LEAN BUSINESS STRATEGY AND PERFORMANCE OF NIGERIAN MANUFACTURING SECTOR, 1990-2014

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A DISSERTATION SUBMITTED TO THE DEPARTMENT OF BUSINESS ADMINISTRATION, FACULTY OF MANAGEMENT SCIENCES, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF DOCTOR OF PHILOSOPHY (Ph.D) IN BUSINESS ADMINISTRATION.

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CERTIFICATION

I, Moneme, Patrick Chigozie do hereby certify that the work embodied in this research was carried out by me and is original. It has not been submitted in part or full for any other degree or diploma of this or any other university.

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APPROVAL

This research titled "Lean Business Strategy and Performance of Nigerian Manufacturing Sector: 1990-2014" has been assessed and approved by the Departmental Postgraduate Committee.

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DEDICATION

This project is dedicated to the Almighty God, the Fountain of All Wisdom, for His Mercies and Grace during the course of this programme, and to my beloved brother, Osita Kenneth Moneme.

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ABSTRACT

The persistent pressure to improve operational performance, maintain competitive advantage, and meet customers' demands and expectations has forced manufacturing firms to continuously improve their business processes. Besides these global market pressures, Nigerian manufacturing sector is further plagued by other domestic constraints especially the deepen high cost of production, scarcity of resources, and unfavourable macroeconomic indices. In this increasing complexity of the business environment, Lean business strategy seems to be an ideal strategic option to confront the divergent problems facing the sector, since it emphasizes on value maximization through efficient and effective utilization of resources. Therefore, this study sets to examine the influence of Lean Business Strategy on Performance of Nigeria's Manufacturing Sector. In pursuit of this broad objective, Descriptive survey research design was adopted. Both primary and secondary data were used for the study. For data analysis, Simple Regression Analysis was used to determine the influence of Lean Business Strategy on Nigerian Manufacturing Sector Performance. After the analysis of the data, the following major findings were made; The first model accepted the alternate hypothesis that Lean Technique has significant influence on the Cost Performance of the selected manufacturing firms with t-Statistics p-value < 1%. The second model revealed that Lean Critical Success Factor (CSF) has significant influence on the Quality Performance of the selected manufacturing firms with t-Statistics p-value < 1%. The third model agreed with alternate hypothesis that Lean Culture has significant influence on Contribution of Manufacturing Sector to Gross Domestic Product (GDP) in Nigeria with t-Statistics p-value < 1%. The fourth model confirmed that Lean sustainability has significant influence on Nigerian Manufacturing Sector Capacity Utilization with t-Statistics p-value < 5%. It was concluded that Lean business strategy is a management technique that supports manufacturing firms to fundamentally reposition their business processes to optimise resources, cut operational costs, become responsive, and customer focused. This implied that Nigerian manufacturing sector should consciously and proactively implements lean business strategy to achieve the best optimal cost structures, increased productivity, and improve quality of their products.

TABLE OF CONTENTS

List of Tables

List of Figures

CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

Intense competition in domestic and international markets and accelerating pace of technological development have placed greater pressure on manufacturing firms in their quest to survive and thrive in today's emerging global economy. Customers are becoming highly educated and more open to new ideas and information. The preference has now shifted to highly customised products with the desire to get the products cheaper, faster and in a better quality (Nahm, Vonderembse, Subba-Rao, & Ragu-Nathan, 2006; Karim, Smith, Halgamuge, & Islam, 2008). To intensify the situation, increasing prices of goods and services to boost revenue is no longer an option for many manufacturing firms as a result of availability of different varieties and brands of goods and services in the global market place (Stuebs & Sun, 2010). Hence, not only competition that fosters manufacturing firms to find out innovative strategies to sustain their operations, but also the pressure of customers' demands for high quality products, and the market pricing level which stimulate companies to reduce their costs and improve quality (Antony, 2004).

To survive and grow in this competitive scenario, new management method designed to analyse and control operational cost while satisfying customers' expectations need to be adopted (Vlachos & Bogdanovic, 2013). In line with this thinking, many manufacturing firms appear to have adopted lean business strategy as the relevant management model that is dedicated and committed to achieving organizational excellence through efficient management of organisational resources, elimination of waste, delivering customers' needs effectively and at affordable costs, improve quality and lower business costs, and as such maintain organisational market position. Hence, lean business strategy is all about adding value by eliminating waste, being responsive to change, focusing on quality, and enhancing the effectiveness of work force (Liker, 2004).

The history of Lean business strategy can be traced back to Henry Ford who invented a Mass Production system that first integrated an entire production processes. Mass production is the production of large amounts of standardised products, especially on assembly lines. Replacing craft production, mass production dramatically lowered manufacturing costs and time for most products in all types of industries. However, over the years, customers' needs

changed and the market required more product varieties and the mass production was unable to meet the new demands of the market. Contrary to the advantages gained from mass production, it is considered inflexible way of production, because firms now need to compete on product differentiation, product quality, price, delivery performance, and time for development so that they can introduce new and improved products to the market.

To address the shortcoming of mass production and also to overcome the challenges of scarcity of resources and high cost of production faced by the Japanese firms after World War II, Kiichiro Toyoda and Taiichi Ohno at Toyota Motor Company revisited Ford‘s original thinking, and invented the next production paradigm shift called Toyota Production System (Lean Enterprise Institute, 2011). From Toyota Production System the concept ‘Lean business strategy’ (Lean Management, Lean Manufacturing, lean thinking, lean system, Lean Enterprise, Lean Production or simply lean are some of the terms used to describe Lean business strategy) emerged. The lean term was coined by John Krafcik (1988). Later in 1990, the principles were popularized by Womack, Roos, and Jones through their book “The Machine that Changed the World”. The authors emphasize that being lean means less of everything- less human effort, less inventory, less time to develop products, and less space to become highly responsive to customer demand while producing top quality products in the most efficient and economical manner. Ever since the publication, the lean principles and practices have been rapidly adapted into various industries and sectors. Furthermore, the lean philosophy gained prominence with the rise in competitive pressure to deliver high quality products at reduced prices to demanding customers. Its ability to reduce wastes simultaneously with creating value addition to customers is considered to be one of the main factors for its rapid proliferation into various industries (Ruy & Cesar, 2014).

Lean business strategy is a departure from traditional mass production. Traditional mass production creates products in anticipation of having a market for them. Operations have traditionally been driven by sales forecasts, and firms stockpile inventories in case they were needed. A key difference in Lean Manufacturing is that it is based on the concept that production can and should be driven by real customer demand. Instead of producing what is hoped to be sold, Lean Manufacturing can produce what the customer wants with shorter lead times. Instead of pushing product to market, it is pulled there through a system that is set up to quickly respond to customers’ demand (Ibrahim, 2011). Lean organizations are capable of producing high quality products economically in lower volumes and bringing them to market

faster than mass producers. A lean organization can make twice as much product with twice the quality and half the time and space, at half the cost, with a fraction of the normal work-in-process inventory. Lean management operates the most efficient and effective organization possible, with least cost and zero waste (Minggu, 2009).

Lean describes a set of management principles and methods used to differentiate waste and value in organizations (Stone, 2012). The proper understanding of waste is inseparable from the understanding of value. Under lean, waste refers to any human activity which absorbs resources but creates no value, and value is regarded from the customer's point of view. Value is the capability provided to a customer at the right time at an appropriate price, as defined in each case by the customer (Womack & Jones, 1996). If waste elimination is disconnected from creating value to the customer, so called improvements provide cost reduction but may lose the inherent value to the customer. When wasteful actions are gone, less effort, space, and capital are required, lead time is reduced, and quality increases whilst the cost of quality decreases (LEI, 2011). Lean functions to drive an organisation towards perfection, facilitating continuous improvement of business processes by removing waste or wasteful action. It involves considering the purpose of the organisation and how it provides value to the customers. The process by which value is created is analysed for the removal of wasteful actions from the root cause, rather than taking impromptu actions, fire-fighting, expediting, and fixing causes of defect only at the surface (Ohno, 1988).

The identification of waste in a process is not the end point in the lean journey. Rather, it should be followed by actions to contain the avoidable waste (Ehrlich, 2006). Consequently, Bhasin and Burcher (2006) view lean system to consist of two levels: lean philosophy and lean practices, while Arlbjorn, Freytag, and Haas (2011) view it as an integrated and interdependent system involving many elements, such as lean philosophy, lean principles and lean practices. These three sub-systems are inter-related elements that jointly create the desired outcomes in lean implementation. The philosophy of lean focuses on continual productivity and quality improvement in the pursuit of excellence in all phases of the industrial cycle. Lean principles involve the five principles introduced by Womack and Jones (1996). The five lean principles are; Identify value from the customer perspective; Map the value stream; Achieve flow within the work process; Achieve customer pull at the right time; and Strive for perfection and continuous improvement. Lean tools and techniques are necessary to reflect lean philosophy and principles practically. As such, by implementing

these tools the organisation should be able to follow the five principles effectively and achieve lean philosophy (Bhasin & Burcher, 2006). Therefore, Lean business strategy incorporates collection of principles, tools and techniques, and culture into the business processes to optimize time, human resources, assets, and productivity, while improving quality level of products and services to the customers (Ronald, 2001).

Lean business strategy is argued to generate several benefits to organisations that when adopted and carefully implemented, can form the roadmap to global manufacturing excellence (Papadopoulou & Ozbayrak, 2005). Essentially, the core idea of lean manufacturing is to maximize customer value while minimizing waste. It offers a solution for cost reduction strategies like the identification and elimination of waste in manufacturing environments. Ichimura (2008) opines that lean is a powerful tool designed to meet recent manufacturing enterprises' challenges in reducing lead-time, human errors, cost, and delivery times while increasing the quality of the final product and continuous flow in the manufacturing process. Bergmiller and McCright (2009) argue that lean can help to increase efficiency, reduce customer response time, cut costs, improve profitability and enhance the organisation's image. Moreover, lean can lead to sustainable development by increasing customer satisfaction and communication, and reducing cost and delivery time, as it is a systematic approach that helps managers to identify wastes and omit them from the organisation at every stage in the operation, which will lead to better organisational performance and make the company waste-free (Upadhye, Deshmukh, & Suresh, 2010). The ultimate goal of implementing lean production in an operation is to increase productivity by incorporating less human effort, less inventory, less time to develop products, and less space to become highly responsive to customer demand while producing top quality products in the most efficient and economical manner possible (Womack, Jones, & Roos, 1990).

However, these lean benefits cannot be achieved unless the organisation recognises the importance of people in the organisation. Along with the elimination of waste, the respect for humans is considered an important principle for lean management (Ohno, 1988; Womack & Jones, 2003; Schmidt, 2011). Neglecting the human component in lean jeopardises the sustainability of the strategy and makes it difficult to reach the level of cultural excellence for continuous improvement (Golicic, & Medland, 2007; Ichimura, Arunachalam, & Jahankhani, 2007). Lean creates a culture that empowers staff at all levels to make innovative changes that improve productivity by reducing wasteful action. With this, lean is not just a mere

method or set of tools and techniques but also involves establishing the right culture to ensure the survival of the lean tools (Hallam, Muesel, & Flannery, 2010). Slater (2007) asserts that often times manufacturers strive to improve performance through the application of lean techniques and tools, but fail to address the underlying culture that ensures that maximum value is extracted from the techniques.

To understand lean business strategy and its contribution to firm performance, Nigerian manufacturing sector was considered for this study because of its strategic link to the economic development of the nation. Several Authors have shown that higher productivity of manufacturing sector is a sure means of boosting economic growth, enhancing firm growth and increasing standard of living of the people through large supplies of both consumer and capital goods at lower costs and prices (Alao, 2010, Anyanwu, 2004, Nto & Mbansor, 2011). Tybout (2000) argues that the growth of manufacturing sector is crucial for economic development because it is a potential engine of modernization, a creator of massive employment, and a generator of positive spill-over effects. Opaluwa, Umeh, and Ameh (2010) opine that the manufacturing sector plays catalytic role in a modern economy and has many dynamic benefits that are crucial for economic transformation. They note that in an advanced country, the manufacturing sector is a leading sector, it is an avenue for increasing productivity in relation to import substitution and export expansion, creating foreign exchange earning capacity, raising employment, promoting the growth of investment at a faster rate than any other sector of the economy, and more efficient linkage among different sectors. Thus, implementing successful manufacturing tools and techniques for Nigerian manufacturing sector would be the first step in the right direction for the development of the sector that will in turn improve the whole economy.

In view of the strong pull effect of manufacturing sector, Nigerian government over the years has designed and implemented plans and strategies to enhance the performance of the sector. This started with import substitution strategy during the First National Development Plan (1962-1968) aimed at reducing the volume of imported finished goods and encouraging foreign exchange savings by producing locally some of the imported consumer goods (CBN, 2003). In 1986, Structural Adjustment Programme (SAP) was adopted to widen the country's industrial base, and provide incentive for increased exports (Bamidele, 2005). The National Economic Empowerment and Development Strategy (NEEDS) formulated in 2004 was targeted, among others, at boosting industrial capacity utilization to 70%. Also, Nigeria

Vision 20:2020 was designed in 2009 as a long term development goal to be implemented with a series of National Development Plans, beginning with the First Medium-term National Implementation Plan, 2010-2013. The Vision made elaborate provisions for the industrial development of Nigeria. It provides a shift in the structure of production towards manufacturing activities with emphasis on the export of processed and manufactured products.

Notwithstanding these policies and plans implemented over the years to propel growth of the sector, it has continued to suffer severe decline due to unfavourable business climate (NBS, 2012). It has been argued that the persistent poor performance of the manufacturing sector in Nigeria is mainly due to massive importation of finished goods, inadequate financial support, lack of necessary infrastructural facilities, poor and epileptic power supply, and high rate of corruption (Tomola, Adebisi & Olawale, 2012). The outcome of this is that the sector has been characterised by grossly underutilized capacity, high production cost, low value added, low level of foreign investment in manufacturing, high import content of industrial output, poor maintenance culture, and weak linkage capabilities (Obioma & Ozughalu, 2005). In this context, Lean has been suggested as the right strategy to tackle the conflicting problems facing organisations in the current business environment (Arlbjørn & Freytag, 2013). Lean business strategy leverages firms to achieve long term competitive advantages by putting in place the proper production systems particularly with regard to product quality, operational effectiveness, costs reduction, productivity, customer satisfaction, and business growth (Womack et al., 1990).

1.2 Statement of the Problem

Manufacturing sector is reputed to be the engine of growth, an antidote for unemployment, and a threshold for sustainable development (Kaldor, 1967). This has been the reason why many developed economies have formulated and implemented different manufacturing productivity schemes that helped them to pull out of poverty trap and set them on the path of growth. In Nigeria, manufacturing sector is seen as the catalyst that accelerates the pace of structural transformation and diversification of the economy. Structural transformation and diversification of the economy will enable the country to fully utilize its natural resources, thereby depending less on foreign supply of finished goods or raw materials for its economic development. Consequently, resources have been channelled into the sector through heavy public sector investment, but the sector seems yet to function as a mover of the nation's

economy. The seemly inability of the sector to remain viable and compete effectively in today's globalised competitive environment has been blamed on their failure to identify, reduce, and possibly eliminate all non-value added activities that are inherent in the manufacturing processes resulting in higher production cost. Most often, policy makers focus on value-added activities through application of capital intensive projects to improve performance but neglect the important effect of adopting lean techniques to manage non-value added activities (wastes) that ensure that maximum value is extracted from investment. Capital intensive projects alone are not sufficient to revitalize the sector, hence the need for efficient manufacturing processes that will result in significant improvement in quality, delivery, flexibility and cost.

Although Nigerian manufacturing firms have always attempted to development strategies, but they are still confronted with the challenges of how to efficiently exploit cheap labour force, abundant raw materials and low-cost agricultural products available to produce globally acceptable products at least possible costs to achieve competitive advantage in the global market. Efficiently utilising these resources require Nigerian manufacturing firms to refocus and re-strategize their operations to achieve higher performance standards through lean culture that focuses on continual productivity and quality improvements to sustain growth and create synergistic value streams across the manufacturing processes.

Accordingly, improving the manufacturing sector presents the most competitive and strategic option for Nigeria in the light of her developmental challenges, and given her background as an essentially monoculture economy that heavily depends on petroleum revenue. Over dependency on petroleum has made Nigerian economy highly susceptible to global price fluctuations, but manufacturing sector is relatively sustainable and has more absorptive capacity to external shock. Manufacturing sector has the capacity to increasingly add value to natural products before they are sold thereby boosting revenues and raising average earnings per input (Mbelede, 2012). An efficient manufacturing sector has the tendency to benefit Nigeria, especially to maximally utilize her abundant resource base, enjoy the benefits of all linkages, lessen average operational costs, and increase national competitiveness.

Having acknowledged the important role of manufacturing sector as an engine of growth and panacea for sustainable development, Nigerian government over the years has pursued several policy initiatives to augment the process of manufacturing production. However, despite all the efforts of the government to launch and sustain rapid industrialisation that can

produce the much needed dynamic changes in the Nigerian manufacturing sector, evidence abound that the performance of the sector has not yielded the desired results as reflected by the sector's capacity utilization and economic contribution to GDP. In 1980 the share of Manufacturing in the GDP was about10%, it fell from 8 to 6 % in 1990s and in 2010 the share was about 7.7%, and during this same period the overall manufacturing capacity utilization fell from over 70% in the 70s to 37% in 1990, and to about 54% in 2010 (CBN, 2012)

Besides the manifest failure of most of the development initiatives aimed at propelling the growth of the sector, the sector appears disrupted by other domestic constraints, such as unfavourable macroeconomic indices (high inflation, high exchange rate and high interest rates and high tax rate), and increasing high cost of production and scarcity of resources resulting from recent decrease in price and supply of oil. The several policy failures together with these domestic constraints may affect lean sustainability and underutilization of installed capacity in the manufacturing sector of Nigeria.

In this increasing complexity of the business environment, Nigerian government is forced to reinvent and reinvigorate business strategy through policy realignment that will sustain the long-term survival and growth of the sector. This paradigm shift serves as part of global strategy to stay in business, remain competitive and increase their market share in the tough globalised market. Lean business strategy seems to be an ideal strategic option to confront the divergent problems facing Nigerian manufacturing sector in the new market environment. Lean business strategy is a multi-dimensional approach designed to synergistically create an efficient processes that intensify effective utilization of resources to produce quality goods with little or no waste (Shah and Ward, 2003).

1.3 Objectives of the study

The main objective of this study is to examine the influence of lean business strategy on the performance of Nigerian manufacturing sector. To achieve the main objective, the following specific objectives are developed:

1) To examine the influence of Lean Technique on the Cost Performance of the selected manufacturing firms.
2) To ascertain the extent to which Lean Critical Success Factor (CSF) influences Quality Performance of the selected manufacturing firms.

3) To determine the influence of Lean Culture on Contribution of Manufacturing Sector to Gross Domestic Product (GDP) in Nigeria.

4) To determine the influence of Lean sustainability on Nigerian Manufacturing Sector Capacity Utilization.

1.4 Research Questions

To accomplish the objectives, the following questions are developed:

1) What has been the influence of Lean Technique on the Cost Performance of the selected manufacturing firms?

2) To what extent has Lean Critical Success Factor (CSF) influenced the Quality Performance of the selected manufacturing firms?

3) What has been the influence of Lean Culture on Contribution of Manufacturing Sector to Gross Domestic Product (GDP) in Nigeria?

