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PROCUREMENT & SUPPLY CHAIN MANAGEMENT

EFFECT OF LEAN MANUFACTURING PRACTICES ON SUPPLY CHAIN PERFORMANCE IN FOOD AND BEVERAGE MANUFACTURING FIRMS IN NIGERIA

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ABSTRACT

Purpose of Study: The study examined the effect lean manufacturing practices and supply chain performance in food and beverage manufacturing firms in Ibadan, Oyo state.

Methodology: To achieve the objectives, three food and beverage manufacturing firms were randomly selected from the twelve food and beverage manufacturing firms quoted in Nigeria Stock Exchange (NSE). Simple random sampling technique was used to draw up the sample size of 155 managers from production, purchasing, quality control, warehouse/ store and physical distribution departments of food and beverage manufacturing firms. Structured questionnaire subjected to reliability test was used to collect the needed information from the respondents. The information elicited from respondents was analysed with descriptive statistics and multiple regression analysis.

Result: The study revealed that there is positive and significant relationship between lean manufacturing practices and supply chain performance. It revealed that pull system, six sigma, 5s, kaizen and supplier relationship are positively related to supply chain performance. Based on the findings,

Recommendation: The study recommends that manufacturing firms should adopt lean thinking approaches and practices to reduce inherent variation with suppliers, processing time, and demand from customers in order to improve on the firm's supply chain performance. Managers should ensure their workers understand, appreciate and embrace lean concept to achieve substantial reductions in production cost to strengthen competitiveness. Manufacturing firms should involve suppliers 'decision making which is one of the best practices of lean manufacturing management.

Keywords: *Lean manufacturing, Supply chain performance, Food and beverage manufacturing firms.*

INTRODUCTION

In the recent time, researchers and practitioners have given much attention to supply chain. Gunasekaran, Patel and McGaughy (2004) discussed that the role of supply chain metrics and measures in the accomplishment of the goals of the organisation cannot be overemphasised because they affect strategic, tactical and operational planning and control. Moreover, the revolution of supply chain management (SCM) in the last decade has testified that increasing number of companies seek to enhance performance beyond their own boundaries (Boyson, 1999; Poirier, 1999).

Supply chain management is a set of synchronised decisions and activities used to efficiently integrate suppliers, manufacturers, warehouses, transporters, retailers and customers so that right product or services is distributed at the right quantities to the right locations in order to minimise system wide costs while satisfying customer service level requirements (Jaskanwal, Deep & Rajdeep, 2013). As competition increased and markets became global, so did the challenges associated with getting a product and service to right place at the right time at the lowest cost. Organisations start to realise that it is not enough to improve efficiencies within an organisation but their whole supply chain has to be made competitive. Vonderembse, Uppal, Huang and Dismukes (2006) observe that competition has shifted from company orientation to supply chain orientation, thus supply chain has become an essential requirement for survival.

Lean manufacturing is one of the improvement initiatives that can be implemented to achieve business excellence (Mohammed, Mann, Grigg & Wagner, 2011). It can also be described as a philosophy that incorporates a collection of principles, tools and techniques into the business processes to optimize time, human resources, assets and productivity while improving the quality level of products and services to the customers (Cianiene & Vienazindiene, 2012). The approach also enables the use of various tools to reduce equipment downtime, cost of quality, levels of inventory and orders lead times (Dankbaa, 1997). The primary aim of lean manufacturing as a method of industrial organisation is to produce only what is needed and when it is needed. It also aims at achieving perfect workflow, while minimising waste and being flexible and able to change (Howards, 2004).

The concepts of Just-In-Time and Total Quality Management (TQM) have transformed into lean management paradigms (Bhasin & Burcher, 2006). Along with Toyota's success and increasing awareness of lean, a global transformation was triggered in almost every industry to lean manufacturing and supply chain philosophy methods (Likers, 2004). The competitive

advantages of lean management are well established in both manufacturing and service industries (Bowen & Youngdahl, 2006). In lean management systems, a process is capable of prompt response to demand without the need for too much of inventories. Therefore, the major objective of lean management philosophy is that the organisation should ensure that inventory levels should be reduced throughout the entire supply chain (Howard, 2004).

In addition, it is mostly frequently associated with elimination of waste held by firms as excess capacity (machine and human capacity) to reduce the effects of variability in supply, processing time, or demand (Reichart & Holweg, 2007). Therefore, to pursue lean manufacturing and minimise inventory, firms have to manage variability in their supply chain, processing time, and demand (Hoop & Spearman, 2004; Trevile & Antonaikis, 2006). Researchers increasingly suggest the implementation of lean in the supply chain as a way to accomplish the required competitive advantage (Cudney & Elrod, 2011; Oliver, 2003; Taylor, 2006).

