values (a measure of the variance explained by factors), factor extraction was done to determine the factors using Eigen values greater than 1. Factors with Eigen values less than 1.00 were not used because they account for less than the variation explained by a single variable.

The result indicates that 23 variables were reduced into 7 factors. The seven factors explain 81.882% (Cumulative percentage) of the total variation, the remaining 16 factors together account for 18.118% of the variance. The explained variation 81.882% > 70% and therefore, Factor Analysis can be used for further analysis. The model with seven factors may be adequate to represent the data.

Figure 4.3: Scree Plot



The Scree Plot is a plot of total variance associated with each factor and shows a distinct break between steep slop of the large factors and gradually trailing off of the rest of the factors. From the Scree Plot, it appears that a seven (7) factor model should be sufficient (factors with Eigen values greater than 1) in the analysis, that is, 23 variables have been reduced into seven distinct factors

Table 4.7: **Rotated Component Matrix**

Variables		Component						
		1	2	3	4	5	6	7
Recognition and reward systems	X_1	.398	-.173	-.067	.380	-.365	**.542**	.195
Organizational structure and culture	X_2	.149	.146	-.033	.478	**-.585**	.119	.217
Training and learning LSS methodologies	X_3	.474	.186	-.132	.429	-.353	.444	.138
Linking LSS to customers(understanding customer requirements)	X_4	.371	.040	-.078	**.748**	-.232	.306	.060
Linking LSS to business strategy	X_5	.222	.225	.054	**.788**	.162	.012	.062
Linking LSS to employees (human resources)	X_6	.051	-.161	.091	**.836**	-.047	-.007	-.174
Linking LSS to suppliers	X_7	-.080	-.055	.394	-.030	.132	-.187	**.769**
Understanding tools and techniques within LSS	X_8	**.791**	-.158	.009	.198	-.135	.327	.252
Effective communication	X_9	**.867**	.135	.270	.082	-.092	-.101	-.180
Project management skills	X_{10}	.118	.039	.374	.014	.217	-.169	**-.761**
Teamwork	X_{11}	**.811**	.101	.117	.246	.063	-.046	-.207
Financial capabilities of the company	X_{12}	**.715**	.002	.065	.102	.262	.394	-.179
Measure the success in terms of financial benefits	X_{13}	.116	.248	-.022	.077	.032	**.866**	-.062
Effective use of technology	X_{14}	-.067	**.804**	.356	-.033	.039	.308	-.022
Effective service/ product design	X_{15}	-.017	**.861**	.267	-.104	-.070	-.042	-.043
Ongoing evaluation, monitoring and assessment	X_{16}	.227	**.760**	.169	.334	.204	.130	-.040
Goal management culture	X_{17}	.208	.157	**.862**	.065	-.024	.006	-.049
Top down management commitment and participation	X_{18}	.067	.317	**.816**	.118	.234	-.080	.155
Trust in organization and project selection, and prioritization	X_{19}	.028	.252	**.798**	-.085	.385	.018	-.086
Proper planning prior to implementation	X_{20}	.192	.077	.414	-.140	**.678**	.361	.015
Leadership	X_{21}	.033	.240	.249	.134	**.830**	-.136	.055
Addressing the root cause of a problem	X_{22}	.448	**.600**	-.011	.016	.439	-.019	-.053
Environment that encourages the constant improvement of product and services	X_{23}	**.659**	.455	.012	.222	.196	.243	.236

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 10 iterations.

The rotated component matrix is to transform the complicated matrix (initial matrix into simpler one).The purpose of rotation is to achieve a simple structure i.e. we would like each factor to have non zero loading for only some of the variable so that we can easily interpret the factors. A factor loading of 0.5 has been used to determine the variable belonging to each factor.

Factor one is made up of the following variables; Understanding tools and techniques within LSS, Effective communication, Teamwork, Financial capabilities of the company and Environment that encourages the constant improvement of product and services.