4) To what extent has Lean sustainability influenced Nigerian Manufacturing Sector Capacity Utilization?

1.5 Hypotheses

1) **H_A:** Lean Business Technique has significant influence on the Cost Performance of the selected manufacturing firms.

2) **H_A:** Lean Critical Success Factor (CSF) has significantly influenced the Quality Performance of the selected manufacturing firms.

3) **H_A:** Lean Culture has significant influence on Contribution of Manufacturing Sector to Gross Domestic Product (GDP) in Nigeria.

4) **H_A:** Lean sustainability has significant influence on Nigerian Manufacturing Sector Capacity Utilization.

1.6 Significance of the Study

The findings of this study reinforce existing knowledge in Lean management fields because it brings to fore the perspectives of lean business strategy in manufacturing sector of emerging economies like Nigeria, an aspect that is still emerging. It helps to sensitize organisations in Nigeria the potentials of lean management thus encouraging them to invest in its implementation as a business strategy to improve their performances. Hence, this study provides a comprehensive picture of the reality of wastes elimination management in its

multidimensions in the manufacturing sector. Thus, it provides tools for policy makers to assess and evaluate the state of lean practices, and develop policies to enhance the competitiveness and survival of Nigerian manufacturing sector in the global market, and ultimately improve its' contribution to the national economy.

Furthermore, the study is of great benefit to academics who would like to pursue the subject further. Finally, this study is timely at this historical juncture in economic development of Nigeria, given the currency of the debate and interest in economic diversification, and with the recent decrease in price and supply of oil that buttressed the need for an efficient manufacturing process.

1.7 Limitation of the Study

This research is focused on Lean implementation in Nigerian manufacturing sector. The use of one sector limits the generalisation of the findings to other sectors. Despite the limitation, the study has contributed to an understanding of how Lean Business Strategy affects the performance of manufacturing sector in developing economy overtime.

1.8 Scope of the Study

This study is restricted to manufacturing sector and the period is 1990-2014. This duration was used because it is detailed enough to give a good result and analysis of manufacturing sector performance. For firm level analysis, four manufacturing firms were selected; Unilever Nigeria, Nestle Nigeria, Dangote Cement Plc, and Cutix Plc. The choice of these large firms in the sector was borne out of the fact that they are the leading firms in their respective industries whose strategic actions are likely to have significant impact on the environment.

CHAPTER TWO
REVIEW OF RELATED LITERATURE

This chapter reviews existing body of knowledge on the subject matter. This section is divided into conceptual review, theoretical framework and empirical reviews. The conceptual review encompasses the system of concepts, assumptions, expectations, beliefs that support and inform a research (Robson, 2002).

2.1 Conceptual Review

Lean is one of the most popular advanced operational management concepts which is based on a combination of advanced techniques of operational management (Schonberger, 2007). Generally, the Lean concept comprises set of measures concerned with mitigating the waste, stability of processes, constant improvement processes and coping with change. Lean approach is a systematic approach to identify and eliminate elements of a process that do not add value to the final outcome of the production process, such as blocking of stock, repairing faulty products and needless movement of people and products around the business (Voehl, Harrington, Mignosa, & Charron, 2013). Lean can be seen as a concept addressing the quality, cost and delivery of a firm's business processes by using an integrated set of principles, methods and tools. It can be referred to as a business model that emphasizes meeting customers' expectations by delivering quality products at the least cost when required. As a strategic approach it can be used for resolving severe organizational problems and uniting several change initiatives that are running currently in a business (Atkinson, 2010).

For Womack (2005), lean always begins with the customer who wants value, that is, the right product at the right time, place, and price, with perfect quality. To maximise this customer value, the steps in the process must be performed with zero waste. To achieve this zero waste, every step in a value-creating process must be adding value, capable, available, adequate, and flexible, and the steps must flow smoothly and quickly from one to the next at the pull of the downstream customer. A truly lean process can thus be regarded as a perfect process. Though there is no such perfect process, but lean thinkers still believe that through never-ending continuous improvement process, organisation can achieve perfection.

Some people interpret Lean as the opposite of ‘fat’ by assuming that the main target of Lean is to lay off people. But Lean is not about cutting staff and resources in the first place, it is about focusing organisation’s resources and efforts on creative tasks, by speeding up the operations through the progressive elimination of waste and idle time created by bureaucracy. Lean focuses on changes on different levels from the raw materials to production and customers’ satisfaction by adding value to the products, reducing the lead-time costs and inventories (Marchwinski & Shook, 2004).The aspiration of an easier, functional and rewarding workplace is the main form of motivation for the fulfilment of Lean objectives (Bonaccorsi, Carmignani, & Zammori, 2011).

In an attempt to crystallize the concept of lean business strategy, several definitions have been examined, each of which represents the authors’ perspective and understanding of the concept. Starting with Womack (1990) lean manufacturing is define as an integrated set of socio-technical practices aimed at eliminating waste along the whole value chain within and across companies. Drew, McCallum, and Roggenhofer (2004) define lean as an integrated set of principles, practices, tools and techniques designed to address the root cause of operational underperformance. It is a systematic approach to eliminating the sources of loss from entire value stream in order to close the gap between actual performance and requirements of customers and shareholders. Lean tries to eliminate three key sources of loss from operating system, waste, variability and inflexibility. While Atkinson (2004) defines lean system as a concept, a process, a set of tools, techniques and methodologies that can be used to attain and maintain effective resource allocation. To Marchwinski and Shook (2004), lean business strategy is a system for organising and managing product development, operations, suppliers, and customer relations that requires less human effort, less space, less capital, less material and less time to make products with fewer defects, to precise customer desires compare with the previous system of mass production. Allway and Corbett (2002) consider lean system as an approach focusing on eliminating non-value added activities from processes by applying a robust set of performance change tools, and emphasising excellence in operations to deliver superior customer services.

Conversely, Worley and Doolen (2006) define lean as a systematic removal of waste by all members of the organization from all areas of the value stream, whereby the value stream is defined as all activities that contribute to the transformation of a product from raw material to finished product. Also, lean is adding value by eliminating waste, being responsive to change,

focusing on quality, and enhancing the effectiveness of work force (Liker, 2004). On the same note, Papadopoulou et al., (2005) define lean as a method aimed at eliminating wastes in a production area, including wastes regarding customer relations, product design, management and suppliers, wherein the main objective is to provide the customer with a good-quality product at minimum cost by using less of everything, including inventory, human effort, lead time to develop the product, and space.

Shah and Ward (2003) perceive lean system as a multi-dimensional approach that encompasses a wide variety of management practices, including Just In Time (JIT), quality systems, work teams, cellular manufacturing, and supplier management in an integrated system. This lean definition was later reviewed and defined as an integrated socio-technical system whose main objective is to eliminate waste by concurrently reducing or minimising supplier, and internal variability (Shah & Ward, 2007). Manville, Greatbanks, Krishnasamy and Parker (2012) suggest that Lean management is primarily concerned with reducing waste or non-value added activities within a business process. As such Lean seeks to make the process as efficient as possible through identifying sources of waste, and reducing and eliminating waste until only the added value elements of the process remain. Sanchez and Perez (2001) refer lean business strategy as a conceptual framework based on a few established principles and techniques such as multi-functional teams, elimination of zero-value activities, continuous improvement and supplier integration to achieve production effectiveness and delivers just-in time.

Though there is no consensus in the definition of lean business strategy but these definitions indicate the general understanding about lean thinking among researchers. The definitions revealed that the main focus of lean business strategy is in four main aspects: defining customer value; eliminating all activities that do not contribute to the customer's value (waste); maintaining effective resource allocation; and continuous improvement of the processes.

2.1.1 Value Creation and Waste

The main theme of lean philosophy is to use less but achieve more through eliminating or minimising non-value added activities within the system (Womack & Jones, 2003). In lean manufacturing, the value of a product is defined solely based on what the customer actually requires and is willing to pay for. This value can be created in two ways: by providing better

products or additional services at the same price leading to better value perceived by customers; and by eradicating wasteful activities from process leading to a reduction in the associated cost and resources (Hines, Howeg, & Rich, 2004).

To create value for customers, lean system perceives any activity that does not add value to a product or service from customers' perspective as completely waste and should be eliminated or controlled to minimum (Petersen & Wohlin, 2010; Turesky & Connell, 2010; Womack et al., 2003). Although the concentration in lean is totally on the value added activity that the customer is ready to pay for, several activities are required to produce the product, these are called essential non-value-added activities. Thus, there are three types of value activities, valued added, essential non-value added and non-value added activity. In order to be lean, the organisation needs to differentiate between these activities and try to eliminate all non-value-added activity that does not add value to the product or to the customer, and to minimise the essential non-value-added activities (Benson and Kulkarni, 2011). The elimination of non-value-added activities or minimization of essential non-value-added activities is based on seven waste types identified in lean literature, they include:

Defects

Defects waste is a direct cost. When defect occurs, rework may be required; otherwise the product will be scrapped. Generation of defects will not only waste material and labour resources, but it will also create material shortages, hinder meeting schedules, create idle time at subsequent workstations and extend the manufacturing lead time. (Rawabdeh, 2005). The source of this type of waste comes from lack of preventive maintenance, standards, design, documentation, quality control, awareness of customer needs, or proper inventory control (Stack, 2012). Ignoring this type of waste could cost the firm delays in processes, discarded defective items, extra work for staff, longer lead time, questionable quality, missed deliveries and low profits (Ferdousi and Ahmed, 2010). To eradicate this type of waste, firms need to have countermeasure activities in place such as standardise work activities, ensuring rigorous quality control, and being fully aware of work requirements and customer needs (Stack, 2012).

Overproduction

Overproduction is unnecessarily producing based on forecasting rather than actual demands or producing it too early before it is needed. Producing more than needed is a very common practice, as firms usually like to keep safety stock. However, this increases the risk of obsolescence, the risk of producing the wrong thing, and the possibility of having to sell those items at a discount or discard them as scrap. Moreover, it adds extra works for staff in terms of transportation, inventory, and WIP (Benson et al., 2011). It can be risky as customer demands can change and also risk of products staying in stock for a long time, which could affect quality. Though, there are some cases when extra supplies of semi-finished or finished products are intentionally maintained, even by lean manufacturers. The effect of this type of waste can be seen as increasing inventory level, which eventually leads to high storage cost (Ferdousi et al., 2010).

Waiting

Waiting is idle time for workers or machines due to bottlenecks or inefficient production flow on the factory floor. Waiting also includes small delays between processing units. Stack (2012) shows that this waste could arise from; poor communication, poor layout, long set-up times, inadequate staff, incompatible production rate, and work absence. This waste will lead to longer lead times and poor flow, as well as firm losing money as they must pay workers even when they are doing nothing due to delays from other sources (e.g. waiting for material, information or equipment to become available) (Benson et al., 2011).

Stack (2012) recommended several steps to eliminate waiting waste: if there is a shortage of staff the company must provide an adequate number of workers to help smooth out the workload; people at lower levels should be empowered to make decisions when needed, rather than waiting for information and instruction to come from the upper level; adequate quality controls should be in place to ensure the reliability of machines and systems; workers should be encouraged to multitask so that an absence of other workers can be compensated for; and good supply control should be provided so that staff will have the materials or equipment they need.

Transport

Transportation includes any movement of materials that does not add any value to the product, such as moving materials between workstations. The idea is that transportation of materials between production stages should aim for the ideal that the output of one process is immediately used as the input for the next process. Raw materials and finished products should be delivered to the point of use, rather than going from place to place which adds no value to the customer. The Lean term for this technique is called point-of-use-storage (POUS) (Kilpatrick, 2003). Excessive transportation adds cost to the organisation, wastes time, and as well affects product quality (Ferdousi et al., 2010). The causes of this waste come from, poor layout, poor system design, misaligned process flow; and unnecessary handling and steps in the system (Stack, 2012; Benson et al., 2011). To get rid of this waste, organisations need to simplify the process, fix or amend plant layout to help smooth out the process, handle products only when needed, and try to make distances between each stage as short as possible (Stack, 2012). Since there is ultimate need to transport product and materials, we cannot manage entirely without transport. Therefore, the waste of transport could not be removed totally, but rather should be minimised as much as possible.

Inventory

Inventory waste means having unnecessarily high levels of raw materials, works-in-process and finished products. Extra inventory leads to higher inventory financing costs, higher storage costs and higher defect rates (Capital, 2004). Inventory tends to increase lead time, prevents rapid identification of problems, and increase space requirements. The main sources are overproduction, unawareness of customer needs, unreliable suppliers, and mismatches in production speeds (Stack, 2012). The organisation can overcome and reduce inventory wastes by applying JIT and producing only according to direct customer orders (Stack, 2012).

Motion

Motion includes any unnecessary physical motions or walking by workers which divert them from actual processing work. This includes walking around the factory floor to look for a tool, or even unnecessary or difficult physical movements, due to poorly designed ergonomics, where operators have to stretch, bend and pick up when such actions could be avoided (Capital, 2004). Organisations can reduce motion that adds no value to processes or to the product itself by improving the workstation layout; ensuring tools, parts and materials

are available when needed, in an obvious place; standardising files, equipment, and work procedures; ensuring an organised workplace (Benson et al., 2011; Stack, 2012).

Over-processing

Over-processing is unintentionally doing more processing work than the customer requires in terms of product quality or features such as polishing or applying finishing in some areas of product that will not be seen by the customer (Capital, 2004). Ferdousi et al. (2010) said that using incorrect procedures, processes or tools in a process leads to over-processing waste, which add no value to end customers. This type of waste has many negative effects on the firm's performance in terms of increased cycle time and impacts on the inventory level.
Womack and Jones (2005) opine that out of those seven wastes identified, five could be totally removed from the processes – overproduction, unnecessary motion, waiting, over processing and defects, while the other two types of waste – inventory and transportation – cannot be totally removed but minimised. This means that firms can always produce exactly as much as ordered, with optimal resources.

2.1.2 Lean Culture

Organisational culture is the personality of an organisation. Organization culture defines the core beliefs, values, norms and social customs that govern the way individuals act and behave in an organization. Some manufacturing firms when implementing lean emphasize only on lean tools and techniques but failed to build the right culture. Philip (2010) mentions that lean cannot exist in an organization where the culture is against it, because the organizational culture determines the success of lean. Therefore, to implement lean, organisation culture and national culture must be considered. Wong (2007) found that national culture has a significant impact during the process of lean implementation because strategic decisions are not only driven by firm capabilities, but are also a reflection of the formal and informal constraints of a particular national culture that managers confront. Culture is an essential element in lean implementation process that ensures successful lean practices in an organisation (Achanga, Shehab, Roy, & Nelder, 2006). Lean requires changes in the corporate culture, from passive and defensive to open and proactive, where people's involvement is essential, customer satisfaction is a priority and continuous improvement is a daily job. Building lean culture guides and changes the way people think and act. Lean culture means the changing of employees' behaviour, emotion and attitude towards work.

Lean culture, which is the ultimate goal of lean, is a culture in which everyone seeks improvement, understands value and strives to attain it, identifies waste and struggles to eliminate it. Cultural adaption is the key to successful lean implementation (Wong, 2007). The main condition for building and achieving an excellent lean enterprise is to create a suitable lean culture that is built on empowerment of people, partnership with stakeholders and continuous improvement manner where all employees participate in the day-to-day decision-making process. This helps an organisation to achieve customer satisfaction and reap the desired benefits from lean.

Given that the roots of lean culture are embedded in Toyota, it is worthwhile considering which lessons can be learned from Toyota in terms of lean implementation. In this regard, it is important to understand the Toyota way of organisational management, and identify the reasons behind its success in order to understand how to create a desirable lean culture in any organisation and to understand the requirements for lean.

Liker (2004) explains that the underlying assumptions of lean's culture are reliant upon two parts: the first part is external, which starts with customers, and the second part is internal, that starts with respecting people and striving for a continuous improvement. Also Takeuchi, Osono, and Shimiz (2008) state that Toyota culture include the mindset of continuous improvement (Kaizen); respect for people and their capabilities; teamwork; humility; putting the customer first; and the importance of seeing things first hand. Liker and Hoseus (2010) emphasize that Toyota relies on two main pillars to drive its business, and these should be embraced by every worker in Toyota, not only in Japan but also in all their branches around the globe. The first pillar is "respect for people" and the second is "continuous improvement".

Respect for People

A lean organisation does not keep its employees in the dark about vital decisions affecting them. It trusts them and involves them in decision making at all levels. A more open and collaborative framework will exploit the talents of all employees (Hewitt, 2002). Employees are the tools that can be used to implement any new business changes. They can either accelerate these changes or hinder them. Without the support and participation of employees all the lean efforts will be useless. For the best to be obtained from employees, they must be involved if they are to understand the need for creativity and if they are to be committed to

changing their behaviour at work, in new and improved ways (Singh, 2009; Kingir & Mesci, 2010).

Employee involvement in decision making serves to create a sense of belonging among workers and a congenial environment in which both the management and the workers voluntarily contribute to healthy industrial relations (Noah, 2008). Lean organisation trusts the employees and involves them in decision making at all levels.

Stubblefield (2005) states that focus on employees can lead to customer satisfaction because only happy and fulfilled employees can provide the highest level of service. Radnor and McGuire (2004) argue that employee involvement brings many benefits to the organisation, it increases employees' productivity at all levels (Jones & Kauhanen, 2010), it creates a positive work attitude (Yadav, & Dabhade, 2013) and it leads to employee empowerment, job satisfaction, creativity, commitment, and motivation, as well as intent to stay (Zhang & Bartol, 2010). Involving employees in strategic initiatives such as lean development and implementation improves the chances of their success (Sadikoglu & Zehir, 2010; Olson, David, & Desheng, 2008), and lack of employees' involvement is one of the reasons for lean failure. Indeed, without such involvement and input, employees may feel disengaged and frustrated, whereas participation provides employees with a sense of belonging and empowerment (Ongori, 2009)**.** Wallace (1992) concludes that organizations must focus on people empowerment, creating efficient workgroups, ensure employment security and compensation plans, and train and educate the workforce adequately for it to be committed to organisational goals.

Respect for people can be applied in manufacturing sector through human capital development. OECD (2001) defines human capital as the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being. Human capital is represented by health, education and other human capacities that can raise productivity (Todaro and Smith, 2003). Health and education are two closely related human (resource) capital components that work together to make the individual more productive. Education has widely been acclaimed as the greatest instrument of positive change. It forms the most effective challenge against ignorance, disease and poverty. Education empowers individuals and transforms societies and nations (Chukwu, 2009). Education provides people with the capacity and potential to develop themselves, thereby enhancing their individual and societal well being. Education can play a part in

developing a sense of responsibility and respect for hardwork which are essential qualities of a good employee for a successful lean implementation. Health connotes the ability to lead a socially and economically productive life. Dasgupta (2004) asserts that improved health status implies fewer working days lost due to ill health and fewer resources spent on health care. Yesufu (2000) concludes that human capital is the stock of human resources that a country has from which it can pool skills, knowledge, entrepreneurial and innovative capacities required to produce, distribute and utilize ideas, goods and services to generate growth and development.