Manufacturing firms face an increasing pressure of customer requirements, while at the same time need to reduce production cost, shorten lead times and lower inventory levels to ensure profitability and increase competitiveness (Reichert & Holweg, 2007). According to Mahalik and Nambiar (2010; p.123), increased regulations in food and beverage industries have resulted in many cases to increase costs, requiring process improvements and innovations in order areas for reducing costs. They stressed the need for adopting LM tools in food and beverage industries, hinting that often the packaging machinery is seriously under-utilised, possibly due to shorter production runs and frequent changeovers. Boston Consulting Group (2015) also advocated the need to implement lean principles in the food industry so as to stay competitive.

The need for lean manufacturing practices to reduce waste in supply chain arises from internal factors such as target costing, use of value engineering, use of cross functional teams and zero defect products (Lysons & Farrington, 2006) as well as external factors such as customer lead times, demand specification, product variety, product life cycle and order to delivery time (Reichart & Holweg, 2007). Supply chain performance relates directly to business performance, increases revenue, lower costs, and improves customer satisfaction and loyalty hence increased profits in the long run thereby motivating both researchers and practitioners to explore the area (Mageto, 2009).

To the best of my knowledge, despite the perceived importance of lean manufacturing practices to manufacturing firms, research on the subject matter is still confined to very limited studies in Nigeria. The only study by (Onwughalu, Okeke & Henry-Chibor, 2017) only consider the

effects of lean production on supplier variability, processing time and demand variability and ignored other dimensions such as inventory level, quality, on time delivery for measuring the supply chains performance and lean manufacturing practices are still at its embryonic stage in Nigeria. Thus, this study attempts to ascertain whether lean manufacturing practices affect supply chain performance of food and beverage industry in Nigeria.

LITERATURE REVIEW

Concept of Supply Chain Management (SCM)

Lambert, Cooper and Pagh (1998) define supply chain management as integration of keys business process from end user through original supplier that provides products, services and information that add value for customers and other stakeholders .Ganeshan and Harrison (1995) defined supply chain management (SCM) as a network of facilities and distribution options that performs the function of procurement of materials, transformation of these materials into intermediate and finished products to customers through distribution of these finished products to customers. Lee and Corey (1995) stated SCM consists of the integration activities taking place among a network of facilities that procure raw materials, transform them into intermediate goods and then final products and deliver products to customer through distribution system.

The concept of SCM has got increasing attention from academia, consultants and business managers. Many organisations have begun to recognise that SCM is the key to developing sustainable competitive edge for their products and / or services in an increasing competitive market place (Jones, 1998). Tan, Kannan and Handfield (1998) use purchasing, quality, and customer relations to represent SCM practices in their empirical study. Alvarado and Kotzab (2001) identify concentration on core competencies, use of inter-organisational systems, and removal of excess inventory in their list of SCM practices. Tan et al (2002) identify six aspects of SCM practice through factor analysis: supply chain integration, information sharing, supply chain characteristic, customer service management, geographical proximity, lean capability. Chen and Paulraj (2004) use supplier base reduction, long term relationship, communication, cross functional teams and supplier involvement to measure buyer- supplier relationship.

Concept of Lean manufacturing

The concept that is today known as Lean has its origin at the floors of Japanese car plants (Liker, 2004). After the end of the Second World War, the Japanese economy suffered from scarcity of (qualified) labour, capital and raw material. Even worse, it was threatened by

dominant position of US producers, whose sophisticated mass production systems were able to realise significant economies of scale (Cusumano, 1985). However, traditional mass production had its own problems, namely poor quality, high (capital) costs and inflexibility regarding product volume and variety (Moden, 1983; Ohno, 1988).

Turning the obstacle of constrained resources into competitive advantage, Toyota developed a production system that was superior to Western mass production as it met demand instantaneously and perfectly i.e. with less inventories and defects, and that allowed low costs and high product variety already at low volumes (Seddon, 2005). However, it is important to note that the development of the Toyota production system (TPS) was not a single –point intervention (Holweg, 2007; Liker, 2004). As early as 1948, Taiichi Ohno, who is today seen as the intellectual father of Lean, started to experiment with the new production concepts in Toyota engine machining shop he was managing (Ohno, 1988). In 1990s, the lean concept became popular in American factories after the study by the Massachusetts Institute of Technology of the shift from mass production to disciplined, process-focused production.

The term "lean" refers to anything that is bringing no added-value for a customer or something he is willing to pay for (Bruce & Howes, 2006).