Mathematically factor one is represented as follows.

$$F_1 = 0.791\,X_8 + 0.867X_9 + 0.811X_{11} + 0.715X_{12} + 0.659X_{23}$$

Factor two is made up of the following variables; Effective use of technology, Effective service/ product design, Ongoing evaluation, monitoring and assessment and Addressing the root cause of a problem

Mathematically factor two is represented as follows.

$$F_2 = 0.804X_{14} + 0.861X_{15} + 0.760X_{16} + 0.600X_{22}$$

Factor three is made up of the following variables; Goal management culture, Recognition and reward systems, Top down management commitment and participation and Trust in organization and project selection, and prioritization

Mathematically factor three is represented as follows.

$$F_3 = 0.862X_{17} + 0.816X_{18} + 0.798X_{19}$$

Factor four is made up of the following variables; Linking LSS to customers (understanding customer requirements), Linking LSS to business strategy and Linking LSS to employees (human resources)

Mathematically factor four is represented as follows.

$$F_4 = 0.748X_4 + 0.788X_5 + 0.836X_6$$

Factor five is made up of the following variables; Organizational structure and culture, proper planning prior to implementation and Leadership.

Mathematically factor five is represented as follows.

$$F_5 = -0.585X_2 + 0.678X_{20} + 0.830X_{21}$$

Factor six is made up of the following variables; Recognition and reward systems and Measure the success in terms of financial benefits.

Mathematically factor six is represented as follows.

$$F_6 = 0.542X_1 + 0.866X_{13}$$

Factor seven is made up of the following variables; Linking LSS to suppliers and Project management skills

Mathematically factor two is represented as follows.

$$F_7 = 0.769X_7 - 0.761X_{10}$$

Of the 23 variables only variable three (Training and learning LSS methodologies) was not included in the seven factors.

4.4.1: The Most Significant Barriers Faced in Implementing Lean Six Sigma Methodologies

The respondents were asked to state the most significant barriers faced in implementing LSS methodologies in their organization. The findings are given in table 4.8

Table 4.8: The Most Significant Barriers Faced in Implementing Lean Six Sigma Methodologies

	Frequency	Percent	Cumulative Percent
Lack of resources	28	73.7	75.7
Internal resistance	8	21.1	97.3
Poor project selection methodology	1	2.6	100.0
Total	37	97.4	
Missing System	1	2.6	
Total	38	100.0	

As indicated in table 4.8 above, the respondent identified Lack of resources (73.7%) and internal resistance (21.1%) as the most significant barriers faced in implementing LSS methodologies.

4.5 Summary of Findings and Interpretation

The study identified eight application of tools and techniques of Lean and Six Sigma to a greater extent; Voice of the Customers, Cause and Effect analysis, Total Quality Management, Continuous Improvement (Kaizen) ,Define Measure Analyse Improve and Control (DMAIC) ,Total preventive maintenance, Cross-Functional work teams, and Plan, Check, Do, Act. It was also noted that the main reasons for implementing these tools and techniques are to increase efficiency, to enhance operational excellence, to reduce costs, and to improve customer satisfaction. The study also found that the two

main ways through which the banks knew about Lean Six Sigma were through professional publications and through top management

Factor Analysis: The study also reduced 23 variables explaining critical success factors of Lean Six Sigma development into 7 factors. The seven factors explain 81.882% (Cumulative percentage) of the total variation, the remaining 16 factors together account for 18.118% of the variance hence it was possible to use factor Analysis for further analysis

Twenty two of the twenty three variables were significant in the factor analysis; that is 23 variables were classified into one of the seven factors. All commercial banks most commonly focused on the following activities when analysis extent of implementation and critical success factors of LSS (communalities); Effective communication (90.1%), Understanding tools and techniques within LSS (87.8%), Effective use of technology (87.6%), Top down management commitment and participation (87.1%), Leadership (84.9%) , linking LSS to customers (85.5) and Environment that encourages the constant improvement of product and services (84.4%).