Teamwork (Partnership with Stakeholders)

Teamwork means workers working as a group to achieve a common goal. Teamwork, if carried out effectively, results in motivated workers, improved job satisfaction, reduced overall work time, and improved quality of work process (Griffin, Patterson & West, 2001). Teamwork enables people to cooperate, increase cohesion among workers, enhance individual skills and provide constructive feedback without any conflict between individuals (Jones, Richard, Paul, Sloane & Peter, 2007). Other benefits of teamwork involve effective communication, effective problem solving, trust and supportive environment within the group, creativity enhancement, and mutual problem resolution (Chow, Then & Skitmore, 2005). Conti and Kleiner (2003) report that teams offer greater participation, challenges and feelings of accomplishment. Moreover, with globalization encouraging different people with different backgrounds and cultures coming together in the workforce, the proper management of such diversity through teamwork can lead to greater creativity and better organizational performance. Lean culture encourages teamwork that will unite and focus group members' feelings, beliefs and values towards achieve a common goal.

In the context of manufacturing sector, teamwork can be identified as collaboration between local firms and Multinational Companies (MNCs). Rosell, Lakemond, and Wasti (2014) assert that knowledge integration and joint learning between local firms and Multinational Companies provides a competitive advantage for the local firms and MNCs. While Teamwork between local firms and Multinational Companies in form of mergers and acquisitions, licensing, franchising or other cooperative agreements has been a major source of skills, equipments, productivity and technological transfers to local firms, it has also provided a type of knowledge that MNCs generally lack, thereby increasing their knowledge bank. The idea that activities of MNCs can result in backward and forward linkages was

introduced by Hirschman (1958) to explain the interdependency between local and foreign firms can lead to industrialization. Through FDI, foreign investors benefit from utilizing their assets and resources efficiently, while FDI recipients benefit from acquiring technologies and from getting involved in international production and trade networks. However, FDI provides much needed resources to developing countries such as capital, technology, managerial skills, entrepreneurial ability, brands, and access to markets. Mugabe (2005) opines that Foreign Direct Investment (FDI) plays an important role in economic development because it helps to make possible superior technology, huge capital outlays, superior production techniques, management, marketing, distribution skills, and technical know-how available to local firms.

Continuous Improvement

Continuous improvement (CI) shows an organisation's ability to endlessly analyse processes in order to search for new wastes. Since there is no ideal process due to continuous changes in people, organisations, technology, world and so on, one can find wastes again and again. In Japanese, it is called kaizen. It means incremental improvement of products, processes, or services over time, with the goal of reducing waste to improve workplace functionality, customer service, or product performance (Suzaki, 1987). Continuous improvement (CI) has been defined as a philosophy focused on problem solving to achieve gradual, orderly and continuous improvement throughout all the elements of the production process (Aherne, & Whelton, 2019). Lean cannot be sustained unless continuous improvement becomes an integral part of an organisation's cultural norm (Radnor, Walley, Stephens, & Bucci, 2006). Continuous improvement is carried out one project at a time. The projects may be concerned with any of the following problem areas: cost reduction, quality improvement, productivity improvement, setup time reduction, cycle time Reduction, manufacturing lead time and work-in-process inventory reduction, and improvement of product design to increase performance and customer appeal. CI can occur through evolutionary improvement, in which case improvements are incremental, or through radical changes that take place because of an innovative idea or new technology. Often, major improvements take place over time through numerous incremental improvements.

Developments in technology and innovations are the primary forces propelling industrialisation today. New ideas and innovations are becoming increasingly the drivers of manufacturing firms' growth. New processes and procedures of doing old things and automation have radically transformed manufacturing activities. Thus, technology, enabled

by Research and Development (R&D) is the major means of maintaining CI in manufacturing sector. A strong R&D is important for Nigeria manufacturing sector to absorb and modify technologies more quickly and efficiently, and adapt them to the local conditions and needs. Technology refers to the sum total of knowledge or ways of doing things. Technology includes inventions, techniques and the vast store of organized knowledge about manufacturing processes. Kamzi (2003) sees technology as consisting of factors that are related to knowledge applied and machine used in the production of goods and services which have an impact on the business of the organization. The state of technology in any organization has a significant influence on the quality and quantity of production of its goods or services. A firm that does not follow up with the changing in production methods and techniques may be forced out of the market. Due to strategic nature of technology, Nigerian manufacturing sector need to constantly scan the environment to keep track of the advancement and invention in technology, nature of changes in technological environment as well as the diversity in technology that may significantly affect the sector's operations, performance and survival. Technological changes in this sense will include changes in raw materials, processes, techniques and the equipment used for production.

Customer Focus

Another key aspect of lean culture is customer focus. In order to stay competitive, the organization must be able to respond and adapt to changing customer preferences and needs (Saravanan & Rao, 2006). It is important that every employee in the organization to be involve and committed towards establishing and sustaining a high level of customer satisfaction. Rahman and Bullock (2005) opine that, it is a necessity that both current as well as future needs of the customers are understood and met, when creating and sustaining lean organization. This implies that the organization must actively establish a variety of mechanisms, and efficient ways of letting customers contact the organization with product inquiries and related questions, as well as establishing channels from which the organization can obtain knowledge about customer preferences. The emphases on the customer in Lean means providing the best quality, in the shortest time, at the lowest cost that met customers' expectation. Therefore, organisations must be aware and responsible about listening to the voice of the customers (Habidin & Yusof, 2013), fulfil customers' need and expectations, and predict customer demand (Shah et al., 2007).

Customer focus can take place through trade liberalization policy resulting to creativity and innovation in manufacturing sector. Trade liberalization leads to increase in importation of intermediate inputs, which in turn enables domestic firm to improve their product quality and the scope of product offering. Trade liberalization increases customer focus because not only that the consumers benefit from lower products prices and availability of varieties of goods, but the increase competition introduce in the domestic market as a result of trade liberalization stimulates efficiency in domestic production (Akinmulegun, 2011). In particular, exposure to foreign competition forces local firms to become more efficient and effective in their operations by increasing their product quality at reduce price to remain competitive in the global market.

2.1.3 Lean Tools and Techniques (Lean Building Blocks)

The application of lean culture supports organization's transformation towards a Lean enterprise. Hence, lean culture provides enabling environment for lean tools and techniques to thrive. If these tools and techniques are used appropriately, they can help in eliminating waste, better inventory control, better product quality, and better overall operational procedures (Womack et al., 1990). The choice of tools is highly dependent on the manufacturing process. Organisations need to understand what they must achieve from lean, and assess their processes before using the tools, in order to avoid failure (Karim, & Arif-Uz-Zaman, 2013). Lean tools and techniques are not discrete; some tools overlap and support each other. There are many tools and techniques that can be applied within an organisation. They include Total Quality Management (TQM), Single Minute Exchange of Die (SMED), Total Productive Maintenance (TPM), Production Smoothing, Just-In-Time (JIT), 5S, Kanban, Kaizen, Standard Work, Visual Control, Cellular Manufacturing, Safety Improvement Program, Information Management System, and Value Stream Mapping. The aim of these tools are to simplify work and the workplace, improve quality, reduce lead-time, and focus people on performing only those activities that create value (Emiliani & Stec, 2005). Importantly, they also help people realize their full potential and actualize innate desires to make positive contributions to the workplace. Below are summary of some of the most essential Lean techniques and tools as applicable to manufacturing sector.

5s

5s is a concept which originated from 5 Japanese words that starts with 'S' Seiri, Seiton, Seiso, Seiketsu and Shitsuke. These words were translated into English as: Sort, Set, Shine, Standardise and Sustain (Chapman, 2005). The 5S pillars provide a methodology for organizing, cleaning, developing, and sustaining a productive work environment (Bicheno & Holweg, 2009). 5S encourages workers to improve the physical setting of their work and teaches them to maintain an organised, clean, safe, and high performance work place. The 5s are described as:

Sorting – This is the first step, which involves sorting out what is needed at the workplace in order to carry out work. Sort is clearly distinguishing what is needed or not needed among the tools, supplies and other materials. Useful practice for sorting is the red tagging. The redundant items are tagged with a red paper note, and then taken out to a central holding area where they are further evaluated. The items which are considered useful are kept in an organized storage, while the rest of the items are discarded.

Set – The second step is setting everything in order. "A place for everything and everything is in its place" (Chapman, 2005). Set is arranging needed items so that they are readily accessible, and labelled so that anyone can find them.

Shine – This step focuses on neatness. Shine means keeping work area cleaned and in an orderly condition during working hours. All staffs are encouraged to routinely clean their work space. Bicheno (2000) asserts that the simple fact is that the cleaner or tidier a location is, the easier it is to see if something is out of place.

Standardise – Standardise means defining the normal condition of the work area. The method of how to carry out the work, the equipment and anything related to the organisation must be standard and made assessable and recognisable throughout the organisation.

Sustain – It is always difficult to change the established process, so sustaining the changes is considered the most difficult "S" to implement and maintain. Resistance typically accompanies the changes, and the personnel easily turn back to the status quo, therefore understanding and promoting the changing processes is essential. Therefore, this final step is to ensure that the four earlier steps become the norm of working in the organisation.

Investment climate is an important mechanism through which manufacturing sector can apply the concept of 5s because healthy Investment climate sustains a productive work environment. Investment climate is defined as location-specific factor that shapes the investment opportunities and incentives for firms to invest productively and expand (World Bank, 2005). It covers aspects of regulation and corruption linked to the cost of doing business, as well as broad issues like the quality of infrastructure, skill base, health system, rule of law, political stability, and security. Investment Climate Surveys argue that creating a level playing field through deregulation and guaranteed property rights is the most important condition for boosting economic growth and making it more equitable. Extensive government regulations and weak property rights create opportunities for rent-seeking bureaucrats to extract bribes, thereby discouraging the growth of private enterprises. Hence, low levels of bureaucracy, an independent judiciary, good roads and a functioning education system are parts of a good business-enabling environment.

Just-in-time (JIT)

JIT refers to the production of goods and services to meet customer demand exactly in time, and in the right quality and quantity (Hutchins, 1999). The main objective of JIT is to deliver just what is necessary, build just what is needed, use just the required amount of effort, and have just the right amount of stock in the system (Wickens, 1995). The process holds the smallest amount of stock needed to meet the delivery lead times, thereby minimising the waste associated with inventory, reducing the risk of obsolescence, and providing more responsive system. This concept promotes the rapid production of smaller quantities tailored to demand variety. Before JIT implementation, it is important to first have an agreement and support with those involved, because it will be impossible for a company to implement JIT without the support of its suppliers, since JIT affects replenishment lead times and order cycle times which involve the suppliers (Lai, 2009).

For JIT to be functional (delivering raw materials just when needed) in manufacturing sector, the ease of securing raw materials and distributing finished products must be established. Strategic transportation decisions are closely related to inventory decisions as well as meeting customer demands. Good transportation infrastructure is essential in manufacturing sector. Transport infrastructure improvements provide incentives for firms to reorganize and reduce their inventories to just-in-time levels. It promotes factor mobility and reduces trade costs. As transport improvement lowers costs and increases market integration and accessibility among

various market actors (input suppliers, labour, and customers) opportunities increase for exporting and importing goods, and new channels open for firms' products.

Total Productive Maintenance (TPM)

Maintenance involves planned and unplanned actions carried out to keep physical assets at acceptable operating conditions (Faccio, Persona, Sgarbossa, & Zanin, 2014). Maintenance aims at increasing the value of the reliability, safety, availability, and quality of an asset with acceptable economical costs (Márquez, 2007).TPM is a management approach that requires participation from all employees to maintain and ensure the productivity of the equipment. Total Productive Maintenance is a holistic approach to maintenance that focuses on proactive and preventive maintenance to maximise the operational time of equipment. Total productive maintenance is defined as a practice that ensures uninterrupted and efficient use of equipments through maintenance on a regular basis to avoid any malfunction or machine breakdown (Dennis & Shook, 2007). The idea behind TPM is that of having zero tolerance for breakdowns, and defects. TPM is a method used to improve overall efficiency and effectiveness of equipment through a complete productive maintenance system for the entire life of the equipment, with participation of all employees from higher management to daily employees. Therefore, TPM is a major departure from the "you operate, I maintain" philosophy where implementation of productive maintenance is carried out by all associated personnel. By adopting TPM, the focus of the organisation will be changed from "fixing" to "preventing" equipment faults, The goal of TPM is to reduce equipment breakdowns because they can adversely affect output, safety, environmental health, quality of end product, customer service, competitiveness and unit costs (Ahuja, 2011).

Through successful implementation of TPM, organisations will not only enjoy benefit of consistence and reliability of machines but also end-product quality, process control, achieved comfort and protection of the employed personnel, compliance with environmental protection regulations, structural integrity and even the physical appearance of the productive system (Bhasin et al., 2006).

Maintenance performance is a critical component of strategic thinking for manufacturing sector. The performance of the maintenance process is important for the long term value creation and economic feasibility of manufacturing firms. However, the major issue in measuring maintenance performance is the formulation and selections of maintenance

performance indicators that can give maintenance management quantitative information that reflect an organisation's maintenance strategy (Swanson, 2001).

Value Stream Map (VSM)

Value stream is a significant lean tool which helps organizations to analyze the process flow of materials from the beginning of the process to final delivery. Value stream mapping (VSM) is a process mapping method that involves the creation of maps to show the "Current State, Future State, Ideal State, and Action Plan" of a firm (Rother & Shook, 2003). The process of mapping must lead to action otherwise it will be regarded as waste. The maps are typically created for a specific area in a firm. The aim of value stream mapping is to identify the processes within a company that add or do not add value to an end product. The information and material flow of a product are defined and the linkages (or conversion processes) between them are documented. The individual tasks within these linkages are further documented and separated into value-adding and non-value-adding tasks. The future state map is then created using only the value-adding tasks. The non-value-adding tasks are then assessed for possible elimination. (Bicheno et al., 2009). Therefore, VSM exposes waste in the current processes and provides a roadmap for improvement through the future state. It is often used to identify which tools to use and where to reduce waste (Radnor et al., 2006).

With respect to manufacturing sector, VSM corresponds to electricity supply which is the key value adding factor that needs to be exploited to improve the future state of the sector. Subair and Oke (2008) admitted that electricity supply which is mainly utilized for driving machines for the production of various items is a strong factor that will catalyze the productivity of manufacturing sector. Also Iwayemi (1998) confirms that for any meaningful improvement in the productivity of manufacturing sector to take place in any economy, electricity supply and demand must remain uncompromising elements of the process. This argument is also in line with the survey of the Manufacturers Association of Nigeria (MAN) in 2005, where it was indicated that the cost of generating power constitute about 36 percent of the total production cost. Nevertheless, poor electricity supply has proved to be the major constraint to the manufacturing sector in Nigeria and Africa in general, and has contributed to the low productivity and poor competitiveness of the manufacturing sector in the continent. The competitiveness of manufacturing firms depends on product quality and the ability to meet orders on time, as well as unit costs. These factors can also be affected by electricity insecurity. Quality can be reduced by spoilage of materials from poorly functioning

equipment due to frequent interruptions on power supplies. Reliance on generators for electricity during outages is expected to increase the overall cost of production, thereby affecting cost-competitiveness. Interruptions due to outages affect manufacturing firms' production schedules and the delivery of goods to deadlines (Cissokho and Seck, 2013). In this regards, the generation, transmission and distribution of steady electricity constitute a central issue in manufacturing sector development.

Kaizen

Kaizen is a Japanese word that stands for "Kai" (means "change") and "Zen" (means "for the good") (Womack and Jones, 1996). Kaizen means continuous improvement. Kaizen is a systematic approach where employees work together proactively to achieve regular, incremental improvements in the manufacturing process (Furterer, 2009). It is a method for accelerating the pace of process improvements. It focuses on the fact that no process can ever be perfect and there is therefore always room for improvement by constantly searching for and implementing ways to reduce cost, improve quality, and increase productivity. There must be continuous improvement, in small increments, at all levels of the firms, forever. It is both a philosophy and a set of tools used for improving a process by a series of small continuous steps. Often times these improvements are small and hard to measure, however the accumulated effect is significant (Wilson, 2009). Thus, it helps to continue working to remove all kinds of wastes, which will eventually help the firm to achieve flow, pull and perfection. The benefits of Kaizen are associated with both individual workers and the company as a whole. In term of a company's benefits, Kaizen reduces overhead cost due to production waste, it improves the quality of the product by reducing non value added activities, and it reduces the total cycle time for the production process (PDTP, 2002). From the workers' perspective, Kaizen benefits them in terms of working culture or environment, freedom and ease in work, and initiatives and innovation for work (PDTP, 2002).

Standardised work

Womack et al. (2003) define standardised work as the best way to get job done in the amount of time available and how to get the job done right the first time and every time. Standardised work ensures that each job is organised and is carried out in the most effective manner (Bicheno, 2008). Standardised work attempts to eliminate waste by consistently applying best practices, and form a baseline for future improvement activities. Experts decide in advance how a job should be done, how long it should take, and how problems are to be handled

(Furterer, 2009). Standardisation ensures that task is performed each time exactly the same way, independent of who is performing it. And if process is performed every time the same way, we can easily predict how much time it will take and what the result will be. Work standards need to be continuously updated to capture the changing conditions (Drew et al. 2004). As the standard is improved, the new standard becomes the baseline for further improvements, and so on. Operating standards benefit customers by providing better and more consistent quality; to the shareholders, gains from higher productivity; and to employees, clear and safe procedures to follow.

This study conceives information system to entail standardised work practices that enable a manufacturing firm to integrate all its primary business processes in order to enhance efficiency and maintain a competitive position. Essential attribute of the information system and applications is its ability to integrate business processes across organizational functions and locations, business best practices already built on system, having a central database and real-time transaction. These systems provide an enticing solution to management to remove incompatible systems and inconsistent policies. Using this system can bring enormous benefits such as easier information access, reduction in inventory levels and cycle times, shortening business process lengths and time, improvement in quality, supply chain management, high efficiency and low costs leading ultimately to competitiveness of the organisation (Al-Fawaz, Eldabi, & Naseer, 2010; Haddara, & Zach, 2011)

Visual Management (VM) or Visual Control (VC)

Visual Management (VM) consists of a system that enables anyone to immediately assess the current status of an operation or process at a glance, regardless of the person's knowledge of that operation or process (Aherne, & Whelton, 2010). It can involve production work planned for the day or week, work centre status, departmental goals, or other information (Parry and Turner, 2006). The aim of VM is to create a work environment that is self-explaining, self-ordering and self-improving. Visual management makes the state and the condition of the manufacturing processes easily accessible and very clear to all workers so that they can understand the process at a glance. Therefore, visual management helps people understand complex information at a glance, reduces waste by communicating effectively, and encourages collaborating among team member because everyone can see what everyone else is working on (Koning, Verver, Heuvel, Bisgaard, & Does, 2006).

Manufacturing sector environment can be assess at a glance through the functioning of a country's formal institutions. Institutions are defined as the rules of the game in a society that provide stability, reduce uncertainty and lessen information complexity in economic exchanges (North, 1990). Formal institutions are explicitly created structures, comprising constitutions, laws, regulations, property rights and contracts that support the effective functioning of market mechanisms. Formal institutions are significant to investment as they can produce incentives for or barriers to invest (Edquist, 2006). Weak institutions reduce firms' incentives to invest due to information asymmetries that increase risk, and inefficient execution of laws and regulations that undermine the functioning of the market mechanism. Conversely, well-established and efficient institutions make it easy to access information and provide adequate and high-quality resources and services for investment, which in turn reduce transaction costs of business operations. In strong institutions, firms, R&D institutions, financial institutions, governments and other types of economic and social agents interact with each other for the purpose of facilitating learning, acquiring information and promoting innovations (Gachino, 2006).