Lean concept determines the value of any process by differentiating value added activities from non-value added activities and eliminating waste so that every step adds value to the process (Abdulmalek & Rajgopal, 2007). Waste (Muda) in this process has seven types; waste from overproduction, wasting time, transportation waste, waste of motion, waste from inventory, processing waste and product defects. According to Bruce and Larco (1990) define lean as a concept that can be viewed and implemented at a number of level and also a commitment process of relentless improvement that can significantly impact upon an organisation's health, wealth and competitiveness.

Karim & Arif- Uz- Zaman (2013) define lean as an integrated socio- technical system where main objective is to eliminate waste by concurrently reducing or minimising supplier, customer and internal variability. The Lean Aerospace Initiative (2002) has defined lean thinking as the dynamic, knowledge driven and customer focused process through which all people in a defined enterprise continuously eliminate waste with the goal of creating value. Some of the major goals of lean practices are to reduce waste in human effort and inventory, getting the product to the market on time, handling the manufactured stocks so that are highly responsive

to customer demand while producing quality products in most effective and economical manner (Ahmed, Zakuan, Jusoh & Takata, 2012).

The concept lean production only marked the beginning of lean evolution. Hines et al (2004) describe how the Western perception of lean has gradually evolved and gained sophistication. During the last two decades, the concept lean has evolved from lean manufacturing to lean marketing and sales, lean engineering etc; and as companies develop with lean thinking, it becomes obvious that lean procurement is mandatory to create a lean management system, motivates the required changes and propels the achievement of on-going lean transformation (Maskell & BMA Inc. Team, 2007). In the recent time, lean management has received the reputation to be a "silver bullet" for achieving dramatic higher quality at lower cost (Womack & Jones, 2014). From its origin in manufacturing, lean has spread to service sector and is now successfully adopted by an increasing number of public sector organisations (Radnor, 2010).

Elements of Lean Manufacturing

Pull System

According to Womack and Jones (2003), one of the steps for becoming lean is to pull material. Pulling material means that no production or any product should be initiated unless there is a demand for it by a customer. Therefore, in an ideal situation every product's production is stated exactly at the time that a customer asks for it. Moreover, this pulling of material should be implemented through the whole value stream and between each step of it, which means there should be no batches in the system.

In a pull- based supply chain, inventory, production and distribution are based on real customer demand rather than forecasted demand (build to order). This can cause a decrease in lead time and inventory levels. However, a pull is difficult to implement when lead time is long. In addition, applying pull system makes it difficult to take advantages of economics of scale. Hence, the combination of push and pull (push- pull system) can be used instead. This means that some stages of the supply chain remain push-based while the rest are pull- based (Simchi-Levi et al., 2008).

Almost all supply chains are push – pull systems. It means that amount of raw materials that should be held in inventory is defined through forecasting, while the final assembly is triggered by real customer demand. The point in which push and pull system meet each other is known as push – pull boundary which is usually is at the beginning of final assembly line (Harrison et al.,2003).

Six Sigma

According to Harland et al. (2007), six-sigma has become a synonym for improving quality, reducing waste, improving customer loyalty and achieving bottom line results. It institutionalizes a rigorous, disciplined fact based way to deliver through process improvement and process design project. Six -sigma is the practice of building quality into the process rather than relying on inspection. It also refers to the theory of employees assuming responsibility for the quality of their own work eliminating any form of waste through ensuring zero defects (Maleka, Hove & Karodia, 2014). Six Sigma's goal is to define processes and manage those processes to obtain the lowest possible level of error (Handfield et al., 2009, Kumar et al., 2006).

Lean manufacturing provides a cost effective delivery of only the necessary quantity of parts at the right quality, at the right time and place. It is a philosophy and a method of inventory planning and control (Bonavia & Marin, 2006).

5s Management (Sort, Set in order, Shine, Standardize and Sustain)

The 5s method – where 5s stands for the Japanese words Seiri, Seiton, Seiso, Seiketsu and Shitsuke- has been used in the automotive and other industries. These words often translated into English as sort, set in order, shine, standardize and sustain, broadly refer to discipline of cleanliness in any workplace (Hirano, 1996). The 5s is a set of practices that aims to generate productivity improvement by creating and sustaining clean and well- organised workplaces (Gapp, Fisher & Kobayashi, 2008; Ho, Cimil & Fung, 1995). It is regarded as low-cost and technologically undemanding participatory approach that workers can implement regardless of their technological knowledge (Imai & Kaizen, 2012). 5s has often been regarded as one of the lean tools (Takara, 2010) and create solid foundation for Lean initiative (Ho etal.1995) . Ho (1999) cites that 5s has significant contribution to successful implementation of lean management. The 5s program has number of benefit such as: Maintaining discipline, reduce work accident, reduce inventory and reduce time for searching spare parts (Lean manufacturing solution Inc., 2008).