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The objective of this study were to examine the extent to which commercial banks in Kenya are familiar with the methods, tools and techniques of Lean and Six Sigma, to find out the extent to which Lean Six Sigma is implemented within commercial banks in Kenya and to determine the Critical Success Factors (CSFs) for implementation of Lean Six Sigma in commercial banks in Kenya .The respondents were made up of managers from commercial banks in the Kenyan banking industry.

The study adopted exploratory research because research in LSS and its implementation in service organization are still at a very early stage. Primary data was collected using questionnaires. The data was analyzed using descriptive statistics and factor analysis. Factor analysis attempts to identify underlying variables, or factors that explain the pattern of correlations within a set of observed variables

The study identified eight application of tools and techniques of Lean and Six Sigma to a greater extent; Voice of the Customers, Cause and Effect analysis, Total Quality Management, Continuous Improvement (Kaizen), Define Measure Analyse Improve and Control (DMAIC), Total preventive maintenance, Cross-Functional work teams, and Plan, Check, Do, Act.

It was noted that key reasons which prompted the banks to kick-off a Lean Six Sigma initiative were; to increase efficiency, to enhance operational excellence and to reduce costs.

Most commercial banks which responded agreed on the following factors as the main Critical Success Factors in the implementation of LSS (communalities); Effective communication, Understanding tools and techniques within LSS, Effective use of technology, Top down management commitment and participation, linking LSS to customers, Leadership and Environment that encourages the constant improvement of product and services.

5.2 Conclusion

From these research findings, it can be concluded that commercial banks in Kenya have implemented the techniques and methods of Lean Six Sigma. The main reasons which Prompted the banks to kick-off a Lean Six Sigma initiative are to increase efficiency, to enhance operational excellence and to reduce costs.

From the study it can be concluded that commercial banks knew about Lean Six Sigma through two main ways i.e. through professional publications and through top management.

5.3 Recommendations

The following recommendations are given to policy makers; this research finds that managers feel that LSS is at times implemented without adequate education to implementers. It thus recommends that proper understanding of the demand placed by implementation of these methods on the resources of a firm should be well assessed

before implementation it is important for the management of the companies to get involved in training and skill development especially in areas of LSS and operations strategy. Professional consultants could be used to train the employees who will be advising the management on the best operations strategies.

To the researchers and academicians it is recommended that a similar study be carried out in other companies to examine the implementation of LSS and their implications on Operations Strategy. From the research findings, the respondents strongly advocated that for successful implementation of LSS methodology, Communication, Understanding of tools and techniques of LSS and top down management affect to a greater extent, hence researchers and academicians may further research on the strength of each critical success factor in relation to Lean Six Sigma.

5.4 Limitations of the Study

In the course of the study, the following limitations were encountered;

The target population was not easily accessed. This was hampered by company policies and bureaucracy regarding their information outflow. The formal procedure is that a document received should go through all the steps until the relevant officer ascertains that the information being sought can or cannot be given out. In some cases the researcher had to go through this to access to data. This was found to be too long. This seriously impeded the researcher's effort to conduct the census.

Respondents from mostly the private companies were reluctant to give information about their operations; this they thought was too much beyond what is required by law and were hence reluctant to give information.

Another potential limitation was the reliability of the data obtained. Inaccuracies could have resulted from the survey respondents misunderstanding the survey questions or terminologies used in Lean Six Sigma. Indeed the researcher had to in many cases explain the meaning of some of the terminologies to the respondents who then could attempt to accord the right response.

5.5 Suggestions for Further Research

Since the study focused on the commercial banks in Kenya, it is recommended that a similar study be carried out in other companies to examine the implementation of LSS and their implications to operations strategy.

Further studies are needed to test the relationship between LSS and the financial performance of the firms implementing it and to test its benefits.

LIST OF REFERENCES

Aboelmaged, M.G., (2010).*Six Sigma Quality: a structured review and implications for future research.* International Journal of Quality &Reliability Management, Vol. 27 No. 3, 2010 pp. 268-317

Achanga,P., Shehab,E. Roy,R and Nelder,G.,(2006). *Critical success factors for Lean implementation within SMEs.* Journal of Manufacturing Technology Management, Vol. 17 No. 4, 2006, pp. 460-471.

