

IMPLEMENTATION OF LEAN & AGILE STRATEGY IN PLANT AND EQUIPMENT PROCUREMENT IN TERTIARY INSTITUTIONS

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Abstract: This research aims to contribute to the development of a solution to the barriers that can create a direct and indirect impact of various forms of plant and equipment procurement in Kaduna state Tertiary Institutions in relation to, need assessment, delay in completion, costs and non-conformance with specification by suppliers and installation related issues, likewise the involvement of professionals in procurement activities. Questioner's, interview, stakeholder's information and procurements records were used to generate data to ascertain the present barriers so as to identify strengths and weaknesses of the organizations, results were analyzed using various statistical tools to establish the existence of these barriers. The knowledge of the existence of these barriers was used to provide a solution for future reoccurrences.

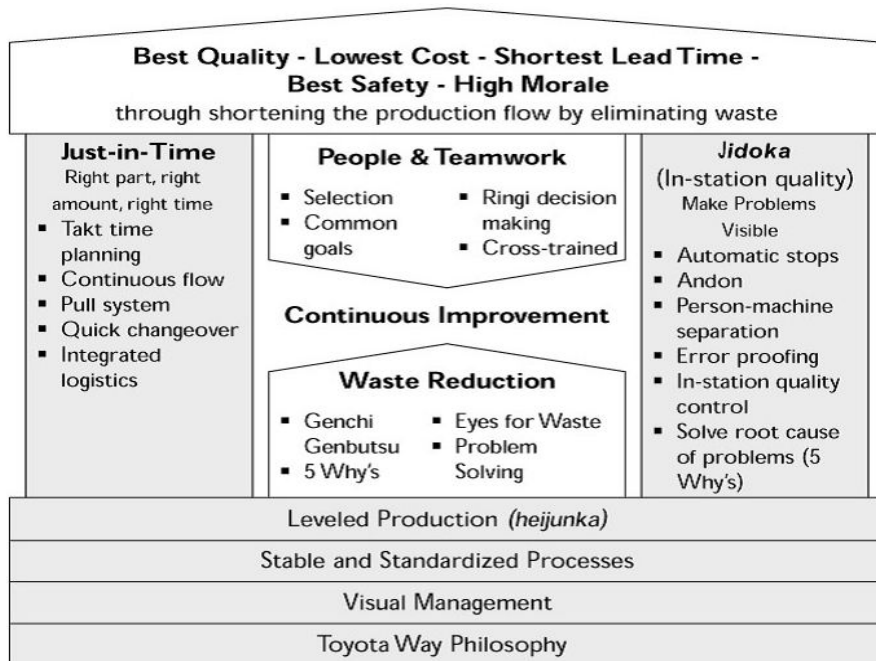
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Introduction

The Tertiary Institutions in Nigeria is a place where Large sums of money and a lot of time are put into procurement. These among other aspects, because many plant and equipment procurements actually shape our Institutions and assist in the provision of quality research and graduates, this among other reasons why different stakeholders in procurement are interested in its success. Plant and equipment procurement throughout history have been overall mostly neglected in Nigeria, and this in combination with it being a conservative business generates few incentives of changing the way it is conducted today. It is, however, necessary to accept the fact that the market is constantly changing and the procurement need to take countermeasures in order to keep up. Creating a more flexible and adaptive way of proceeding with the planning and implementation phase may generate more communication between the different actors in a procurement. This would hopefully result in a more precise planning and implementation. It is cheaper and easier to make changes in the earliest stages of a procurement than after implementation.

The evolution of lean and agile initiatives in the context of world and Nigeria in particular, and its importance to the society explains the need of the lean and agile procurement, performances and its expected role in providing advantages and opportunities to tertiary institutions. Ariff and Ahmed (2005) used a case study of a medium-sized industry in Malaysia to present strategies to instill supplier capabilities and the support activities in creating a lean supply chain across multiple tiers of Small and Medium-sized Industries (SMIs). On the other hand, Christopher (2000) offered a distinction between the philosophies of leanness and agility, apart from discussing the appropriate application of these agile ideas in supply chains. As a distinction to the mass production system (Womack et al., 2007), lean needed half the human effort, manufacturing space and capital investment (Lean Enterprise Institute, 2008), where strong partnerships with suppliers were essential (Liker, 2004). Instead of learning new practices, trade barriers and other impediments were set up before it was realized that Toyota and their production system was the new guideline to follow for improved quality, productivity and flexibility (Womack et al., 2007).