Kaizen (Continuous improvement)

New management principles have been adapted to maintain competitiveness in global manufacturing. These principles include Kaizen, which is Japanese term ("Kai' meaning "change" and Zen meaning "good") used to define continuous improvement (Palmer,2001) . Ohno (1998) describes Kaizen as one of the pillars of lean management system and a

continuous improvement method as it follows the renowned Plan-Do-Study-Act (PDSA) methodology. According to Terziovski and Sohal (2002:544), Kaizen means on-going improvement involving everyone, including both managers and workers

with the underlying principle of serving customer needs. Palmer (2001) cites low cost and less inventory, as well as a practice to reduce waste in processes and obtain continuous change in systems when compared to lean implementation. Continuous improvement is the continual pursuit of improvement in quality, cost delivery and design. It ensures organization achieve competitive advantage. Kaizen could be seen as a culture of sustained improvement aiming at eliminating waste in the entire organization and involves everyone in a common aim to improve work without huge capital investments (Mertins & Jochem, 2001).

Supplier Relationship

The key to lean manufacturing is visibility. Supplier must be able to" see" into their customers operations and their customers must be able to "see" into their suppliers' operations. Supplier have been reported as critical factors for the success of lean manufacturing (Keller et al., 1997) and they have been given much attention by various researchers (Wu, 2003; Sanchez & Perez, 2001; Panizzolo, 1998) Particularly, it is important to encourage suppliers to develop Just-in time production capabilities as well as just- in- time delivery in order to enhance long term competitiveness (Helper, 1991). Liker and Choi (2006) states that lean companies have more focus on increasing their supplier's capability in order to reduce cost and improve quality. They also state a mutual goal between manufacturers and supplier to reduce waste and cut down cost is crucial to drive lean manufacturing to success.

Relationship between Lean Manufacturing practices and Supply Chain Performance

The lean notion has always been linked with operational performance (Shah & Ward, 2007). Operational performance has been distinguished in terms of time, quality, cost and flexibility.

Many studies have been undertaken to display the impact of lean practices on operational performance (Huson & Nanda, 1995; Shah & Ward, 2007; Kannan & Tan, 2005), there exists observable evidence that indicates otherwise (Sakakibara, 1990; Callen, 2000). Sakakibara (1990) noted that there was no adequate corroboration to support a relationship of importance between lean practices and operational performance.

Similarly, although some internal lean practices (e.g set- up time reduction) had a positive effect on operational performance. It was found that not all lean tools appeared to be effective, and thus contradicting some of the earlier studies (Callen, 2000). Even Zhu and Sarkis (2004)

considered lean as a double –edge sword that can result to both negative and positive contribution to supply chain performance.

The study by Belekoukias, Garza-Reyes & Kumar (2014) on the impacts of lean tools and methods on the operational performance; the real effects of these methods and tools on contemporary measures of operational performance i.e. cost, speed, dependability, quality and flexibility. The study investigates the impact of five essential lean methods automation, pull system, kaizen, total productive maintenance and value stream mapping on these measure. A linear regression analysis modelled the correlation and impact of these lean practices on the operational performance of 140 manufacturing organisations around the world. In addition, structural equation modelling (SEM) was used to cross verify the findings of the regression and correlation analyses. The results indicate that pull system and automation have strongest significance on operational performance while TPM and VSM have a lesser effect on it, and kaizen has no effect on operational performance.

The study by Shah, Ganji and Coutroubis (2017) on lean production practices to enhance organisational performance of service based businesses through the case study of a local baked goods supplier. The research framework adopted consists of questionnaire survey method implement with different end users, thus covering the production- retail-customer cycle. The collected data was analysed using SPSS 21.0.

An analysis of the result suggest that most popular lean production tools used by the firms are Pull system, VSM, 5s, kaizen and poka yoke. The findings of the study show that pull system have a high impact on improving the overall performance (quality, speed, dependability, flexibility and cost). Poka yoke also plays a vital role on performance as it helps them to prevent and eliminate quality defect and improve speed, dependability, flexibility and cost, while kaizen and 5s have moderate impact on their overall performance (quality and speed).

A study by Wu (2002) indicates that implementation of lean manufacturing practices have positive effect on supply chain performance. The study shows that implementation of lean manufacturing practices lead to improvement on inventory level, quality, supply lead time and delivery service level.