Cellular design

Cellular manufacturing is a lean tool and technique that concerns with proper arrangement of machines and equipment in order to enhance the steady and uninterrupted movement of materials, tools, and information through the process of production without stoppages and time wastage. Families of parts are produced in one cell (Abdulmalek et al., 2006). This means organising the entire process for a particular product or similar products into a group or cell, including all the necessary machines, equipment and operators needed for the production. The main benefit of Cellular Manufacturing is that it assists organizations to reduce the overhead cost, since an individual worker can monitor and manage series of machines and equipment in a production channel. It also encourages flexible manufacturing as well as reduces the wastage of shop floor space. Its proper application enhances flow, and helps in no small measure in tackling the wastes of transportation, movement, and waiting.

Since the essence of cellular design is to remove transportation waste, manufacturing sector practices cellular design technique through Agglomeration economies. Agglomeration economies are the benefits that come when firms and people are located near one another in cities and industrial clusters. These benefits ultimately come from transport costs savings. Of course, transportation costs must be interpreted broadly, and they include the difficulties in

exchanging goods, people, and ideas as a result of location. The importance of agglomeration has been emphasized because firms and workers in the agglomerated area benefit from agglomeration externalities through more efficient sharing of scarce resource, local suppliers, better matching between employers and workers, and knowledge spillovers among firms and workers (Duranton and Puga, 2004)

2.1.4 Lean Critical Success Factors

Womack *et al.* (1990) assert that Lean is the Japanese secret weapon that led Toyota to success and prosperity, and consequently has stimulated many organisations around the world to try to apply lean within their organisation. Liker et al. (2010) explained that many firms around the world see Toyota as a role model in this regard, while Bicheno, Millman, and Ostrowski (1997) suggested that Toyota has been regarded as a benchmark and an example of best practices for firms who want to adopt lean. However, researchers and practitioners have shown that, despite the benefits that lean can offer to organisations, most firms have failed to successfully implement lean (Papadopoulou et al., 2005; Emilliani, 2008). Hence, it is of interest that we understand the important factors affecting the success of lean implementation for improving the operational performance. This leads to important questions of which factors are imperative ingredients in implementing lean successfully? Organisations fail to successfully implement lean because of lack of broad-based acceptance of the critical success factors (CSFs) to the implementation of lean. Bruno and Leidecker (1984) define CSFs as those characteristics, conditions or variables that, when properly sustained, maintained, or managed, can have a significant impact on the success of a firm competing in particular industry. Also, Boynton and Zmud (1984) defined CSFs as those things that must go well to ensure success. Activities associated with CSFs must be performed at the highest possible level of excellence to achieve the intended overall objectives. Study of CSFs will help firms to focus their efforts on some areas to meet their goals, or even allow firms to decide if they have the capability necessary to meet the basic requirements.

Various studies have been conducted to identify the significant factors that are necessary for the successful implementation of lean. Achanga, Shehab, Roy, and Nelder (2006) identified four factors that are critical for the implementation of Lean Manufacturing within SMEs. The factors are: Leadership and Management, Financial Capability, Skills and Expertise and Organizational Culture. To Scherrer-Rathje, Boyle, & Deflorin (2009), lean implementation success depends on: management commitment; employee autonomy; information

transparency of lean goals; and evidence of initial performance improvements and long-term sustainability of lean efforts. Kumar, Antony, and Douglas (2009) identify the importance of the following critical success factors within SMEs implementing lean: Management involvement and commitment; Communication; Link quality improvement to employee; Culture change; Education and training; Link quality improvement to customer; Project selection; Link quality improvement to business; Link quality improvement to supplier; Project management skill; Organization infrastructure; Vision and plan; IT and innovation. Crute, Ward, Brown, & Graves (2003) consider five factors significant for lean implementation: Change strategy targeted and holistic; Effects of company culture; Product focus; Senior management commitment; Timing for performance improvements.

Although there is no consensus on what the main lean critical success factors are in the literature reviewed, but it is crucial for Nigerian Manufacturing sector to have a better understanding of these lean critical success factors, as this will enable them to optimise their resources and efforts appropriately. The most common ones are discussed below.

Management Commitment and Support

Commitment and support from top management is essential to influence employees not only to be comfortable with lean implementation, but also to embrace it and become change agents themselves. The overall presence, involvement, and support of management throughout the process are essential to demonstrate to the workforce that their efforts and concerns are recognized and important. By being present, managers can also understand better the dynamics and challenges of the lean process within their operations and tackle them early in the process. Management commitment and support is needed for successful lean implementation as they need to assign people to the right tasks, empower people, invest in training, and create strategies and vision to promote lean culture (Näslund, 2013). Management tasks will be those of consultants, mentors and coaches to help the employees avoid unnecessary waste of effort so that they can (i) increase their task-relevant knowledge and skills, and (ii) formulate creative, unique and appropriate performance strategies that generate synergistic process gains. They should also be responsible for answering requests from employees to ensure that the resources required for increasing performance are available when needed.

This study conceives Management commitment and support in manufacturing sector to entails government commitment on the provision of infrastructural facilities that raises

productivity and lowers production costs in manufacturing sector. Infrastructure includes broad categories such as telecommunication, transportation, utilities, waste removal, education, health care, research and development, and training facilities. The provision of infrastructure in most countries is the responsibility of the government. This is because of the nature of infrastructure investment. Infrastructure supply is characterized by high set-up cost which prevents the private sector from investing on. Also its long development period and indirect way of pay-off, makes it generally unattractive to private investors. Moreover, provision also generates externalities that the producer may not be fully able to internalize in the pricing structure. Thus, in the face of other investment alternatives, that promise higher and quicker return, few private investors will be willing to embark on infrastructure investment (Ajayi, 1995). Sufficient infrastructural services are indispensable for economic development. For instance, Abdullah (2000) asserts that government expenditure on health and education raises the productivity of labour and increase the growth of national output. The provision of adequate and reliable physical infrastructure plays an important role in supporting the growth of industry, delivery of social services, enabling the movement of people and goods, amongst others (Akampurira, Root, & Shakantu, 2008). Similarly, expenditure on infrastructure such as roads, communications, power, etc, reduces production costs, increases private sector investment and profitability of firms, thus fostering manufacturing sector performance.

Employee training

Successful lean implementation requires a deep understanding of its principles and practices and the implementation process will be facilitated with extensive training at all levels. Based on Hashim (2001), training refers to a planned and systematic effort to modify or develop knowledge and skill to achieve effective performance in an activity or range of activities. In addition, training can provide employees with specific, identifiable knowledge and skills to perform their jobs. Training is one of the most important factors that contribute to the success of lean implementation. Training should focus on changing employees' beliefs and attitude (Bozdogan, Milauskas, Mize, Nightingale, Taneja, & Tonaszuck, 2000). Training will help all the members of the organisation to fully understand the concept of lean and more importantly matching the skills acquired to firms needs. Lean training includes educating and training all employees, help employees to increase knowledge, provide information about the mission, vision, direction and organization structure to enable them to gain skills in an effort to improve the quality and thus solve the problem. Training will result in increase

productivity, quality improvement, profitability, and team spirit, as well as, improve organisational culture. Lean training may include: lean skills for leaders, and other training on lean tools and techniques such as: process mapping, value stream mapping, and project management. Thus it is important to train this key resource and change their attitude in other to inculcate the right skills to be able to implement the new way of doing their work.

Because of the importance of labour efficiency in enhancing the productivity of the manufacturing sector, skills development process and skills formation systems are important factor for successful lean implementation (Akingbade, 2008). Employees training is generally reckoned as the outcome of learning mechanisms that enable firms improve their capability endowment. Skills need to be constantly attuned to the structure of the industry and changes over time as industrialization proceeds. Employees training can affect growth through different mechanisms (Emadzadeh and et al., 2009); first, training increases human capital in the labour, which leads to increase in productivity and economic growth (neoclassical theory). Second, training increases the power of innovation in the economy and contribute to the creation of new knowledge and technologies that improve the manufacturing process (endogenous growth theory).Third, training helps in dissemination and transfer of knowledge needed for new process adaptation and successfully applying the new process. Therefore, for high efficiency and product quality which are imperatives for competitiveness, better performance and survival, there is need for substantial investment in labour force

Effective Communication

A successful lean implementation is influenced by how the company will effectively communicate with those affected by the new way of doing the business (Worley & Doolen, 2005). For companies to succeed in their lean implementation process, managers need to convey the benefits of lean, as well as, how the implementation will take place to all the members of the organisation (Mathaisel, 2005). Good communication plan is vital to involve everyone in the implementation process to get them committed and to identify how the implementation of lean will affect their work. Workers communication needs to be effective to coordinate efforts, leading to improvement in quality of the work. Communication quality which has the characteristics of being timely, accurate, useful, and complete enhances productivity and the quality of work (Byrne, & Lemay, 2006).

Efficient and effective communication processes enable collaboration and consensus along with shared vision and engagement. A desired outcome of lean implementation is for the

workers to take ownership of the lean project, make it their mission and genuinely care about its success. Such commitment is only possible with open communication. Effective communication can be use to recognize, motivate, maintain the momentum, exchange knowledge, reinforce the mission, and engage all personnel in lean implementation (Radnor et al., 2006). Rather than working individually, successful lean implementation required cross-functional teamwork of all employees in the organization. Brainstorming and frequent communication are typically considered important ingredients of successful implementation of various improvement initiatives (Upton, 2011). Also, effective communication ensures better awareness and understanding, which reduces resistance to change and fear of a new system, creating a strong culture favourable to lean implementation and building a positive momentum for it (Malina & Selto, 2001).

Furthermore, the migration of businesses towards online or e-business services has intensified interest in ICT, as the ICT functions become intrinsic to business primary activities of delivering value to customers. Developments in ICT are making it increasingly possible for organisations to learn, communicate, and coordinate their activities, thereby enhancing their success in the competitive environment. Deployment of ICT provides the means to produce; store, use, and reuse information that an organisation needs to transform its routines and achieve its desired state. The role of ICT in this process includes knowledge acquisition, information distribution, and information interpretation.

Supplier's Management

Manufacturing firms are inclined to work with different suppliers in different ways. It is important that the relationship with suppliers satisfies the firm's needs. An effective supplier's management involves regulating the delivery of raw materials, JIT, establishing a stable partnership with the suppliers information sharing and acquisition among the suppliers and manufacturers, and suppliers' involvements in product design and quality programme. The main benefits of this system are huge decrease in inventories, building long-term relationship of loyalty and trust suppliers which will improve product quality, and reduce process and/or product variability. In general, a reduction in the cost of production is achieved.

Because of the peculiar nature of Nigerian manufacturing sector, availability of raw materials can only be made possible through agricultural sector and importation of raw materials. Agriculture is important in feeding domestic firms with raw materials such as animal skins

for leather processing, cotton for textiles, cocoa for beverages and confectionary, maize and wheat for brewing; and so on. But the near total neglect of agricultural sector in Nigeria has denied many manufacturers and industries their primary source of raw materials. Most of Nigerian Manufacturing firms now import virtually all their raw materials for production. Consequent upon this, delivery of raw materials depends largely on the cost and availability of foreign exchange needed for the importation of raw materials, spare parts and machinery. While the depreciation of the naira affected the cost of imported raw materials directly, it has a similar effect on local raw materials although indirectly. This is because producers of local raw materials also depend on imported machinery and spare parts for their production. Moreover they depend on products from imported raw materials for their existence. Any decrease in the value of the Naira against dollar will result to a corresponding rise in the cost of production of the manufacturers and hence decrease in its output and profitability. Devaluation of Nigerian currency also reduces the competitiveness of the manufacturing sector, as the output of the domestic firms cannot compete in the global market with foreign products in terms of price due to high cost of production. Apart from the cost implications, this dependence on importation has the potential of continuously disrupting manufacturing activities as several production outfits may be put out of operation because of the delay or shortage of raw materials, spare parts and components.

2.2 Nigerian Manufacturing Sector

The manufacturing sector of any economy is critical in the development process. Adebayo (2011) defines manufacturing sector as those industries which are involved in the manufacturing and processing of items and indulge in either the creation of new commodities or in value addition. Loto, (2012) refers to manufacturing sector as an avenue for increasing productivity in relation to import replacement and export expansion, creating foreign exchange earning capacity, raising employment and per capita income which causes unrepeatable consumption pattern. Charles (2012) asserts that manufacturing industries creates employment which helps to boost agriculture and diversify the economy on the process of helping the nation to increase its foreign exchange earnings. Dickson (2010) opines that manufacturing sector accounts for a significant share of the industrial sector in developing countries. The final product can either serve as finished goods for sale to customers or as intermediate goods used in the production process.

The performance of Nigerian manufacturing sector since independence has been a mixture of initial mild growth and subsequent decline. Nigeria's early independence years were dominated by the oil boom which enabled expansion of infrastructure and public sector investment in large scale manufacturing concerns. This expansion was aimed at achieving import substitution of foreign consumer goods and consumer durables. Import substitution policies were introduced which made the sector heavily dependent on import of raw material and capital goods, protection from foreign competition and preferential treatment in foreign exchange allocation (Adewuyi, 2006). This resulted in lack of competitiveness and the creation of a manufacturing base that has insignificant backward and forward linkages effects with the rest of the economy.

With the slump in oil price in the early 1980s, the manufacturing sector performance began to decline. The sharp decline in oil revenue resulted to austerity policy measures such as increase in import duties, review of import licenses, 40 percent across the board cut in public expenditures without priority and upward review of excise duties, interest rates and prices of petroleum products. These policy measures brought a lot of stress on the productive sector of the economy and there was a decline in performance of the manufacturing sector with dramatic loss of production capacity resulting in gross losses in output and employment. It was reported that the manufacturing sector contribution to GDP fell from 11.2% in 1982 to 7.98% in 1986, capacity utilisation rate fell from 70.1 to 38.8 between 1980 to 1986 (CBN, 2012).

With the intention of revamping the economy and setting it on the path of sustainable growth, Structural Adjustment Program (SAP) was introduced in 1986, as a medium-term strategic policy aimed at addressing the inherent weaknesses of the economy, and enhancement of manufacturing performance through restructuring process geared at reducing import dependence and promoting manufacturing activities. Loto (2012) reveals that SAP was partly designed to revitalize the manufacturing sector by shifting emphasis to increased domestic sourcing of inputs through monetary and fiscal incentives. The deregulation of the foreign exchange market was also effected to make non-oil exports especially manufacturing sector more competitive, even though this also resulted in massive escalation in input costs. This was done through high tariffs or bans on imported inputs, and the correction of the Naira's over-valuation that leads to shortage of foreign exchange. The increase in the cost of imports and pressure by government resulted in the rise of local raw material sourcing by industry. The introduction of the SAP improved the sector with capacity utilisation rate rising to 42.4%

in 1988, and manufacturing contribution to GDP rose to 8.65% in 1988 with an increased growth rate put at 11.7% (CBN 2012).

Nonetheless, in recent years manufacturing sector has emerged as the single largest contributor to economic growth in 2013, contributing 22 percent to 2013 GDP growth. The majority of manufacturing growth has been in the Food & Beverages subsector, although other subsectors have also been growing. It is yet to be seen whether the recent growth in Manufacturing can be sustained.

2.2.1 Lean Sustainability in Nigerian Manufacturing Sector

Oluremi and Gbenga (2011) assert that business organisation that wants to succeed must develop a clear understanding of the trends of business environment and forces that shape competition. Knowledge of this will enable the organization to choose the appropriate strategy or strategies that fit the trends in the business environment. Likewise, Adeoye (2012) state that in the manufacturing sector, environmental changes are continuously exerting new pressures on manufacturing firms; to respond to these changes, some firms have formulated and implemented strategies to reorganize and reform the way products are manufactured and distributed to final consumers. Thus, manufacturing firms need to direct their attention to the environment when formulating lean business strategy in order to ensure successful implementation.

It is against the backdrop that environmental conditions and factors have the potentials to have significant impact on organizations survival and performance that Nigerian government since independence has been formulating and implementing different industrial policies, strategies, and plans to improve manufacturing sector. Some of these strategies include Import Substitution Strategy, Export Promotion Strategy and Local resource-based Strategy, indigenization policy, structural adjustment programme, and Nigeria Vision 20:2020. In pursuance of these objectives, the government has initiated a number of incentives aimed at positively influencing the performance and productivity of the manufacturing sector. Some of these incentives include tax holidays, tariff protection, import duty relief, total ban on certain foreign goods, direct government participation, export incentives, establishment of special industrial development financial institutions, and Industrial Raw Material Research and Development Council (IRMRDC). Furthermore, Nigerian government has embarked on the establishment of industrial core projects (ICPS) like iron and steel plant, aluminium smelter plant, petrochemical and fertilizer factories, cement industries, sugar plants, marble industries

amongst others. All these targeted areas of public sector industrial projects are meant to provide the necessary foundation for the growth of the manufacturing sector by providing the basic infrastructure for the production of raw materials, spare parts, equipment components and machinery needed in the various manufacturing establishments in Nigeria.

Rather than achieving a globally competitive manufacturing sector, with a high level of local content resulting from these investments, the reverse is the case, with rising general price level, primary industrial base, and heavily import dependent economy. Some of the reasons as pointed out by MAN that resulted to the above phenomenon are high production costs, high interest and exchange rates, influx of foreign imported commodities, numerous types of taxes, and insufficient effective demand as a result of low disposable income (MAN, 2008). The World Bank (2006) in the report of survey of investment climate in Nigeria, ranked constraints in the manufacturing sector as Electricity, Access to finance, Transportation, Multiple Taxes, Crime, and Corruption. Aremu (2005) believes that lack of sufficient Government protection, unfriendly fiscal policies, and adverse macroeconomic indices like high inflation, high exchange rate, and high interest rates are responsible for the poor performance of Nigeria's manufacturing sector. In this context, industrial policies, strategies, and plans are necessary but not sufficient for attaining a globally competitive manufacturing sector, hence the need for macroeconomic framework playing complementary roles as a sufficient condition. Some of these macroeconomic frameworks are discussed below.

Exchange Rate

Exchange rate is the price of one country's currency expressed in terms of some other currencies. It is the price for exchanging one currency for another. It determines the relative prices of domestic and foreign goods, as well as the strength of external sector participation in the international trade. Osiegbu (2011) posits that exchange rate plays a key role in an open economy. Exchange fluctuation is a risk associated with unexpected changes in exchange rate, this is caused by some economic factors such as inflation rate, interest rate and balance of payments (Ozturk 2006). Therefore, movements in the exchange rate have significant effect on other economic variables such as interest rate, inflation rate, import, export, output, general price level, and investment. These facts underscore the importance of exchange rate to the economic well-being of every country that opens its doors to international trade.

The relationship between exchange rate fluctuation and the manufacturing sector performance has been the subject of much debate (Carranza, Cayo & Galden-Sanchez, 2007; David, Umeh & Abu, 2010). For instance, exchange rate devaluation leads to an increase in aggregate demand. In this approach, devaluation will increase the domestic price of foreign imports and reduce the foreign price of domestic exports. This will result to a decrease in imports and an increase in exports, thereby increasing the country's exports, and switches local demand towards domestically produced goods as a result of increased price of foreign goods. At the same time, devaluation increases the domestic currency cost of imported inputs and reduces the volume of imported inputs. Reduction in imports implies insufficient inputs necessary for production. Thus, because of the lack of enough inputs and higher cost relative to the prices of their domestic final products, firms tend to produce less, which leads to a reduction in aggregate supply.