Adam, R.M. & Hazlett, S, A., (2010). *An absorptive capacity interpretation of Six Sigma* Journal of Manufacturing Technology Management, Vol. 21 No. 5, 2010, pp. 624-645.

Aldlaigan, A.H, & Buttle, F.A (2002). SYSTRA-SQ: *A New Measure of Bank Service quality,* international journal of service industry management, vol. 13 No. 4 pp.362-381.

Antony,J. & Desai, D.A.,(2009). *Assessing the status of Six Sigma implementation in the Indian industry Results from an exploratory empirical study,* Management Research News Vol. 32 No. 5, 2009, pp. 413-423.

Antony,J. (2004) *Some pros and cons of Six Sigma : an academic perspective* The TQM Magazine ,Volume 16 · Number 4 · 2004 · pp. 303-306.

Arnheiter, E. & Maleyeff, J. (2005) *The integration of Lean management and Six Sigma* The TQM Magazine Vol. 17 No. 1, pp. 5-18.

Banuelas, R.C & Antony.J.,(2002) *Critical success factors for the successful implementation of Six Sigma projects in organizations*, the TQM magazine, Total Quality Management vol.14.No.2, pp. 92-99.

Carleysmith,S.W., Dufton,A.M & Altria,K.D.(2009).*Implementing Lean Sigma in pharmaceutical research and development*: a review by practitioners ,R&D Management 39, 1, 2009

Chakrabarty, A. & Chuan, T.K. (2009). *An exploratory qualitative and quantitative analysis of Six Sigma in service organizations in Singapore* ,Management Research News, Vol. 32, No. 7, 2009 pp. 614-632.

Chakrabarty, A. & Chuan, T.K., (2007). *The current state of Six Sigma application in services, Managing Service Quality*, Vol. 17 No. 2, 2007. pp. 194-208

De Koning, H.,Does, R.J.M.M. & Bisgaard, S. (2008) *Lean Six Sigma in financial services, Int. J. Six Sigma and Competitive Advantage*, Vol. 4, No. 1, pp.1–17.

De Koning, H., Does, R .M.M.R., Groen, A. & Kemper, P.H.B. (2010) *Generic Lean Six Sigma project definitions in publishing* International Journal of Lean Six Sigma Vol. 1 No. 1, 2010 pp. 39-55.

Delgado, C., Ferreira, M. & Branco, M.C. (2010) *The implementation of Lean Six Sigma in financial services organizations*, Journal of Manufacturing Technology Management Vol. 21 No. 4, pp. 512-523

Denyse M. J. & Benny T. (2009). *Lean thinking implementation at a safari park.* Business Process Management Journal Vol. 15 No. 3, pp. 321-335.

De Souza L. B. (2009) *Trends and approaches in Lean healthcare Leadership in Health Services*, Vol. 22 No. 2, pp. 121-139.

Furterer, S. &. Elshennawy, A.K., (2005). *implementation of tqm and Lean six Sigma tools in local government:* a framework and a case study, Total Quality Management, Vol. 16, No. 10, 1179–1191.

Githiri,A.K.(2004) '*Application of Lean production techniques.* A survey of large construction firms in Kenya'

Glaveli. N., Petridou. E., Liassides. C. & Spathis. C. (2006) *Managing Service Quality* Vol. 16 No. 4, pp. 380-394.

Gurumurthy,A & , Kodali.R. (2008) *A multi-criteria decision-making model for the justification of Lean manufacturing systems*, International Journal of Management Science and Engineering Management, Vol. 3 No. 2, pp. 100-118.

Hensley,R.L., & Dobie,K.(2005). *Assessing readiness for Six Sigma in a service setting, Managing Service Quality*.Vol. 15 No. 1, pp. 82-101

Hu.G., Wang,L., Fetch, S., & Bidanda,B. (2008) *A multi-objective model for project portfolio selection to implement Lean and Six Sigma concepts*, International Journal of Production Research, Vol. 46, No. 23, 1 December 2008, 6611–6625.