The empirical study by Jasti and Kodali (2016) on implementation of lean principles in Indian manufacturing industry. The survey questionnaire was sent to 753 manufacturing organisations located in India. The selected respondents were production managers, maintenance managers, quality control managers, sales managers and CEOs of the organisation. The study considered

different kinds of lean elements such as 5s, pull system, kaizen and quick changeover. The study found that the lean elements are positively related to operational performance. The study also found that the drivers for implementation of LM were customer satisfaction and organisational continuous improvement program. The study found that barriers to implement LM principles were employees resistance, budget constraints and lack of understanding of LM principles to shop managers.

The study by Onwughalu, Okeke and Henry-Chibor (2017) on lean production and its effects among selected manufacturing organisations in Port Harcourt, River State, Nigeria. Lean production practices were examined to ascertain their effects in minimising variability associated with suppliers, processing time and demand. The causative effects of lean practices on the operations of the selected organisations were shown using regression analytical tool. The findings revealed that lean practices adopted had significant relationship with minimised variations associated with suppliers, processing time and demand ; thus they concludes that lean manufacturing tools help to achieve leanness in operations hence eliminating several forms of wastes.

Another study conducted by Mbithuka (2010) on lean manufacturing practices and supply chain responsiveness among vegetable oil processing firms in Kenya. The findings established that lean practices enable the firms to have responsive supply chain, and the firms experience the advantage of improved lead time for innovative product life cycle, reduced costs, and increased revenue by optimising inventory levels under demand uncertainty.

A study by Sumo (2015) on lean practices and supply chain performance among automobile assembly firms in Kenya. The findings of the study established that value stream mapping, 5s, pull system, Kaizen and Jidoka have positive impact on supply chain performance of the firms. The research findings revealed that lean manufacturing practices caused reduced inventory level, reduced manufacturing cost, and reduction in waste and short set up time.

Despite various evidences showing the relationship between lean manufacturing practices and supply chain performance, there is still an apparent dearth of literature and empirical researches on lean manufacturing practices and supply chain performance in Nigerian context.

Theoretical Framework

This research is based on theory of resource- based view (RBV). Theory of resources based view states that a firm's overall performance is affected by firm's specific resources and capabilities (Peteraf, 1997). This implies that organisational resources are allocated unevenly

within the industry (Barney, 1996). He further indicates that an organisation's resources are its assets and strengths. Consequently, such resources are controlled by organisation, enabling it to plan and implement strategic actions that promote its organisational effectiveness and efficiency. Weru (2015) indicates that reduction of waste in supply chain through adoption lean manufacturing practices and resources based view share a common perspective as they both cause continued performance improvement. The cohesion between the two is weaved in conviction that resources and capabilities of the organisation are scarce, and for organisation to survive, the organisational resources should be utilised in most economical manner.

The study is also based on system theory. The theory was developed by Katz and Kuhn (1978) into paradigms of management. This theory explains how lean production as a holistic or integrative approach creates value in production by linking value creating activities all the way from supply of basic raw material (inputs) to efficient value creation processes that have zero waste as output, to providing the best quality product to customers at the lowest cost and shortest time.

METHODOLOGY

The study examined the relationship between lean elements and supply chain performance of the beverage manufacturing firms in Nigeria. The study employed a cross – sectional research design since it seeks to ascertain the population's current view of the subject matter (Cooper & Schindler, 2003). The population of the study comprised procurement managers, Warehousing/store managers, production managers, quality control manager, physical distribution manager and workers at the supervisory level of the manufacturing firms. Three manufacturing firms were randomly selected from the total population of twelve food and beverage manufacturing firm quoted in Nigerian stock exchange. The selected firms are Nigeria Eagle flour mill, Nigeria Breweries Plc. and Seven up bottling company Plc. The population of the study as at May 2018 is 266. The information is got from the personnel/ human resource of each of the manufacturing firms. Since the population is known and finite, the researcher used the Yamane (1967) formula for estimating sample size for study. n=N1+N e)2

Where n = sample size, N = population size, *e* = 0.05 (error term or probability of type I error).

$$n=2661+(266\ 0.05)2 \ \backsimeq 155 \text{ respondents}$$

Therefore, a sample size of approximately 155 was used for the study, meaning that 155 copies of questionnaire were proportionately distributed to managers at the supervisory level in

production, purchasing , quality control, warehouse/store and physical distribution department of the selected manufacturing firms .