Given the import dependent nature of Nigerian manufacturing sector, the continued devaluation of naira exchange rate means that more resource would be needed to increase domestic output. A depreciating exchange rate in the absence of domestic sources for input and inadequate infrastructure will raise the cost of production, which will in turn make locally produced goods less competitive compared to the imported counterparts, thus, reversing the benefit of cheaper exports expected from depreciation of any currency. Similarly, the over-dependence of the economy on imported capital goods implies that a depreciating exchange rate would crowd out marginal investment because of high investment cost. Therefore, the choice and management of an exchange rate regime is a critical aspect of economic management to safeguard competitiveness, macroeconomic stability, and growth in manufacturing sector.

Interest rate.

Interest rate is the price paid for the use of money. It is the opportunity cost of borrowing money from a lender. It is the cost of capital which influences the demand for loanable funds by different types of borrowers (Soludo, 2009). Interest rate has fundamental implications for any economy, because it either affects the cost of capital which influences investment or influences the availability of credit, by increasing savings (Acha & Acha 2011). Even when credit is available, high lending rates, make it unattractive and even riskier since returns on investments in manufacturing are below the rates of borrowing. In this way, the level of interest rate influences the growth of investment and output in manufacturing sector. Keynes

theory of income, output and employment explains how interest rate, through changes in investment, influences manufacturing sector growth in the economy (Jhingan, 2003). Keynes (1936) establishes a positive relationship between investment and manufacturing sector growth. Investment may take the form of machinery, equipment, building or increased investments of consumers' goods. Since an increase in investment will bring a multiplier effect, an increase in output and income, and investment is inversely related to interest rate; it then follows that the interest rate is also inversely related to manufacturing sector growth. If interest falls, investment will rise and output rises. On the other hand, if interest rate rises investment and output will fall.

Rate of Inflation

The concept of inflation has been defined as a general rise in overall price level sustained over a long period of time (Fatukasi, 2012). It is not once and for all upward price movement but has to be sustained over time and affect all goods and services within the economy. Changes in inflation rate have significant effect in the purchasing power of money and the cost of production in the manufacturing sector. The effects of inflation are viewed in two perspectives; effect on the aggregate demand and effect on the cost of production. During period of high inflation, consumers with fixed income have a low purchasing power due to the reduced value of money hence reduced demand for products. Equally inflation increases the cost of production resulting from surge in the cost of factor inputs such as labour wages and raw materials. This may partly explain why Nigerian manufacturing firms' products are costly and substandard making the foreign imported goods to have competitive advantage in terms of cost and quality over the domestic commodities.

Tariff

Oluwole (2011) defines tariff as a means of generating revenue for the government for the improvement of the welfare of her citizenry or serves as a protection for infant industries. Tariff policy have evolved over the years as not only a means of generating revenue for the government but also as tool for achieving other policy objectives like industrialisation via protection of infant industry and import substitution (Akinlo, 1996). As such, tariff reflects an Industrial policy, it is a trade mechanism that needs to be driven by an industrial strategy. Tariff has found increasing application as a discriminatory tool of restraining the importation of certain commodities in Nigeria. This is in a bid to avoid competition with local market or discourage importation of non-essential goods (Adebayo, 2006). Conversely, the proponents

of free trade consider protection as a barrier to industrial growth and argue that protection tends to stifle innovation and productivity enhancement. Hence, tariff manipulations encouraged the expansion of assembly activities dependent on imported inputs. These activities contribute little to indigenous value added or to employment, and subsequent industrial growth.

2.2.2 Manufacturing Sector Performance

Performance measurement means using appropriate indicators to monitor, evaluate, and assess the efficiency and effectiveness of an organization's services, and its impact on clients and the community at large. Fwaya (2006) views performance as a formula for the assessment of the functioning of an organization under certain parameters such as productivity, employee' morale and effectiveness. Odhiambo (2009) identifies three approaches to performance measurement in an organization which are the goal approach, which states that an organization pursues definite identifiable goals. This approach describes performance in terms of the attainment of goals. The second approach is the systems resource approach which defines performance as a relationship between an organization and its environment. This concept defines performance according to an organization's ability to secure the limited and valued resources in the environment. The third approach is the process perspective which defines performance in terms of the behaviour of the human resource of an organization (Waiganjo, Mukulu, & Khariri, 2012).

Kiragu (2005) highlights performance in terms of four perspectives which are the financial, customer, internal processes and innovativeness. The financial perspective identifies the key financial drivers of enhancing performance which are profit margin, asset turnover, leverage, cash flow, and working capital (Odhuno, Kambona, Othuno, & Wadongo, 2010). The customer focus describes performance in terms of brand image, customer satisfaction, customer retention, and customer profitability. Internal processes involve the efficiency of all the systems in the organization while innovativeness is concerned with the ease with which a firm is able to adapt to changing conditions.

It is difficult to fairly assess the operational performance of manufacturing activities of a firm using financial measures, such as ROI, ROA, ROE *etc.*, because these financial measures are subject to many factors outside the scope of manufacturing operations. An attempt to isolate the performance of the operations function is to utilise measures where the management of operations plays an integral part, that is, operational performance measures (Shah et al.,

2003). Operational performance reflects the performance of internal operations of the company in terms of cost and waste reduction, product quality improvement, delivery performance, flexibility and productivity improvement (Jeyaraman & Teo, 2010).

Quality Performance

Quality has become top priority in many manufacturing firms due to the globalisation of world trade and the competitive pressure brought about by the continuous changing demands of consumers, who want better products and services (Thiagaragan et al., 2001). Today quality has been regarded as a key strategic component of competitive advantage. Therefore, improvement of product quality is of prime concern for today's firms (Soltani et al., 2011). Quality is defined with the customer's requirements in mind (Seaver, 2003). Quality is important for the acceptance of a product. High costs, low productivity, and loss of market share are directly related to poor quality. Maintaining high and consistent product quality is a key dimension of competitiveness, affecting both product cost and customer loyalty. Quality is a multifaceted term. Garvin (1987) asserts that quality can be viewed from up to eight different perspectives; performance, features, reliability, conformance, durability, serviceability, aesthetics and perceived quality. Within manufacturing operations the conformance dimension is most influential since it refers to the process' ability to produce products to their predefined specification reliably and consistently (Slack & Lewis, 2002). Internal measures of quality performance include percentage of products that pass final inspection, scrap rate among others. Customer satisfaction is often regarded as the prime measure of external quality performance (Anderson and Sullivan, 1993).

Delivery Performance

The two main dimensions of delivery performance are delivery reliability and delivery speed (Ward, Bickford, & Leong, 1996). Delivery reliability is sometimes referred to as dependability or on-time delivery, and concerns the ability to deliver according to a promised schedule or plan. Delivery speed is concerned with the length of the delivery cycle. Ward *et al.* (1996) argues that although the dimensions are separable, long run success requires that promises of speedy deliveries be kept with a high degree of reliability. There is a caveat with the delivery dimension, firms in different environments relate differently to both delivery speed and reliability. Delivery speed is, from a market perspective, the elapsed time from the receipt of a customer order to final delivery (Handfield & Pannesi, 1992). This definition is quite straightforward for firms operating in a make-to-order environment. However, for

companies operating under a make-to-stock strategy this definition is rather strange since the actual customer order enters the system more or less on the shelf leading to a delivery lead time that is zero (time of transport *etc.* not accounted for). Likewise, in make-to-stock environments high delivery reliability is interpreted as the percentage of orders filled directly from inventory while in make-to-order environments delivery reliability is to honour the promises made to customers.

Flexibility Performance

The complex markets, fierce competition and fast changes in demand require that firms to be ready to react promptly to customers' needs. Flexibility can be understood as the ability to react and adapt quickly to changes in the market due to an increase or decrease of customers' requirements, accelerating or decelerating the manufacturing processes when it is requested. Also flexibility can be seen as the speed in which the operations may adapt to changes in the customer requirement. Flexibility is also regarded to be a multidimensional concept. D'Souza and Williams (2000) define four dimensions of manufacturing flexibility; volume, variety, process and material handling flexibility. The level of flexibility is not directly evaluated by the customer; it is more of an operational means to provide possibilities for more customised products and product deliveries (Slack, 1983). Flexibility can thus be referred to as an enabler, enabling the manufacturing system to offer shorter delivery lead times, wider product range amongst other. The externally visible properties of a highly flexible manufacturing system include a very broad product range, major opportunities to product customisation and highly flexible delivery times (Slack, 1983).

Cost Performance

Cost is an absolute term and measures the amount of resources used to produce a product. Every Naira removed from the operation's overall cost is a Naira added to the profits. Therefore cost performance is the most important of the different operational performance dimensions (Slack & Lewis, 2002). Important to note is that a reduction in the actual cost of manufacturing does not necessarily translate to an equally decrease in the products selling price. The distribution of cost reductions is at the manager's discretion.

Since this study concentrates on the performance of manufacturing sector over a period of time, it resorts to measure performance of Nigeria's manufacturing sector using some macroeconomic performance indicators and some operational performance measures which are more applicable at firm level. These macroeconomic indicators include contribution of

manufacturing to gross domestic product, employment in the manufacturing sector, capacity utilization in the manufacturing sector, and contribution of manufacturing to export.

Capacity Utilization in the Manufacturing Sector

Capacity utilization is used to gauge the extent to which the productive capacity of a plant, firm, or sector is being used in the process of generating goods and services. It refers to the relationship between actual output that 'is' produced with the installed equipment and the potential output which could be produced with installed equipment, if capacity was fully used (Ihejirika, Peters, Warri, & Branch, 2012). If actual output falls short of normal, it points to the fact that there exists underutilization of capacity while if actual capacity surpasses normal, we deduce that there is over utilization of capacity. Firms operating close to full capacity are more likely to invest in additional capital and/or employ more workers in order to increase their output, and may be more likely to increase the prices of their output. In contrast, when capacity utilisation is low, a firm can increase output by utilising its existing labour and capital more intensively. Many reasons have been advanced for decreasing capacity utilization level; they include increase cost of raw materials, increase cost of borrowing, and lack of foreign exchange to procure raw materials, spare parts and machinery.

Manufacturing Sector Capacity Utilisation enhances the understanding and measures of productivity of the sector (Shapiro et al, 2011). Manufacturing productivity growth and capacity utilization are linked such that the higher the capacity utilized, the larger the outputs that are produced and the faster the growth of manufacturing productivity. Productivity is defined as the relationship between outputs (goods and services) and the inputs (factors of production) that are used to produce them (Bannock, et al, 1998). Manufacturing productivity growth therefore, is the increase in the efficiency and productive capacity of the manufacturing sector.

Contribution of Manufacturing to Export

Naude and Rossouw (2008) reviews the endogenous growth theory that sees export diversification from primary commodities into high skilled, high technology manufactured goods as an important lever for growth through productivity gains. Increased export through manufacturing can perform the role of engine of economic growth because it can increase employment, create profit, trigger greater productivity and lead to rise in accumulation of reserves allowing a country to balance their finances. Manufactured goods having more positive spillovers as pointed out in Herzer and Nowak-Lehmann (2006) encourage

knowledge spillovers from improved production techniques, new management and marketing practices into other industries. Herzer and Nowak-Lemann(2006) also contend that manufacturing export generates a learning process on international markets requirements , quality control and standards, marketing , management and logistics considerations. In the same vein, Agosin (2007) argues that long run growth is associated with learning to produce an expanding range of goods. Growth is the result of adding new products that embody productivity change to the production and export basket so that countries that have few local sources of productivity growth benefit by opening new sectors that have higher factor productivity. Furthermore, to enhance manufacturing export in the face of globalization and accelerating cross-border trade, countries' exports need to be globally competitive to take advantage of leveraging world markets.

Contribution of Manufacturing to Gross Domestic Product

Manufacturing contribution to Gross Domestic Product (MGDP) is the monetary value of all the manufacturing finished goods and services produced within a country's borders in a specific time period. It is usually employed to ascertain the economic contribution of manufacturing sector to a country's development. Manufacturing sector plays a major role for economic growth in the developed as well as in developing countries. It is now well established in the growth and development literature that there is a strong causal relation between the growth of manufacturing output and the growth of GDP (Pacheco-López & Thirlwall, 2013). The increase in the share of the manufacturing sector in the economy witnesses economic growth. The link between the growth of manufacturing output and the growth of GDP is sometimes referred to as Kaldor's first growth law. Kaldor (1968) states that there are four growth laws. First, high growth rate in the manufacturing sector leads to accelerated economic growth via positive externalities in the economy. Second, a faster growth rate in manufacturing industry production leads to a faster growth rate in labour productivity in the manufacturing industry due to increasing returns to scale. This is called the Verdoorn Law. Third, growth rate in manufacturing sector production is not constrained by labour supply, but determined by the demand in the agricultural sector in the early stage of development and by export in the later stages. Fourth, faster growth in export leads to long-term economic growth (Blecker, 2009).

Employment in the Manufacturing Sector

Manufacturing employment rates indicate the percentage of persons of working age who are employed in manufacturing sector. Employment in modern manufacturing sector enhances skill development and technological learning which in turn promote productivity growth, and economic development. By increasing productivity, the sector can increase both the average wage and the number of manufacturing jobs. Rising labour incomes are the primary means through which growth is translated into improved standards of living and lower poverty rates. As countries industrialize, labour shifts from low-productivity agriculture to higher-productivity manufacturing jobs that possess some characteristics that make them more desirable. Higher productivity jobs are normally associated with higher wages, and historical evidence from advanced economies and newly industrialized countries has shown that wage gains as a result of productivity have helped pull large sections of the population out of poverty (Weiss, 2013). Besides offering higher wages, manufacturing typically provides better employee benefits and security than do jobs in other sectors and tends to develop higher skills than equivalent jobs in the rest of the economy (Lavopa & Szirmai 2012).

2.2.3 Lean and Manufacturing Sector Performance

Improved performance and achievement of a competitive edge is the core of any business optimization strategy. Since time immemorial, organisations have always sought a competitive advantage that would allow them to serve customers as efficiently as possible, maximise profits, develop loyal customers and keep competition at bay. Lean business strategy is one of such business optimisation strategies that reduces the waste in human effort, inventory, time to market and manufacturing space to become highly responsive to customer demand while producing world-class quality products in the most efficient and economical manner.

The chief benefits derived by manufacturing sector from lean implementation are improvement in productivity and quality, along with reduction in customer lead time, efficient product development cycle and manufacturing cost reduction, and greater flexibility (Shah et al., 2003). Productivity growth reduces production costs and increases returns on investments, some of which provide greater income for business owners and investors, while some are turned into higher wages. The virtuous circle between productivity and manufacturing sector is supported through the investment side of the economy, when some productivity gains are reinvested by a firm in product and process innovations, improvements

in plant and equipment, and measures to expand into new markets, will in turn spur further output growth and productivity.

Also, excellent and smooth lean implementation benefits manufacturing sector through customers' satisfaction. Wallace (1992) states that competing and winning in the market place require strategically linking customer and competitors issues into the primary operational elements of the business. Consequently, the development of a customer-driven operational strategy which establishes the primacy of the customer by focusing all operational aspects of the business on the customer raises the chances of achieving success in business. Womack (2005) maintains that the concept of customer is central to lean thinking; lean always starts with the defining value based on customer perspective where customer expectations are not only held high, but they are met accurately and on time. The components of a high customer satisfaction include low price, quick response, great service and high quality. These are similar to value added by lean within manufacturing firms, which are higher quality for products or services, lower cost, and faster delivery. Lean is often associated with the improvement of organisational performance regarding reduced manufacturing lead-time, reduced inventory, increased flexibility, increased quality and overall improved customer satisfaction (Worley & Doorlen, 2006).

Furthermore, the benefits of lean initiatives to manufacturing sector is also found on the elimination of waste and errors in production line and procedural workflow that ensures flawless product quality, improvement on the existing system, delivery of value to customers in a repeatable manner leading to satisfaction. These benefits have indirect association with profit maximization and non-financial aspects, such as investments in research and development, capacity to develop a competitive profile, new products development, market development and market orientation (Jeyaraman and Teo, 2010). Elimination of waste will reduce production cost in terms of materials, time saving in workflow while improved quality encourages consumption, enhances sales volume and organizational market share.

2.3 Theoretical Framework

The underpinning theory that governs this study is General Systems Theory (GST) developed initially by Ludwig von Bertalanffy (1950) in the field of biology and later extended by Daniel Katz and Robert Kahn (1978) into paradigms of management. The essential focus of the GST approach is the relationship and interdependence of the parts. Rather than reducing an entity into its parts or elements, systems theory centres on the relationships between the

parts and how they work together as a whole. This often referred to as a holistic approach to understanding phenomena. GST therefore, explains how lean business strategy as an integrative approach creates value in manufacturing sector by linking value creating activities all the way from supply of basic raw materials as "input", to efficient value creation processes that have zero waste as "throughput", to providing the best quality product to customers in the shortest time, and at the lowest cost as "output", and finally understands customer value and refocuses its key processes to continuously increase it as "feedback".

Major Tenets of General Systems Theory

The key principles or tenets of GST identified by Daniel Katz and Robert Kahn are briefly discussed below.

Importation of energy: No social structure is self-sufficient or self-contained. All need resources and raw materials from the environment to survive. This importation of energy is typically referred to as input. In manufacturing sector, input refers to raw materials, spare parts, and machinery available for production.

The throughput: Throughputs are the structures or processes by which inputs are converted to outputs. Physical plant, work flow, methods and procedures, and hours of work are throughputs. Inputs originate in the environment of the organization, throughputs, as the term implies, are contained within the organization. Throughputs are analyzed by work sampling, work simplification, methods improvement, staffing patterns, and physical layout analysis.

The output: Open systems export some product into the environment. Outputs are the goods and services that the organization (or subdivision or unit) must produce. These outputs may be routine, frequent, predictable, and somewhat easy to identify. The stated purpose of the organization usually contains information on its basic, obvious outputs.

Systems as cycles of events: The pattern of activities defined by input, throughput, and output has a cyclic character; that is, successful completion of the cycle provides sources of energy and resources for repetition of the cycle. Manufacturing firms import inputs such as raw materials, spare parts, and machinery, transform them into goods and services, and deliver this output to their customers at profit, and the profits used to regenerate the cycle.

Information input or feedback: In addition to receiving energy and resources from the environment, open systems receive information. Some of these information help the system to correct its deviations from course thereby attaining the desired or steady state. It is through

the feedback process that inputs and even throughputs are adjusted to produce new outputs. Feedback is provided by such activities as market research and forecasting in business organizations, client surveys, efficient communication network and control processes, and periodic employee evaluations in work groups.

Manufacturing sector is a system model. Manufacturing system receives input elements from the environment and then later undergoes a few processes in the transformation stage. The desired product is produced in the output stage. Quality and cost of the final output rely heavily on the factors that affect or control the system during the transformation process. The goal is to produce the right product at the right time and with the right cost in order to gain profitability and stay competitive by continuous growth.

To facilitate the understanding and implementation of lean Business Strategy, Womack and Jones (1996) provide practitioners and researchers with five general principles of lean; specify value; identify the value stream; create flow; respond to customer pull; and finally pursue perfection.