Iwaarden, J.V., Van Der Wiele, T., B. Dale, R. W. &. Bertsch, B.,(2008) International Journal of Production Research, Vol. 46, No. 23. 6739–6758.

Jaramillo and Marshall, W.G (2004) *Critical success factors in the personal selling process -An empirical investigation of Ecuadorian sales people in the banking industry.* The International Journal of Bank Marketing Vol. 22 No. 1, pp. 9-25.

Kollberg. B. & Dahlgaard, J.J. (2007) *Measuring Lean initiatives in health care services: issues and findings,* International Journal of Productivity and Performance Management.Vol. 56 No. 1, 2007 pp. 7-24.

McAdam,R. Davies ,J., Keogh & Finnegan, A (2009)*Customer-orientated Six Sigma in call centre performance measurement* ,International Journal of Quality & Reliability Management Vol. 26 No. 6, pp. 516-545

Nabhani,F & Shokri,A (2009) *Reducing the delivery lead time in a food distribution SME through the implementation of Six Sigma methodology*, Journal of Manufacturing Technology Management Vol. 20 No. 7, 2009 pp. 957-974

Nakhai,B.&.Neves,J.S.(2009)*The challenges of Six Sigma in improving service quality*, International Journal of Quality & Reliability Management Vol. 26 No. 7, 2009pp.663-684.

Nunally,C.J, (1978) *Psychometric Theory*, New York, McGraw-Hill.

Pettersen,D (2009). *Defining Lean production: Some Conceptual and Practical issues*, The TQM Journal Vol. 21 No. 2, 2009 pp. 127-142.

Selltiz, C.,Wrightsman,L.S. & Cook, W. (1976). Research methods in social relations.

Shah, R., Chandrasekaran, A, & Linderman, K. (2008). *In pursuit of implementation patterns: the context of Lean and Six Sigma* , International Journal of Production Research, Vol. 46, No. 23, 1 December 2008, 6679–6699

Singh, Garg, S.K & Sharma, S.K. (2010). Lean *implementation and its benefits to production industry* International Journal of Lean Six Sigma Vol. 1 No. 2, 2010 pp. 157-168.

Snee, R.D. (2010). *Lean Six Sigma – getting better all the time* International Journal of Lean Six Sigma , Vol. 1 No. 1, 2010, pp. 9-29.

Thomas, A., Barton, R. & Chiamaka, C.O. (2009). *Applying Lean Six Sigma in a small engineering company – a model for change*, Journal of Manufacturing Technology Management Vol. 20 No. 1, 2009 pp. 113-129

Wang ,F.K., & Chen K.S.(2010). *Applying Lean Six Sigma and TRIZ methodology in banking services* journal of Total Quality Management Vol. 21, No. 3, pp.301–315

Womack, J.P. & Jones, D.T. (1996). *Lean Thinking: Banish Waste and Create Wealth in Your Corporation,* Simon & Schuster Ltd, London.

Womack, J.P., Roos, D. & Jones, D.T. (1990). *The Machine That Changed the World*: The Massachusetts Institute of Technology, Rawson Associates, New York, NY.

APPENDICES
APPENDIX 1: QUESTIONNAIRE

PART A: General information and Company Background

1. Respondent's Name (optional):.....
2. Position occupied.....
3. Name of the commercial bank:.....
4. Legal status of your company:
   a. State owned [ ]
   b. Private owned [ ]
   c. Public owned [ ]
   d. Any other (specify).....
5. Nature of ownership of your company
   a. locally owned [ ]
   b. foreign owned [ ]

PART B: Usage of Quality and Process Improvement Methods, Tools and Techniques used within Lean Six Sigma (LSS)

Six Sigma *approach is a methodology for improving the capability of business processes by using statistical methods to identify and decrease or eliminate process variation. Its goal is reduction of defects and improvements in profits.*