A convenience sampling method was adopted in administering the questionnaires. The questionnaire is made up of two sections. Section A provides for demographic information of the respondents while section B examines effects of Lean manufacturing practices on supply chain performance of food and beverage manufacturing firms. The questionnaire was distributed personally by the researchers according to departments in the month September, 2018, while data collected were analysed through descriptive and inferential statistics. The descriptive statistics involves frequency table and percentage while the hypotheses were tested using regression analysis of the Statistical Package for Social Science version 22. The regression model for the study is stated as:

$SCP = \alpha_0 + \alpha_1 PS + \alpha_2 SS + \alpha_3 FS + \alpha_4 KZ + \alpha_5 SR + \varepsilon$

α = regression parameter or coefficient to be estimated

And a priori expectation: $\alpha_1 > 0, \alpha_2 > 0, \alpha_3 > 0, \alpha_4 > 0, \alpha_5 > 0$

The supply chain performance (SCP) is the dependent variable and its influenced by independent variables, Pull system (PS), Six sigma (SS), Five S (FS), Kaizen (KZ) and Supplier Relationship (SR).

DATA PRESENTATION, ANALYSES AND INTERPRETATION

Description of Respondents' Socio- demographics

The socio-demographic variables of the respondents include: gender, age, educational qualification, working experience and the status in the institution. The gender representation showed that the majority of the respondents were males. This category of respondents accounted for 59.0% of the total number of respondents, while 41.0% of the respondents were females. This shows that the percentage of the male staff are higher compared to their female counterparts. For the age distribution, a majority of the respondents were between the ages of forty-one (31) and fifty (40). This category of respondents accounted for 65.8% of the total number of respondents. Also, respondents between the ages of eighteen (18) and thirty (30) accounted for 27.8% of the total number of respondents. 5.6% of the respondents were between the ages of fifty-one (41) and sixty (50), while the respondents age that falls within 51 and above years were 0.8%. This shows that we have capable men and women who are still active to carry out assigned responsibilities in the organisation.

Likewise, a majority of the respondents obtained HND/BSC degrees as their highest educational qualification. This category of the respondents accounted for 68.8% of the total number of respondents. 13.9% of the respondents obtained masters degrees and 17.7% of the respondents obtained OND/NCE/SSCE certificate as their highest educational qualification.

This is an indication that the respondents are educated to understand the questionnaire. Also, a majority of the respondents have worked in their organizations for between five (5) to ten (10) years. This category of respondents accounted for 48.7% of the total number of respondents. 40% of the respondents have worked in their organizations for less than five (5) years, while the remaining 11.3% have worked in their organizations for about ten (10) years and above. Respondents from Nigeria Eagle flour mill (subsidiary of flour of Nigeria PLC) accounted for 29.3%, while Nigeria Breweries Plc. and Seven Up bottling company Plc. accounted for the highest respondents with 35.3% respectively. Lastly, respondents from production department accounted for 12.8%, purchasing accounted for 21.1%, quality control department accounted for 13.2%, warehousing / store department accounted for the highest with 24.4%

Description of Research Variables

Description of Lean manufacturing practices

For pull system in lean manufacturing practices, majority of the respondent agreed that efforts were made to reduce assembly batches in production with over (50%), majority disagreed and strongly disagreed that kanban cards is used to signal when material is needed with over (50%), majority agreed that only materials to be used are available on the shop floor with over (55%), over 60% of the respondents agreed and strongly agreed that suppliers deliver just-in.-time, over 60% of the respond agreed and strongly agreed that orders of material is made to actual customers' demands rather than forecasts , while majority of the respondents with over 60% disagreed and strongly disagreed that employees have profound knowledge of how pull system works.

For six sigma in lean manufacturing practices, majority of the respondent with over 50% agreed that their companies translate customer's needs and expectation into six sigma quality goals. Over 60% of the respondents disagreed that the company uses a set of measure (such as a sigma level, defect per unit, process capability indices) to evaluate process improvements. Majority of the respondents with over 50% disagreed with the fact that six sigma has greatly reduced inventory process variance.

For 5s in lean manufacturing practices, Majority of the respondents with over 70% agreed that frequently used items are properly stored. Over 70% of the respondents agreed that cleaning materials are sufficient to clean the work area. Majority of the respondents with over 70% agreed that standardization procedures are being introduced from time to time. 78% of the respondents agreed and strongly disagreed that most staff are conversant with 5s program. Over 60% of the respondents agreed and strongly agreed that the checklist is provided during the implementation of 5s. There is an indication that 5s is extensively practised in the manufacturing firms.