First principle: Specify value

Analysing value is the starting point of lean process. The production process should be defined and analysed with respect to customer values and satisfactions. Customer value can be defined as how the customer perceives the product or service offered by the organisation. Whilst, customer satisfaction means how the customer utilises and benefits from these products and services. This means that organisations should not try to use their existing resources in the most efficient way from their point of view, but instead should first clearly understand what is needed by customers, what is value for the customers, and then create a process for value creation in a most effective and efficient manner (Vlachos et al., 2013). Lean therefore, must start with a conscious attempt to precisely define value in terms of specific product with specific capabilities offered at specific prices through dialogue with customers (Womack et al., 2003).

Second principle: Identify the value stream

Identifying the value stream means to understand all the activities required to produce a specific product, and then to optimize the whole process from the view of the end-user customers. By mapping the value stream of the product or family of products, the organisation will be able to expose the non-value-added activities that are occurring and

creating waste. This step is very important as it will allow the organisation to see the process from start to finish, which in turn makes the non-value-added activities visible for easy removal (Womack et al., 1996).

Third principle: Create flow

Adoption of continuous flow principle will eliminate all types of wastes and obstacles that interrupt flow of material or process. The continuous flow approach reduces the lead-time, processing time, and overall production costs. To Oppenheim *et al.* (2011) flow means that the organisation needs to work through the planned and streamlined value-adding steps and processes to avoid idle time, work stoppage, unplanned rework or backflow. Availability of materials, tools, operators, and machines are essential factors for successful continuous flow system (Womack et al, 2003). 5s, visual control (VS), standardisation and status indicators can serve as lean tools to enhance the flow (Womack and Jones, 2003).

Fourth principle: Respond to customer pull

In pull system, customers' demands control and govern the flow of production through the production line. The principle of pull makes use of Just-In-Time application to meet the customer needs and subsequently customising and delivering them more predictably when the customer requires them as it means only producing what customers have asked for (Hopp and Spearman, 2004). Having a pull system in place will decrease inventory levels and allow the organisation to know exactly what the customers are willing to pay for, avoid the need to produce products based on forecasting, which may lead to products ending up on the shelf for very long time (Womack et al., 2003), and save human effort and improve staff schedules (Oppenheim *et al.*, 2011).

Fifth principle: Pursue perfection

Once the organisation has successfully specified value, identified the whole value stream, achieved a continuous flow, and let the customers pull their products, they have to pursue perfection by combining the previous four principles with each other. To achieve perfection means constantly considering what is being done, how it is being done and harnessing the expertise and knowledge of all those involved in the processes to improve and change it (Womack et al., 1996). Perfection can be achieved through a continuous improvement in eliminating all forms of obstacles and non-value adding tasks along the flow process (Dulaimi & Tanamas 2001). Organizations should be aware that lean cannot be implemented

overnight. Therefore, there is a need to work continuously to reduce waste and increase commitments by looking at opportunities and limitations.

In conclusion, the contribution of the GST to this study can be seen from the direction that the manufacturing sector is a system in which lean principles are used to optimise the operation processes. This can be described with figure 2.1 below.

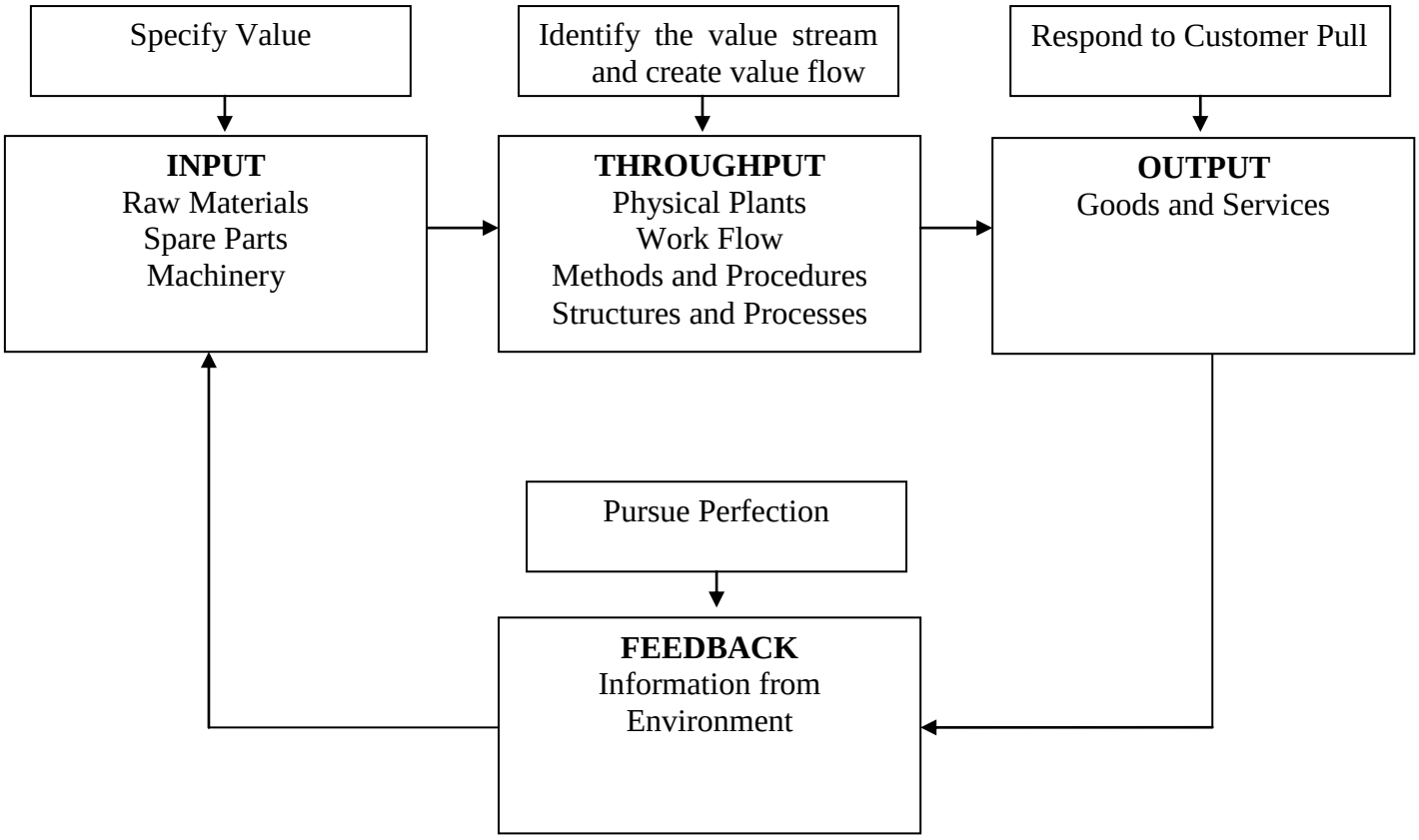

Figure 2.1: Conceptual Framework of Lean Value Stream

First, manufacturing inputs are defined and analysed with respect to customer values and satisfactions and not base on existing resources to avoid waste of overproduction and inventory. The throughput is improved through Value Stream and Create Flow. Value Stream identify and optimize the whole manufacturing process required to produce goods and services, while Create Flow removes all types of wastes and obstacles that interrupt flow of material or process to reduce the lead-time, processing time, and overall production cost. Lean principle of pull production ensures that manufacturing outputs are exactly what the customers want and are willing to pay for. Therefore, production is controlled or pulled from customer's demand with the aim of satisfying the customer in a most effective and efficient

manner. The lean principle of pursue perfection sharpens the feedback function of gaining information from environment in the manufacturing sector. Information from environment are used to refocus the key production processes through Continuous Improvement. Continuous Improvement eliminates all forms of non-value adding activities present in production process in order to produce the right product which the customers value, and keep the sector in a continuous improvement state for survival and growth.

2.4 Empirical Review

Natasa and Stefano (2014) carried out a research survey examining the measurement of the degree of lean implementation in manufacturing within 72 medium and large-sized Slovenian manufacturing companies. Eight crucial areas were identified based on a synthesis of 'lean' literature for assessing and measuring the degree of lean implementation within existing manufacturing systems: value concept and customers, value stream mapping (VSM), pull/kanban and flow, waste elimination, productive maintenance, just-in-time (JIT), employee involvement and the development of excellent suppliers (lean suppliers). After the analysis, results show that the identified variables can be important both for understanding 'lean' and measuring the degree of lean implementation within existing manufacturing systems.

Hibadullah, Habidin, Zamri, Fuzi and Desa (2014) conducted a pilot study to investigate critical success factors (CSFs) towards successful Lean Management Practice implementation in the automotive manufacturing industry of Malaysia. Survey design was adopted for this study. Questionnaire were designed and copies were distributed to the 50 respondents. The findings of this empirical study indicated number of factors an organisation should consider for successful lean implementation. These factors are**:** Customer Focus, which is viewed as the most crucial factor that should be sustained in order to satisfy customer requirements; Supplier Management, which needs to be sustained in order to manage and control the use of vendor during the production process; Employee Involvement, which is a significant part of quality of work life; and Just-In-Time which is necessary for improving firms' performance of activities in service context.

Manzouri , Ab-Rahman, Zain,and Jamsari (2014) identified the effective lean tools required for eliminating wastes in supply chain in Malaysia. This study focused on Halal food supply chains. The study employed a descriptive survey research design. The results of the analysis

showed that demand collaboration, continuous improvement, and inventory management practices are the most important tools in Lean Supply Chain (LSC) implementation. In addition, the results indicated that only a small percentage of Halal food companies are implementing Lean Supply Chain.

Rose, Deros, and Rahman (2014) explored the level of perceptions on the importance and extent of practice of Lean Management implementation with respect to 13 Critical Success Factors (CSFs). To perform this study, a survey instrument consisting of 13 CSFs and 78 items was developed and distributed to local companies. The comparison was carried out on each of these CSFs based on perception, number of years and company size. The statistical analysis using the Kruskal Wallis test had identified four basic critical success factors- Management commitment and leadership, Quality management, Continuous improvement, and Customer management- for both SMEs and large companies with respect to the perception on the importance and extent of practice. These four factors were found to be prime factors for lean implementation which should be practiced in the organization. It was also found that organizational culture, human resource management, and supplier management were the three least implemented factors.

Okpala (2013) attempted to investigate the application of lean accounting as a strategy towards achieving lean business philosophy in Nigerian manufacturing firms. The study population consisted of 53 manufacturing firms listed in the Nigeria stock exchange with 2,246 employees selected based on the researcher's criteria. 50% of the population used as sample frame was selected at random. The study employed a descriptive survey research design. The formulated hypotheses were tested using Pearson Product Moment Correlation statistical test instrument. Findings revealed that lean accounting correlated positively with lean business philosophy and that lean accounting method is a laudable technique worthy of implementation but has not been adopted by Nigeria manufacturing firms due to lack of awareness, expertise, finance and infrastructural deficiency.

Sarhan and Fox (2013) sought to identify and assess the possible barriers to the successful implementation of Lean Construction in the UK. Based on an extensive literature review, followed by a statistical analysis of data gained from a questionnaire survey which targeted practitioners in the UK construction industry, a number of barriers were identified as key barriers. These are Fragmentation & subcontracting, Procurement & contracts, Lack of adequate Lean Awareness & understanding, Culture & Human attitudinal issues, Time &

Commercial pressure, Financial issues, Lack of top management commitment, Design/Construction dichotomy, Educational issues, and lack of the use of process-based PMSs. Further analysis revealed that only three of these barriers were determined as significant- lack of adequate lean awareness and understanding, lack of top management commitment, and cultural & human attitudinal issues.

Naveen, Sanjay, Abid, and Pardeep (2013) attempted to develop a structural model of the variables important to implement Lean Manufacturing System in Indian automobile industry. Classification of the variables was carried out based on the driving power and dependence. In addition to this, a structural model of variables to implement lean concept in Indian automobile industry was developed using Interpretive Structural Modeling (ISM) technique. Interpretive Structural Modeling (ISM) methodology was used for finding contextual relationships among various variables to implement lean manufacturing in Indian automobile industry. Questionnaire based survey was conducted to rank these variables. Findings show that out of the eighteen variables identified from literature and subsequent discussions with experts - Quality of human resources, Relative cost benefits, Effective scheduling to reduce waiting time, Part standardization to reduce complexity and excessive processing, Efficient use of newer more efficient technology, Effective visual control, Increased safety and ergonomics, Collaborative decision making, Proper utilization of floor space, Minimization of defects, Value addition, Customer involvement in quality program, Capability and competence of sales network, Appropriate quality of manufacturing facilities, Improved quality of raw material, Reduction in unnecessary inventory, Top management commitment, and Optimization of transportation and material handling cost-out of which nine variables were identified as dependent and nine variables were identified as driver. No variable was identified as linkage variable and autonomous variable. From the model developed, 'Relative cost benefits' has been identified as top level dependent variable and top management commitment as bottom level most independent variable.

Kumar, Luthra, Kumar, and Haleem (2013) examined the role of top management in facilitating lean manufacturing systems implementation in Indian automobile industry. Classifications of the variables were carried out based on the Mean, Variance and Kurtosis values. A questionnaire based study was carried out, identifying five variables- Top management commitment, Quality if the human resources, Collaborative decision making, Customer involvement in quality program, Capability and competence of the sales network. Relationships of variables were determined through the hypothesis testing using two sample

t-test. Findings show that Top Management commitment has strong relationship with the variables (capability and competence of the sales network, Quality of the human resources, Customer involvement in quality program, Collaborative decision making). They concluded that clear understanding of relationship among these variables will help organizations to prioritize and manage these variables more effectively and efficiently to get more speed in lean implementation.

Abioye and Bello (2012) examined the level of awareness and implementation of some selected Lean Management tools/practices within the Nigerian Small-Scale Manufacturers (NSSMs). A field survey was carried out with the use of a structured questionnaire, interviews and site visits to get necessary information from the respondents. One hundred small-scale companies were selected purposely to represent the best scenario of Lean Management practices within Nigerian small-scale manufacturing companies. The findings revealed that the awareness and implementation levels of 5S, Kaizen, Kaban pull system and value stream mapping are very low whereas team work, staff training and visual management were extremely known and their implementation levels were high. It was also found that lack of full understanding of lean principles, high logistic problem in Nigeria, cost of implementation, and large communication gap between the manufacturers and their suppliers and customers were main barriers to full implementation of the Lean Management tools within the Nigerian Small-Scale Manufacturers.

Adeyemi (2010) examined the extent of Just-In-Time Production System in Nigeria, with a view to identify the extent of adoption as well as the hindrances to full adoption and implementation of the technique. Copies of Structured questionnaire were administered to companies to find out whether or not they were adopting the technique. Information was also elicited on the nature of Just-In-Time Production System adopted by these companies, as well as the benefits accrued from adopting the method. The findings showed that fairly larger companies adopt the Just-In-Time method more while the relatively smaller ones are still not well aware of the existence of the technique. Lower Inventory Investment, Large Space Savings, Increased Flexibility, Increase in Employee Morale, Reduction in Lead Time, Improvement in Productivity, Reduction in Customer Complaints, Reduction in Defects, Reduction in Machine Downtime, and Reduction in Setup time were benefits found to accrue from adopting and using the method. The study also found a number of structural hindrances to the adoption of Just-In-Time Production System such as Supplier Factors, Personnel Factors, Product Factors, and Production Factors.

Gap in Literature Review

The literature reviewed has shown that Lean business strategy has been studied extensively since its invention. This fact underscores the essence, importance and relevance of this concept to improve business operations by maximizing value delivered to customers and minimising cost through eliminating non-value added activities (Womack and Jones, 1996). However, until now, Lean business strategy has only been studied mostly in fragments, with existing literature focusing on either lean tools (Adeyemi, 2010; Abioye and Bello, 2012; Natasa et al., 2014; Manzouri et al., 2014), or lean CSFs assessment (Kumar et al., 2013; Naveen et al., 2013; Sarhan et al., 2013; Rose et al., 2014; Hibadullah et al., 2014), or lean culture (Okpala, 2013). Consequently, these studies did not account for the likely interplay between the different aspects of Lean as it affects firm performance. In an attempt to overcome this shortcoming, this study examines lean as an integrated framework that involves lean tools, lean CSFs and lean culture.

Furthermore, a critical review of extant literature revealed that most of the studies are cross-sectional researches that utilize primary data collection, and the unit of analysis chosen for the studies are firm level. Although these cross-sectional studies have contributed significantly to our current understanding of Lean Business Strategy, but they cannot clearly confirm the stability of their observed findings across time. Again, the literature shows that until now, there has not been any study that linked the performance of the Nigerian manufacturing sector with Lean business strategy. Thus, there appears a negligible research gap that investigates the relationship between Lean business strategy and performance of Nigerian Manufacturing Sector over time. This then create a knowledge gap which this study fills.

This study bridges this gap by leveraging on these valuable empirical studies to develop operational models of lean business strategy using combination of cross-sectional and longitudinal research method to examine the influence of Lean business strategy on the performance of Nigerian manufacturing sector. Consequently, this study advances the body of knowledge by developing mathematical models using the sub components of lean business strategy to examine lean as a strategic management tool used at firm level (micro level application) and as an economic policy tool used to provide enabling business environment (macro level application) for manufacturing firms to thrive.

CHAPTER THREE
METHODOLOGY

This chapter discussed the essential research method employed in addressing the research objectives stated in chapter one of this study. The issues discussed are the research design, the study population, sample size and sampling techniques, specification of model, variables of the study, sources of data, data collection methods, the validity and reliability of the instrument, and techniques of data analysis.

3.1 Research Design

The research design embodies the blue print for the collection, measurement and analysis of data related to the study. This study adopted Survey research design. Survey research design is the type of enquiry that deals with the collection and analysis of data for discovering ideas and insights from an existing situation or phenomenon without subjecting it to any form of manipulation and control (Abiola, 2007). Therefore, the choice of the design is necessitated by the fact that the study sought to examine the influence of Lean Business Strategy on the performance of manufacturing sector of Nigeria. Both primary and secondary data related to lean business strategy and performance of manufacturing sector in Nigeria were used for the analysis. Manufacturing Sector Performance was operationalised using Cost Performance, Quality Performance, Contribution of Manufacturing to Gross Domestic Product and Manufacturing Capacity Utilization. Lean Business Strategy was operationalised by Lean Technique, Lean CSF, Lean Culture and Lean Sustainability. This is depicted in figure 3.1 below.