Lean production *is a philosophy that advocates for the use of a set of practices and tools to eliminate waste of any kind.*

Lean Six Sigma (LSS) *is a methodology that combines Six Sigma tools and Lean management practices to enhance competitiveness, operational efficiency and effectiveness and agility of an organization.*

6. Tick in the table below, the application of tools and techniques of Lean and Six Sigma in your company.

	Never Been Used	Used Once	Used Sometimes	Used Continuously
Just In Time(JIT)				
VOC (voice of customer)				
Continuous improvement (Kaizen)				
Team problem solving tools				
Total Preventive Maintenance				
Bottleneck constraint removal				
VSM(Value Stream Mapping)				
Cross-Functional Work Teams				

DMAIC (Define, Measure, Analyze, Improve and control)				
TQM(Total Quality Management				
PDCA (Plan, Do, Check, Act)				
Cause and Effect analysis				
Brainstorming				
Histogram				
Benchmarking				
Input -output analysis				
VOE (voice of employee)				
Statistical Process Control (SPC)				
FMEA (failure mode and effect analysis)				
Process Capability Analysis				
Gantt Chart				
SIPOC (Suppliers, Inputs, Process, Outputs, Customers)				
DoE (design of experiment)				
Quick Change Overs				
Process flowchart/ mapping				
Continuous flow production				
Quality function deployment (QFD)				
Pareto analysis				
Fishbone Diagram				
Error proofing methods				
Quality-costing analysis				

PART C: Lean Six Sigma (LSS) Implementation Details:

7 Indicate how your company came to be aware of Lean Six Sigma ?

a) From professional publications [ ]

b) From the top management [ ]

c) From the customers [ ]

d) Have not heard of Lean Six Sigma in any context [ ]

e) Other ways [specify]..... [ ]

8. Indicate the specific reasons which prompted you to kick-off a Lean Six Sigma initiative.

a) To enhance operational excellence [ ]
b) To increase efficiency [ ]
c) To reduce costs [ ]
d) To reduce lead time [ ]

e) To engage employees through preventive actions [ ]
f) To optimize operational capacity [ ]
g) To improve customer satisfaction [ ]
h) To become world-class institution [ ]
i) To solve chronic problem [ ]
j) To create better image of product/service [ ]
k) Other reasons, specify.....

9. If not practicing LSS methodology by any means reveal which quality/productivity improvement tool(s) you are implementing.....

PART D: Critical Success Factors (CSFs) of Lean Six Sigma (LSS) Deployment:

10. Rank in the table below the following CSFs (*essential factors aiding the deployment of LSS in your company*), on a scale of 1 to 5, i.e.

1 = (Not important), 2 = (less important), 3 = (important), 4 = (very important) and 5 = (crucial).

	1	2	3	4	5
Top-down Management commitment and participation					
Organizational Structure and Culture					
Training and learning LSS methodologies					
Linking LSS to customers(understanding customer requirements)					
Linking LSS to business strategy					
Linking LSS to employees(human resources)					
Linking LSS to suppliers					
Understanding tools and techniques within LSS					
Effective communication					
Project management skills					
Teamwork					
Financial capabilities of the company					
Measure the success in terms of financial benefits,					
Effective use of technology,					
Effective service /product design					
Ongoing evaluation, monitoring, and assessment;					
Goal management culture					
Recognition and reward systems					
Trust in organization and project selection, and prioritization					
Proper planning prior to implementation					
Leadership					
Addressing the root cause of a problem					
Environment that encourages the constant improvement of product and services					

PART E: Challenges you faced in implementing LSS methodology in your organization.

11. Indicate the most significant barriers you faced in implementing LSS methodologies in your organization.

a) Lack of resources (this includes financial resources, human resources, time,etc) [ ]

b) Internal resistance (political resistance, technical resistance, etc.). [ ]

c) poor project selection methodology (i.e. there is no structured and disciplined approach to selecting projects) [ ]

d) lack of tangible results [ ]

e) Other reasons [specify] .....

End. Thank you