For Kaizen in Lean manufacturing practices, Over 50% of the respondents strongly agreed and agreed that their companies has knowledge of continuous improvement strategies. Over 50% of the respondents strongly disagreed and disagreed that there are enough expertise on how to implement Kaizen. Majority of the respondents with over 70% disagreed that there is technological capability to implement Kaizen activities. Over 60% of the respondents disagreed that adequate financial resources are allocated to implementation of Kaizen activities. Over 50% of the respondents disagreed and strongly disagreed that Kaizen workshops are held to assist in improving operations. Majority of the respondents with over 70% agreed that employees are motivated to come up with suggestions on continuous improvement.

For supplier relationship in lean manufacturing practices, 90 % of the respondents agreed and strongly agreed that the firms established long term relationship with their suppliers. Over 70% agreed and strongly agreed that they have frequent contact with our suppliers. Over 60% of the respondents agreed that the firms look together with their suppliers to improve the quality of parts provided. Majority of the respondents agreed and strongly agreed that commercial, technical data and information is exchanged with our supplier in order to develop together demand predictions. There is an indication that the manufacturing firms have good relationship with their suppliers.

Description of Supply Chain Performance

The description of supply chain performance, over 91% of the respondent agreed and strongly agreed that lean manufacturing practices are flexible in order to meet changing demand in a demand driving supply chain. Over 50% of the respondents agreed and strongly agreed that lean manufacturing practices help to maximize new product expense. More than 50% of the respondents agreed that lean manufacturing practices reduce lead time. Majority of the

respondents with over 55% agreed that lean manufacturing practices sheer cost of disrupting production. 55% of the respondents agreed and strongly agreed that lean manufacturing practices allow a supply chain to be more efficient. Majority of the respondents with over 75% agreed that lean manufacturing practices reduce inventory level. Finally, over 60% of the respondents agreed and strongly agreed that lean manufacturing practices enable supply chain to be more responsive.

Regression Analysis Result

This defined the relationship between lean manufacturing (pull system, Six Sigma, 5S, Kaizen (continuous improvement) and Supplier relationship and the dependent variable (supply chain performance). The regression results are shown below:

Table 1: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.782[a]	0.612	0.605	0.30114

a. Predicators: (Constant), Pull System, Six Sigma, 5S, Kaizen, Supplier Relationship.

Source: Researcher's Field work (2018)

The R-squared value of 0.612 from the table above is an indication that the independent variables (Pull system, six sigma, 5S, kaizen, Supplier relationship) have accounted for approximately 61% variations in the dependent variable (Supply Chain Performance). While 39% of the variation was explained by variables that could not be accounted for in this study.

Test of Hypotheses

The hypotheses were tested with p-value in regression result. Where the p-values are greater than or equal to 0.05, the null hypotheses (H_o) are not rejected. And where the p-values are less than 0.05, the null hypotheses (H_o) are rejected. The results of the hypotheses are presented below.

Table 2: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	4.401	0.378		11.642	0.000
	Pull System	0.132	0.043	0.146	3.069	0.003
	Six Sigma	0.216	0.030	0.304	7.218	0.000
	5s	0.159	0.030	0.208	5.305	0.000
	Kaizen (CI)	0.289	0.041	0.336	7.048	0.000
	Sup Relationship	0.319	0.041	0.417	7.780	0.000

a. Dependent Variable: Supplier Chain performance

The table above indicates that pull system, six, sigma, 5s, Kaizen (continuous improvement) and supplier relationship are all significantly and positively related to supply chain performance. And all the p-values of pull system, six-sigma, 5S, continuous improvement and supplier relationship of 0.003, 0.000, 0.000, 0.000 and 0.000 respectively are less than the alpha value of 0.05 hence all the independent variables are significant. Hence, all the independent variables are all significant to supply chain performance.

Hypotheses Testing

Hypothesis One: *There is no significant relationship between pull system and supply chain performance*

The Table above indicted that there is a significant relationship pull system and supply chain management. This was confirmed by the t- statistic of 3.069 and p-value of less than 0.05%. We do reject null hypotheses. Thus, there is a significant relationship between pull system and supply chain performance.

Hypothesis Two: *There is no significant relationship between six-sigma and supply chain performance.*

The table above indicated that there is a significant relationship between six-sigma and supply chain performance. The t-statistics of 7.218 and p-value of less than 0.05% confirmed the relationship. Based on this, we do reject null hypotheses. This implied that there is significant relationship between six-sigma and supply chain performance.

Hypothesis Three: *There tends to be no significant relationship kaizen (continuous improvement) and supply chain performance*

The t-statistics of 7.048 and p-value of less than 0.05% indicated that there is a significant relationship between kaizen (continuous improvement) and supply chain performance. We do reject null hypotheses to confirm the relationship.