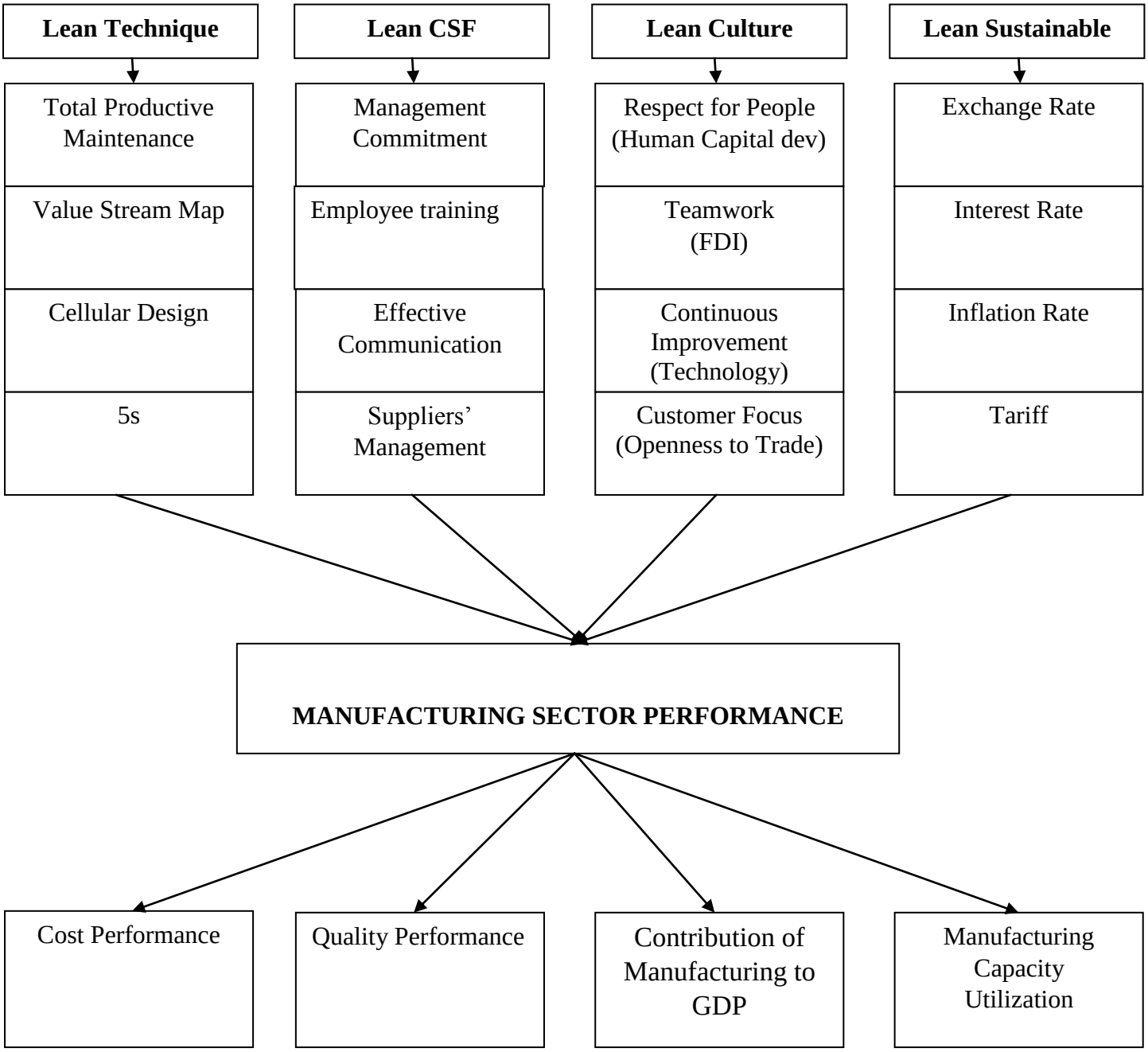

Figure 3.1: Research Framework

3.2 Population of the Study

The population of the study constitutes the totality of manufacturing firms in the economy that make up Nigerian Manufacturing Sector. Prior to rebasing, Nigerian manufacturing sector included just three industries; Oil Refining, Cement and Other Manufacturing. Now, the Other Manufacturing Activity has been broken down into 11 different industries, bringing the total industries in the Nigerian manufacturing sector to 13 industries. The Nigerian

Manufacturing Sector today comprises of Engineering, Construction, Electronics, Chemical, Energy, Textile, Food and Beverage, Metal-working, Plastic, Transport, Telecommunication, Oil Refining and Cement (CBN, 2010). Due to the pervasive and heterogeneous nature of Nigerian manufacturing sector, the population of the study was contained by the performance indicators of the manufacturing sector. At micro level, this study considered all the managers and Supervisors of the four selected manufacturing firms; Unilever Nigeria, Nestle Nigeria, Dangote Cement Plc, and Cutix Plc. Since the number of Managers and Supervisors of the selected manufacturing firms are of controllable size, complete enumeration-based survey was adopted.

Table 3.1 Population of the Selected Manufacturing Firms

S/N	Manufacturing Firms	Rank/Position	Total
3	Unilever Nigeria	Managers/ Supervisors	39
4	Nestle Nigeria	Managers/ Supervisors	37
5	Cutix Plc	Managers/ Supervisors	28
9	Dangote Cement Plc	Managers/ Supervisors	34
			138

Source: Field survey, 2016

3.3 Sources and Method of Data Collection

The data for this study were obtained from primary and secondary sources. The primary data were collected from the field survey using questionnaire. The structured questionnaire adopted five point likert scale with options ranging from (4- Strongly agree (SA)) (3- Agree (A)) (0- Neutral (N)) (2- Disagree (D)) (1- Strongly Disagree (SD)). The survey used an extensive questionnaire, yielding detailed information on a wide range of issues such as Cost Performance, Value Stream Map, Cellular, 5s, Total Productive Maintenance, Quality Performance, Employee Training, Effective Communication, Management Commitment, and Suppliers Management.

A total of 138 copies of questionnaire were administered to participants and 107 returned, representing 78 percent of distributed questionnaires. The secondary data were obtained from Central Bank of Nigeria Statistical Bulletins (Various Issues) and Central Bank of Nigeria Annual Report and Statement of Account. This study employed annual data on Nigerian Manufacturing Sector Capacity Utilization, Exchange Rate, Contribution of Manufacturing Sector to Gross Domestic Product, Human Capital Development, over the period 1990 to 2014.

3.4 Variables of the Study

Objective 1

To examine the influence of Lean Technique on the Cost Performance of the selected manufacturing firms.

The two main variables in this objective are Lean Technique (LT) and Cost Performance (CP). Cost Performance is the dependent variable, while Lean Technique is the independent variable.

Objective 2

To ascertain the extent to which Lean Critical Success Factor (CSF) affects Quality Performance of the selected manufacturing firms.

The two main variables of interest in this objective are Lean Critical Success Factor (LCSF) as the independent variable, and Quality Performance (QP) as the dependent variable.

Objective 3

To explore the value added by Lean Culture on Contribution of Manufacturing Sector to Gross Domestic Product (GDP) in Nigeria.

The two main variables for this objective are Contribution of Manufacturing Sector to Gross Domestic Product (GDP) (MGDP), as the dependent variable, and Lean Culture (LC) as independent variable. Lean Culture was operationalised with Human Capital Development (HCD)

Objective 4

To determine the influence of macroeconomic indices fluctuation on lean sustainability, with focus on Nigerian Technolog.

For the purpose of this objective, Nigerian Manufacturing Sector Capacity Utilization (MCU) was adopted as dependent variable and Lean Sustainability as independent variable. Lean Sustainability (LS) was captured by Exchange Rate Fluctuation (EXCHR) that triggers other macroeconomic variables equilibrium which in turn effect operations of manufacturing firms.

3.5 Model Specification

In an attempt to determine the extent to which lean business strategy influences the performance of Nigerian manufacturing sector, the following models were specified.

Model I

CP = f(LT) . . . . . (i)

Hence, the model is rewritten as thus;

$CP = a_0 + a_1LT + \mu$ . . . . . (ii)

Where

μ = stochastic Term

$a_0 - a_1$ = parameter estimate

CP = Cost Performance

LT = Lean Technique

Model II

QP = f(LCSF) . . . . . (iii)

Hence, the model is rewritten as thus;

$QP = \alpha_0 + \alpha_1LCSF + \mu$ . . . . . (iv)

Where

μ = stochastic Term

$\alpha_0 - \alpha_1$ = parameter estimate

QP = Quality Performance

LCSF = Lean Critical Success Factor

Model III

$MGDP = f(LC)\mu$ . . . . . (v)

Hence, the model is rewritten as thus;

$MGDP = \beta_0 + \beta_1LC + \mu$ . . . . . (vi)

Where

μ = stochastic Term

$\beta_0 - \beta_1$ = parameter estimate

MGDP = Contribution of Manufacturing Sector to Gross Domestic Product

LC = Lean Culture

Model IV

MCU = f(LS) . . . . . (vii)

Hence, the model is rewritten as thus;

$MCU = n_0 + n_1LS + \mu$. . . . . . . (viii)

Where

μ = stochastic Term

$n_0 - n_1$ = parameter estimate

MCU = Nigerian Manufacturing Sector Capacity Utilization

LS = Lean Sustainability.

3.6 Method of Data Analysis

The statistical package SPSS (version 21) was used for data analysis. The method of data analysis employed is Simple Regression analysis. Simple Linear Regression Analysis is used when there is a single dependent variable and a single independent variable. It is valuable in measuring influence of explanatory variable on a dependent variable. It can also evaluate the direction (positive/negative) and the strength of the relationship between the two variables (Nolan & Heinzen, 2014).

Mathematically, this is expressed as:

$Y = \beta_0 + \beta_1 x + \varepsilon$

Where:

Y = Dependent variable

x = Independent variable

β_0 - β_1 = Parameter Estimate

ε = Stochastic variable

The following test will be conducted under Simple Regression Analysis;

- $R^2_{(adjusted)}$: This is also known as co-efficient of multiple determinations. This is used to measure the extent to which the explanatory variables are responsible for the changes in the dependent variable. It shows the percentage of the total variations of the dependent variable that is explained by the independent variables. The values of $R^2_{(adjusted)}$ lies between zero and one. The higher the $R^2_{(adjusted)}$, the greater the percentage of the variation of the dependent variables explained by the independent variable and the better the goodness of fit, while the closer the $R^2_{(adjusted)}$ to zero, the worse the fit (Gujarati, 2004)

- Dubin-Watson (D-W) Statistic: This is used in determining how the past data is affecting the present data. The Durbin-Watson is appropriate for the test of first order autocorrelation and it has the following criteria. If d* is approximately equal 2(d*=2) we accept that there is no autocorrelation in the function. If d*=0, there exist perfect positive auto-correlation. If 0<d*<2, that is if d* is less than two but greater than zero, it denotes some degree of positive autocorrelation, which is stronger, the closer d* is to zero. If d* is equal to 4(d*=4) there exist a perfect negative auto-correlation, while if d* is less than four but greater than two (2<d*<4), it means that there exist some degree of negative autocorrelation, which is stronger the higher the value of d*.

- t-statistics: The F-test is used to test the overall significance of the whole regression model, while the t-test is used to test the significance of each individual independent variable in the model. If the probability of t-statistics is greater than 5% (five percent), we accept the null hypothesis and reject the alternative hypothesis.

3.7 Validity of the Research Instrument

Saunders, Lewis and Thornhill (2009) assert that validity is concerned with whether the findings are really about what they appear to be. Thus, validity refers to the extent to which a test measures what it was meant to measure. To test the validity of the instrument, content and construct validity were conducted. Content validity is a subjective measurement of how appropriate the items are. Content validity for this study was derived from thorough review of lean literature, and expert reviews

3.8 Reliability of the Instrument

The ability of an instrument to yield consistent measurements and produce similar results when administered under the same or similar condition or population at different time is referred to as reliability (Kumar, 2011). In order to assess the reliability of this research study, Cronbach's alpha is used to evaluate the internal consistency of the measurement scale of each construct. Where the alpha value is computed from 1-0 value, the alpha level of 0.60 or above is considered acceptable as suggested by (Sekaran, 2003). However, given the sensitivity of Cronbach's alpha to the number of items in a construct (that is, the value of Cronbach's alpha increases with an increase in the number of indicators used in measuring a construct), an alpha value of 60% or 50% can be acceptable especially in exploratory research or for constructs with low number of items (Hair et al., 2010). The reliability of each construct was established using the Cronbach's alpha. As shown in Table 3.2, all factors

possessed a satisfactory reliability value ranging from 0.54 to 0.75. Details are attached as Appendix III

Table 3.3: Reliability Statistics

Variables	**No. of Items**	**Cronbach alpha Values**
Productivity	3	0.586
Quality Performance	4	0.702
Cellular	4	0.749
5s	3	0.742
Total Productive Maintenance	3	0.585
Value Stream Map	3	0.633
Employee Training	4	0.748
Effective Communication	3	0.545
Management Commitment	3	0.695
Suppliers Management	3	0.671

Source: Extract from SPSS (version 21) Output

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

This chapter is concerned with the presentation and analysis of data obtained using the data collection instruments. The data were presented in tables and hypotheses tested using the results of data analysis obtained from Simple Regression Analysis.

4.1 Presentation of Result

Table 4.1: Results of Regression Model I, Dependent Variable; Cost Performance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.505	0.276	9.089	0.000
Lean Technique	0.245	0.083	2.955	0.004

Source: Extract from SPSS (version 21) Output

Cost Performance = 2.505 + 0.245Lean Technique
Durbin-Watson = 1.518
Adjusted R^2 = 0.680

4.1.1 Interpretation of Model I Result

In Table 4.1, the regression coefficient for Lean Technique 0.245 implies that one percent increase in Lean Technique increases 24.5 percent Cost Performance level of the selected manufacturing firms if other variables are kept constant. The Adjusted R-squared (R^2) value of 0.680 implies that 68% changes in the dependent variable were explained by the independent variables during the study period. The Durbin-Watson (DW) result of 1.518 indicates an absence of autocorrelation.

The t-statistic was found to be statistically significant, with p-value < 5%. This implies that the independent variable has a significant influence on the dependent variable. Consequently, alternate hypothesis was accepted that there is a significant influence of Lean Technique on the Cost Performance of the selected manufacturing firms.

Table 4.2: Results of Regression Model II, Dependent Variable; Quality Performance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.951	0.182	5.213	0.000
Lean Critical Success Factor	0.729	0.063	11.547	0.001

Source: Extract from SPSS (version 21) Output

Quality Performance = 0.951 + 0.729Lean Critical Success Factor
Durbin-Watson = 1.858
Adjusted R^2 = 0.555

4.1.2 Interpretation of Model II Result

The result demonstrates that 1% increase in Lean Critical Success Factor will lead to 72.9% increase in Quality Performance of the selected manufacturing firms. The coefficient of multiple regression (R^2) is 0.555, meaning that 55.5% of the dependent variable (Quality Performance) is explained by the independent variable for the period under review. The Durbin-Watson (DW) result 1.858 indicates absence of autocorrelation.

The result of t-Statistics shows that the independent variable has a statistical significant effect on the dependent variable with the probability value less than 5% significant level. Therefore, alternate hypothesis was accepted, meaning that Lean Critical Success Factor (CSF) has a significant influence on Quality Performance of the selected manufacturing firms.

Table 4.3: Results of Regression Model III, Dependent Variable; Contribution of Manufacturing Sector to Gross Domestic Product

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.171	1.113	3.748	0.001
Lean Culture	0.015	0.003	4.584	0.000

Source: Extract from SPSS (version 21) Output

Contribution of Manufacturing Sector to GDP = 4.171 + 0,015Lean Culture
Durbin-Watson = 0.391
Adjusted R^2 = 0.455

4.1.3 Interpretation of Model III Result

The result of the regression analysis revealed that the coefficient of Constant and Lean culture are statistically significant. The result also showed positive relationships Lean culture and Contribution of Manufacturing Sector to GDP. Our result also showed that the Coefficient of Multiple Regression (R^2) is 0.455. This means that 45.5% of the dependent variable (Contribution of Manufacturing Sector to GDP) is explained by the independent variable (Lean Culture), while the other 21% were explained by factors not included in the model, but are captured by the error term for the period under review. The Durbin-Watson (DW) result 0.391 indicates that there is presence of autocorrelation.

The t-statistic with p-value <5% implies that the independent variable is statistically significant in influencing the dependent variable. Thus, the result confirms alternate hypothesis that Lean Culture has significant influence on Contribution of Manufacturing Sector to GDP in Nigeria.

Table 4.4: Results of Regression Model IV, Dependent Variable; Nigerian Manufacturing Sector Capacity Utilization

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	34.467	3.629	9.498	0.000
Lean Sustainability	0.078	0.032	2.432	0.023

Source: Extract from SPSS (version 21) Output

Manufacturing Sector Capacity Utilization = 34.467 + 0.078Lean Sustainability
Durbin-Watson = 0.265
Adjusted R^2 = 0.170

4.1.4 Interpretation of Model IV Result

Table 4.4 regressed Manufacturing Sector Capacity Utilization on Lean Sustainability. The result of the regression analysis revealed that the coefficient of Lean Sustainability is statistically significant and positively related to Manufacturing Sector Capacity Utilization. The Adjusted R-squared (R^2) value of 0.170 shows that 17% changes in the dependent variable were explained by the independent variable during the study period. The Durbin-Watson (DW) result 0.265 indicates a presence of autocorrelation.

The t-statistic with p-value < 5% implies that the independent variable is statistically significant in influencing the dependent variable. Therefore, the result agreed with alternate hypothesis that Lean Sustainability has significant influence on Nigerian Manufacturing Sector Capacity Utilization.

CHAPTER FIVE
DISCUSSION OF FINDINGS

This section provides detailed description and discussions of the various findings obtained from data analysis.

5.1 Discussion of Model I Finding

The finding of model one revealed a positive influence of Lean Technique on the Cost Performance of the selected manufacturing firms. This position corroborates with the views of Shah and Ward, 2003 that Lean Techniques are all geared towards the increase of operational efficiency by reduction of waste, that is, scrap and rework costs, and the elimination of dysfunctional variability. Therefore, the various bundles of Lean Technique such as Value Stream Map, 5s, Total Productive Maintenance and Cellular manufacturing are all aimed at reducing waste, complexity and variability through the improvement of processes.

VSM reduces cost of production by continuous identification of opportunities in business processes to enhance value, eliminate waste, and improve flow. Kilpatrick (2003); and Rahman, Laosirihongthong, and Sohal, (2010) also argue that efficient application of 5s reduces cost of production by improving work environment and space utilization, health and safety of employee, less scope of error, elimination of time wasted for searching tools and equipment, increased machines' efficiency, and early detection of potential sources of damages. The finding further indicated that the t-statistic is not statistical significant.

This finding agrees with the expectation that due to the similarity of parts and the proximity of workstations in a manufacturing cell, cellular manufacturing systems improves productivity through easier scheduling tasks, simplified material flow management, reduced setup time, low work-in-process inventory, reduced costs, reduces lead-times and enhanced throughput. This argument was supported by Yang and Kuo (2003), who argue that Cellular design improves productivity of a facility and reduce its operating costs, waiting time between process, machine setup time, distance and handling of work pieces, flow of materials between workstations. Also in agreement to the finding, through Total Productive Maintenance, equipment breakdowns and defects are reduced to manageable level, thus leading to equipment productivity improvement and cost reduction. This is consistent with Tripathi (2005) who submits that TPM ensures higher productivity, fewer breakdowns, lower

costs, reliable deliveries, motivating working environments, enhanced safety and improved morale of the employees.

5.2 Discussion of Model II Finding

The finding of model two showed that Lean Critical Success Factor positively influenced Quality Performance of the selected manufacturing firms. From the result, firms can improve Quality Performance by adopting Lean Critical Success Factors, involving Suppliers Management, Management Commitment, Employee Training, and Effective Communication.

Employee Training increases the abilities, knowledge and competencies of employees to do their work efficiently and effectively. This is consistent with the findings of Noe, Hollanbeck, Gerhart and Wright (2003) who reported that by means of training, new knowledge, skills and changing attitudes are impacted on employees leading to increase in quality as a result of potentially fewer mistakes, accuracy, effectiveness, good work, safety practices, and quality customer services

Organizations that invest their resources into developing their suppliers will record high profitability and better quality performance. This finding was supported by Forker (1999) who states that a firm's quality performance (output) can only be as good as the quality performance of its suppliers (input). If organizations get poor quality of inputs from their suppliers, the end product will also be poor quality of output.

Also strong commitment from the top management is vital in quality performance of any organization. Sila and Ebrahimpour (2005) identify the roles of top management on quality performance as; participating in quality improvement efforts, establishing quality policies, establishing and deploying quality strategies and goals, providing resources, and providing problem-oriented training and development.

A firm that communicates throughout the workplace in an effective manner is more likely to build a stronger morale and a more positive attitude towards work, which will translate to higher quality performance. In agreement to this, Tayler (2012) confirms that effective workplace communication helps organizations develop better rapport among employees which consequently make them to be happier and more successful in their roles at the workplace.

5.3 Discussion of Model III Finding

Model III Finding illustrated that Coefficient of Lean Culture poses a positive sign and statistically significant. This means that Lean Culture leads to more efficient operations, and increased customer loyalty and retention resulting in repeated purchases and growth in sales, hence increasing Contribution of Manufacturing Sector to GDP. Martin (2008) agrees to this by stating that culture is the driving force behind an organization's competitiveness, given that the ability of an organization to change its structure, work habits and systems to meet competitive threats and market opportunities is dependent on its culture. From this result, Nigerian manufacturing Sector can improve their contribution to GDP by adopting different dimensions of Lean culture which are Technological improvement that will provide continuous improvement in the sector; empowers employees with the capacity and potential to develop themselves, and enhance the individual and societal well being through Human Capital Development; delivering superior value to consumers through Trade Openness that will make available high quality products at lower prices; and encourages collaboration and teamwork between local firms and Multinational Companies through Foreign Direct Investment (FDI).

It is an established fact that the more skilled workers a firm has, the more flexible the firm will be in terms of arranging the workforce to suit the specific needs of the firm, and also decrease in the labour costs arising from multi-skilled workers who can be fitted in more than one segment in the production line. This view is reinforced by Roux (1994) who states that improving the quality of the work force yields implicit, non-economic outputs related to the generation of ideas and decisions, which have a significant positive impact on investment, innovation and other growth opportunities. In agreement with this view Yesufu (2000) opines that the core need of human capital development is to ensure that workforce are continuously adapted to and upgraded to meet the new challenges of their environment in order to be relevant and contribute to the growth of the firm.

Zarsky (2005) states that FDI can stimulate Manufacturing Sector growth through the integration of the local market with the international operators, labour mobility between subsidiaries and indigenous firms resulting in knowledge spillover, and learning from the demonstration of new technologies represented in foreign subsidiaries. Thus, creating an enabling business environment for FDI helps developing countries to generate the additional

external funds, new technologies, skills, marketing expertise, and novel management techniques required by the manufacturing sector to meet its demands and expectations.

Olofin (2002) asserts that high degree of trade openness will increase Contribution of Manufacturing Sector to GDP through several channels. First, a less protectionist trade regime increases scale efficiency by enlarging the size of the market faced by producers. Secondly, a more liberal trade regime leads to increased competition from abroad forcing domestic firms to adopt a more efficient production process to reduce inefficiency and waste. Finally, he argued that Openness to trade provides access to needed raw materials and capital goods through importation. These raw materials and capital goods embody new technology that helps the production process to become more efficient and culminates in productivity improvements.

Farrell (2003) identifies technology as a powerful tool for achieving dynamic flexibility in Manufacturing Sector through different processes. First, technology enables the development of new products and efficient business processes that leads to administrative savings, higher quality, and lower costs. Secondly, technology facilitates rapid industry-wide diffusion of innovations. Finally, technology improves firm's responsiveness to market through capturing of market information, adjusting production to meet demand, and exploiting scope economies through selling of complementary products or services. In line with this, Litan and Rivlin (2000) opine that organizing production and distribution around technology enables adoption of new processes, procedures, and organizational structures that result to sustainable gains in productivity, quality, and responsiveness.

5.4 Discussion of Model IV Finding

Table 4.5 demonstrated how Lean Sustainability affects Nigerian Manufacturing Sector Capacity Utilization. The result is statistically significant and positively related, revealing that Lean Sustainability has a positive linkage with Nigerian Manufacturing Sector Capacity Utilization. The efforts of Lean business strategy to achieve competitive advantage and increase Capacity Utilization in Nigerian manufacturing sector cannot be done without a proper management of Lean Sustainability factor which is captured in this study as Macroeconomic Indices Fluctuation involving Exchange Rate, Interest Rate, Inflation Rate, and Tariff.

Tariff which is a levy by government on products, incomes or economic activities in the country has a positive relationship with Manufacturing Sector Capacity Utilization. Amiti and

Konings (2007) confirm that reduction in tariff offers substantial gains in productivity. Lower tariff encourages investment in Manufacturing Sector thereby increasing the Sector's Capacity Utilization. On the other hand, a higher tariff reduces disposable income, investment opportunities and inhibits growth of the Manufacturing Sector Capacity Utilization. Therefore, this positive relationship may be because of ineffective tax administrative system, tax evasion by corporations operating in the country, or corrupt practices by tax officers and government officials.

Kamin and Roger (2000) affirm that depreciation in exchange rate decreases capacity utilization especially in developing countries like Nigerian because of the nature of manufacturing sector which is highly import dependent especially major raw materials, modern equipments and spare parts. Any decrease in the value of the Naira will result to a corresponding rise in the cost of production and hence decrease in its output. Therefore, depreciating exchange rate leads to decrease in the propensity to invest in modern production systems required to efficiently utilize installed capacities of production plants.

Also, increase in interest rate would naturally impose some constraint on the borrowing capacity of the investor thereby affecting manufacturing capacity utilization negatively through weakening the investment potential of manufacturing firms. The cumulative effect of this on manufacturing sector is that the utilization of available capacity in the industry suffers a downturn.

A higher rate of inflation means high costs of goods and services including that of industrial production resources. As such, the rising cost may constitute a limiting factor to the procurement of raw materials and equipment in the production of goods and services in various manufacturing firms within the economy. However, Orubu (2009) argued that moderate inflation could increase the level of investments leading to a faster overall growth in capacity utilization. This reasoning emanates from the fact that inflation tends to lower the value of liquid assets (money), hence the preference of investors shifting their investment to real capital projects rather than holding their assets in cash vulnerable to inflation.

CHAPTER SIX
SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

This chapter presents the summary of major findings, conclusion, policy recommendations, contributions to knowledge, and suggestions for further study.

6.1 Summary of Findings

This research sought to assess the influence of lean business strategy on the performance of Nigerian manufacturing sector. This was done at both micro and macro levels using secondary and primary data. To capture the inherent nature of multidimensional facets of lean integrated framework and how they affect manufacturing sector performance, the study developed operational models using the sub components of lean business strategy to examine its' influence on the performance of Nigerian manufacturing sector over a period of time. After the analysis of the data collected, the following major findings were made.

The finding from the first model revealed that Lean Technique as an independent variable is statistically significant and positively influences the Cost Performance of the selected manufacturing firms.

The second model showed that Lean Critical Success Factor has significant influence on Quality Performance of the selected manufacturing firms. Findings of the model also demonstrate positive relationships between the dependent variable of Quality Performance and independent variable of Lean Critical Success Factor.

The third model revealed that Lean Culture as the explanatory variable is statistically significant and positively influences Contribution of Manufacturing Sector to GDP in Nigeria.

The finding of the fourth model showed that Lean Sustainability is statistically significant. The model further revealed that the sign of the coefficient of Lean Sustainability is consistent with expectations of its' relationships with Nigerian Manufacturing Sector Capacity Utilization.

6.2 Conclusion

The study has revealed that the major hindrances of the manufacturing sector in Nigeria are multidimensional and peculiar. The apparent escalating cost of production and scarcity of resources resulting from recent decrease in price and supply of oil has buttressed the need for Lean business strategy as an ideal strategic option to confront the conflicting problems facing the

sector. Lean business strategy has emerged as a key competitive strategy that create an efficient manufacturing processes by differentiating and converting waste into value, reducing lead time through increasing the performance of different activities within the organization, and make processes more flexible to accommodate wider demand variations. To this end, Lean business strategy has been considered as a management technique that has the potential to support Nigerian manufacturing firms to fundamentally reposition their business processes to optimize resources, cut operational costs, become responsive, flexible and customer focus. Therefore, this study validates the relevance of Lean business strategy in Nigerian manufacturing sector and revealed that the successful lean implementation facilitates the manufacturing sector quest for achieving competitive advantage by limiting waste, improve manufacturing processes, increased productivity and equipment utilization, and achieve sustainable growth by creating synergistic value streams across a manufacturing environment.

6.3 Recommendations

1) Due to the high cost of production in Nigeria, much emphasis and attention should be given to lean production to enable firms to achieve the best optimal cost structures, increased productivity and equipment utilization, and as well as improve quality level of their products. Thus, firms should consciously and proactively implement lean business strategy to maximize the benefits therein.

2) Given that the manufacturing sector is highly dependent on the importation of raw materials and spare parts, efforts should be geared towards reducing the import dependence of the sector through improving the level of technology, improving agricultural productivity and domestic sourcing of raw materials in order to reduced high import dependence that is volatile to exchange rate fluctuations.

3) To boost production in Nigerian manufacturing sector, Nigerian Government should provide adequate infrastructural support particularly in developing forward and backward integration of the sector. This can be done by developing Special Industrial Zones in line with natural resource endowment and raw materials found in different areas in the country. This will boost availability of raw materials, optimal utilization of resources and ensure steady supply of products that are vital to the nation and the economy as whole.

4) Acknowledging the recent trend of trade liberalization and globalization, it is imperative for the Nigerian government to formulate appropriate industrial and trade policies

that will foster the competitiveness of manufacturing sector, support local manufacturing firms, and make the sector compete adequately and enjoy the emerging opportunities in international market without resorting to protective measures.

5) To take advantage of the opportunities presented by the new era of advanced manufacturing and to avoid falling behind our competitors, Nigeria government needs to build an Advanced Manufacturing Workforce by emphasizing on closer coordination between the industry, technical training institutions, education and research institutions. In the same vein, manufacturing firms should be encouraged to adopt on the job training for workers interested in improving their skills and creating a culture of continuous learning that allows career workers to personally develop themselves and acquire new skills.

6.5 Contributions to Knowledge

The major contributions of this research are listed below:

1) This research contributes to knowledge by developing and empirically testing econometric models that capture both macro and micro contributions of lean business strategy in Nigerian manufacturing sector. More specifically, the model developed, highlights not only the additive impact of lean practices but also the possible synergy between manufacturing firms and Nigeria business environment.

2) This research was undertaken to investigate the influence of lean business strategy on domestic manufacturing sector in emerging economy. As such, it contributes to the scholarly writings that discuss the transfer and implementation of Lean from the automotive business to other fields.

3) Finally, this study developed an operational measure of lean business strategy and framework that identified its most salient dimensions to reflect the inherent nature of multidimensional facets of lean integrated framework and how they affect manufacturing sector performance.

6.4 Suggestions for Further Research

The following related areas have been suggested for further research.

1) This study was conducted on Nigerian manufacturing sector. Generalizing results of one sector and one country setting to other sectors and countries may be doubtful. Therefore,

the study recommends performing similar studies on other sectors and countries especially developing countries that have similar economic and social environment with Nigeria.

2) This study did not take into account the cost of lean implementation and utilization. Achieving lean involves integrating tangible assets, knowledge, and skills of the organization, which makes it difficult to implement without incurring some costs. Thus, future studies may address the costs of lean development, and measure the potential benefits against the cost of adoption.

3) Due to the sizeable number of Lean tools and techniques, only a fraction was analyzed in details. Hence, future research may replicate this study by conducting a more deep and encompassing analysis of all Lean methods and tools for more robust results to be obtained.

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APPENDIX I

Department of Business Administration
Faculty of Management Sciences
Nnamdi Azikiwe University
Awka,

19th July, 2016

Dear Participant,

REQUEST TO FILL IN QUESTIONNAIRE

I am a post graduate student of the above named department and university. I am carrying out a research study on Lean Business Strategy and Performance of Nigerian Manufacturing Sector, as a partial requirement for Doctoral Degree in Business Administration.

I would be grateful if you could help me answer this questionnaire. This is purely for academic purpose and your response will be treated with the utmost confidentiality and anonymity.

Thank you for your time and co-operation.

Yours sincerely,

MONEME, PATRICK CHIGOZIE

APPENDIX II

QUESTIONNAIRE

Please tick (√) as appropriate
SA = strongly agree, A = agree, SD = strongly disagree, D = disagree and N = neutral

S/N	ITEMS	SA	A	N	D	SD
	Firm Performance					
1	Wastes have been reduced due to efficient utilisation of resource by our employees					
2	We have lower cost of operation than competitors					
3	In my Organisation, there is emphasis on efficient utilisation of resources to reduce cost					
4	We continuously improve our business processes to reduce cost of operation					
5	In my organisation, feedbacks from customers are used to improve our products and services					
6	We constantly look for opportunities to add value to our customers					
7	There has been a reduction in number of customer warranty problems because of improvement in quality.					
8	My organisation is keen on providing reliable quality at competitive price					
	Lean Techniques					
9	In my organisation, similar operations are placed close to each other to eliminate unnecessary movements.					
10	The process flow of material and components is smooth and continuous, as the equipment is grouped.					
11	The workshop is divided into different workplaces and each zone has a specific task.					
12	The company is keen on good arrangement of the factory to reduce excess movements					
13	There has been a reduction in number of accidents and injuries due to improved workplace housekeeping.					
14	My organisation is keen on cleanliness of the internal Environment					
15	My organisation has different stores for different tools and equipment needed.					
16	Each item/piece of equipment is labelled to ensure it is located in the right place in the workshop.					
17	We maintain all our equipment regularly.					
18	We have a formal program for machine and equipment maintenance					
19	There is an improvement in overall equipment effectiveness as a result of my organisation's maintenance culture.					
20	Every staff is involved in the maintenance of equipment					
21	My organization has a business process that can easily detect and remove obsolete and non- essential procedures					
22	My organization has a simplify processes to reduce costs and production time.					
23	There has been a reduction in down-graded products (Second quality) because of improved value creation processes.					

24	My organization constantly review its' processes to remove non-essential procedures					
	Lean Critical Success Factor					
25	Our organization provides training and/or education programs to update the employees' skill					
26	My skills are frequently updated through learning activities created by the organization.					
27	My organisation has committed adequate resources to education and training of staff.					
28	I am periodically trained to update my skills.					
29	Changes in organisation are well communicated to all levels within the organisation					
30	The information flow is adequate and timely enough for people at all levels to understand					
31	Information and ideas can easily be shared between employees in the same or different department					
32	We have data base where information can be easily accessed by anybody in the organisation.					
33	Management encourages and coaches workers by visiting the workplace on a regular basis.					
34	Managements have provided adequate financial resources to facilitate changes in the organisation.					
35	Management is fully involved in providing unique quality products and services.					
36	Management is fully committed to process improvement to attain cost minimization and value maximization processes					
37	Local suppliers are sometimes used to avoid shipment delays.					
38	My organisation constantly evaluates supplier performance in terms of quality, delivery and prices.					
39	We hold meetings with our suppliers on a regular basis to ensure steady supply.					
40	Our company atimes switches suppliers to avail of lower costs, better quality or improved delivery times.					

MGDP and HCD Data

YEAR	MGDP%	HCD/₦Billion
1990	8.2	3.40
1991	8.5	2.68
1992	8.4	1.34
1993	7.34	14.66
1994	7.18	10.09
1995	6.65	13.82
1996	6.48	15.99
1997	6.29	22.06
1998	5.9	21.44
1999	4.72	71.37
2000	3.70	84.79
2001	3.89	79.63
2002	4.59	152.19
2003	4.08	102.61
2004	3.061	134.39
2005	2.795	151.65
2006	2.578	194.17
2007	2.522	256.67
2008	2.410	332.93
2009	2.48	354.19
2010	7.6	550.90
2011	17.8	785.44
2012	13.5	790.06
2013	21.8	844.07
2014	23.4	615.34

SOURCE: CBN Statistical Bulletin (Various Issues)

MGDP= Contribution of Manufacturing Sector to Gross Domestic Product, HCD= Human Capital Development

MCU and EXCHR Data

YEAR	MCU%	EXCHR ₦/1$
1990	37.1	8.04
1991	38.9	9.91
1992	40.4	17.30
1993	41.5	22.05
1994	42.5	21.89
1995	40.3	81.20
1996	42.0	81.20
1997	38.1	82.00
1998	36.2	84.00
1999	30.4	93.95
2000	29.3	102.10
2001	34.7	111.93
2002	34.2	121.00
2003	32.4	129.30
2004	35.9	133.50
2005	36.1	131.66
2006	42.7	128.65
2007	44.3	134.05
2008	56.9	132.37
2009	55.7	148.90
2010	54.8	149.74
2011	53.3	153.85
2012	53.5	157.33
2013	54.7	157.27
2014	54.3	158.55

SOURCE: CBN Statistical Bulletin (Various Issues)

MCU=Nigerian Manufacturing Sector Capacity Utilization, EXCHR= Exchange Rate,

APPENDIX III

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.277[a]	.077	.680	.63893	.077	8.734	1	105	.004	1.518

a. Predictors: (Constant), Lean Technique

b. Dependent Variable: Cost Performance

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.505	.276		9.089	.000
	Lean Technique	.245	.083	.277	2.955	.004

a. Dependent Variable: Cost Performance

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.748[a]	.559	.555	.70086	.559	133.326	1	105	.000	1.858

a. Predictors: (Constant), Lean Critical Success Factor

b. Dependent Variable: Quality Performance

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.951	.182		5.213	.000
	Lean Critical Success Factor	.729	.063	.748	11.547	.001

a. Dependent Variable: Quality Performance

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.691[a]	.477	.455	4.27609	.477	21.016	1	23	.000	.391

a. Predictors: (Constant), Lean Culture

b. Dependent Variable: Contribution of Manufacturing Sector to GDP

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.171	1.113		3.748	.001
	Lean Culture	.015	.003	.691	4.584	.000

a. Dependent Variable: Contribution of Manufacturing Sector to GDP

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.452[a]	.205	.170	7.91261	.205	5.914	1	23	.023	.265

a. Predictors: (Constant), Lean Sustainability

b. Dependent Variable: Manufacturing Sector Capacity Utilization

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	34.467	3.629		9.498	.000
	Lean Sustainability	.078	.032	.452	2.432	.023

a. Dependent Variable: Manufacturing Sector Capacity Utilization

APPENDIX IX

Cronbach's Alpha Coefficient

Reliability Statistics for Cost Performance

Cronbach's Alpha	N of Items
.586	3

Reliability Statistics for Quality Performance

Cronbach's Alpha	N of Items
.702	4

Reliability Statistics for Cellular Design

Cronbach's Alpha	N of Items
.749	4

Reliability Statistics for Total Productive Maintenance

Cronbach's Alpha	N of Items
.585	3

Reliability Statistics for Value Stream Map

Cronbach's Alpha	N of Items
.633	3

Reliability Statistics for 5s

Cronbach's Alpha	N of Items
.742	3

Reliability Statistics for Employee Training

Cronbach's Alpha	N of Items
.748	4

Reliability Statistics for Effective Communication

Cronbach's Alpha	N of Items
.545	3

Reliability Statistics for Management Commitment

Cronbach's Alpha	N of Items
.695	3

Reliability Statistics for Suppliers Management

Cronbach's Alpha	N of Items
.671	4