Hypothesis Four: *There is no significant relationship between 5S and supply chain performance.*

The t-statistics of 5.305 with p-value of less than 0.05% confirmed the relationship. We do reject null hypotheses. Thus, there is significant relationship 5S and supply chain performance.

Hypothesis Five: *There is no significant relationship between supplier relationship and supply chain performance.*

The t-statistics of 7.780 with p-value of less than 5% confirmed the significant relationship. We do reject null hypotheses thus established that there is significant relationship between supplier relationship and supply chain performance.

Discussion of the findings

The broad objective of this study was to examine the influence of lean manufacturing practices (pull system, six sigma, 5s, kaizen, supplier relation) on the supply chain performance of manufacturing firms.

The findings from this study were obtained from responses from managers of production, purchasing, quality control and physical distribution department of the manufacturing firms.

The study revealed that there is a linear relation between lean manufacturing practices and supply chain performance which is in line with the study by Belekoukias, Garza- Reyes & Kumar (2014). The study also revealed that there is a positive and significant relationship between lean manufacturing practices and supply chain practices which in line with the study by Wu (2002) that indicated that implementation of lean manufacturing practices have positive effect on supply chain performance. It also indicated that implementation lean manufacturing practices lead to improvement on inventory level, quality, supply lead time and delivery service level.

The study also found that pull system is significant and positively related to supply chain performance. This finding agree with Bonavia and Marin (2006) argument that JIT manufacturing provides a cost effective manufacturing of only the necessary quality of product

at the right time and place. This is accomplished through the application of element which requires total employee involvement and team work.

The study also found that there is a positive and significant relationship between supplier relation and supply chain performance. This finding agree with Hine et al (2008) study which asserts that lean manufacturing practices depend on visibility, that is , supplier must be able to "see" into their customers' operation and customers must be able to "see" into their suppliers 'operations.

The study also found that there is a positive and significant relationship between six sigma and supply chain performance. This finding is consistent with the study by Kuei, Madu & Lin (2001), and Flynn & Flynn (2005) which found that six sigma as one of the elements of lean management practices play a pivotal role in improving supply chain performance to serve the increasing needs of customers and grow the market share of the organisation.

The study also found that there is significant and positive relationship between 5s and supply chain performance. The study is consistent with the study by Shah, Ganji & Coutroubis (2017) which indicated that 5s as one of the lean production tools have positive impact on the organisation overall performance (quality and speed).

The study also found that there is a significant and positive relationship between kaizen and supply chain performance. This study is line with the study by Jasti and Kodali (2016) which revealed that the drivers for implementation of lean manufacturing were customer satisfaction and continuous improvement program.

CONCLUSION

This study focused on establishing relationship between lean manufacturing practices and supply chain performance of food and beverage manufacturing firms quoted in Nigeria stock exchange.

Three manufacturing firms were selected from food and beverage industry quoted in Nigeria stock exchange. The specific objectives were formulated using selected elements/ tools of lean manufacturing practices (pull system, six sigma, 5s, kaizen and supplier relationship) on supply chain performance of food and beverage manufacturing firms in Nigeria. The findings were obtained from responses of the sample of managers from production, purchasing, quality, warehouse / store and physical distribution department of the manufacturing firms. The study revealed that pull system, six sigma, 5s, kaizen and supplier relationship are positively and significantly related to supply chain performance. This implied that lean manufacturing

practices improved the supply chain performance and were important factors of enterprises competitive advantage as lean organisation are able to be more responsive to market trend, deliver products and services faster and provide product at lower cost.

RECOMMENDATIONS

1. Manufacturing firms should strive to adopt lean thinking approaches, principles, tools and practices so as to reduce inherent variation with supplier, processing time and demand from customers in order to improve on the firm's supply chain performance.
2. Manufacturing firms should commit more resources to staff training so as to develop skills and update knowledge of workers on lean manufacturing.
3. The manufacturing firms should endeavour to increase expertise on continuous improvement and promote culture of continuous improvement throughout the organisation.
4. Manufacturing firms should involve more of suppliers' decision making which is one of the best practices of lean manufacturing management. They should note that customer's satisfaction starts with the source of the product and thus it is important to involve suppliers in decision making.

Suggestions for Further Study

Apart from highlighted lean manufacturing practices used for the research objectives, many other lean elements can positively and negatively affect supply chain performance in food and beverage manufacturing firms. Other elements such as cellular manufacturing, single minute exchange of die and jidoka affect supply chain performance. Further study can find the impact of these other lean elements on supply chain performance.

The domain of this research study was limited to food and beverages manufacturing firms quoted in Nigeria stock exchange; however subsequent studies should expand the scope to involve more manufacturing firms as well as service firms as lean benefits are not limited to production firms.

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