Along with Toyota's success and the increasing awareness of lean, a global transformation was initiated in almost every industry to lean manufacturing and supply chain philosophy methods (Liker, 2004). Lean has successfully been applied in other industries than the automobile, such as the service industry, healthcare and government, and continues to evolve and spread (Bowen & Young dahl, 1998; Larsson, 2008). For instance Liker (2004) highlights that lean also efficiently can be applied in all business processes, including procurement. Additionally, supplier relationships are of high importance in lean for its success (Arnold & Chapman, 2004; Liker, 2004) and generally, the supplier plays a vital part in order to survive in the increasingly competitive market place (Bergdahl, 1996).



Source: The Toyota House Liker (2003)

According to Bhasin and Burcher (2006), it is important for the implementation of lean to have a clear vision of what the organization will look like after the transformation with a strategy of change and clear set goals that are connected to the staff. It seems that the major difficulties when applying lean are a lack of planning and project sequencing (Bhasin & Burcher, 2006; Ahlstrom, 1997). Knowledge of the tools and methods is often not the problem, according to Bhasin and Burcher (2006), but rather difficulties of coordinating the work and making people believe in them. However, as the culture takes hold, lean is spread by the people (Liker, 2004), which leads to commitment and cooperation to the lean work (Liker, 2004; Meland & Meland, 2006).

Kaizen is a Japanese word that in English means continuous improvements (Manos, 2007; Bodek, 2002). Traditionally, the Western world has been more into rapid changes or traditional way of improvements, in similarity to the Japanese way of kaizen (Liker, 2004; Manos, 2007; Wittenberg, 1994). 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 (Bhuiyan & Baghel, 2005). Meland and Meland (2006) explain that the work is led in a top-down approach but it is run by a bottom-up approach where the driving force is the employees' opportunity to be a part of the whole workplace's development. Meland and Meland (2006) states that the approach that engages and motivates employees is more likely to give result. Originally kaizen has been referred to as small and gradual improvements over time but does now also include more efficient improvements in form of kaizen events (also known as kaizen blitzes, quick kaizen or rapid improvement projects) (Manos, 2007). The kaizen events put small teams together to improve processes aiming at bringing big changes to the work area (Bodek, 2002). Both kaizen and kaizen events produce results but in different ways as kaizen is a constant effort which results in smaller changes (Bodek, 2002; Manos, 2007). The kaizen events may last for some days (Manos, 2007), commonly five days Lean Enterprise Institute, (2008). According to Mason (2007), the benefits of kaizen or kaizen events are several such as reduced costs, time savings, shorter travel distances, less people required, reduced lead time or cycle time, value etc. non-value added content, fewer steps in processes, reduced inventories, etc. Kaizen events have the advantage that they can be scheduled and thus assures they are performed. Further, the events require teamwork, which may be enjoyable for many and also promote departments to align their work, contributing to the lean culture. The kaizen events also give results immediately which give people visible proof that improvements have been achieved.

A study by Bashir (2016) the development of conceptual models for plant and equipment procurement was able to look into the problems and provides solution models to various plant and equipment procurement in tertiary institutions, but needed an implementation strategy that can enhance efficiency and value for money and reduction of wastages. The reasons for poor plant and equipment procurement performances abound. Previous researches have dealt much with the problems of project risk and uncertainty, variations in project outcomes,

work fragmentation, complex relationships among stakeholders and activities, and excessive phase overlaps in general.

The difficulties associated with procurement of plants and equipment have been identified as one of the most influential problems facing Nigerian Universities Aniekwu, (2006). Knowledge of engineering fundamental helps check critical to choice of equipment and its financial implication with merits of different approach in selection, best cost effective and alternative to achieve the best approach in eliminating financial waste and enable right-in time job delivery lekan (2015). According to Onyema (2011), procurement is a big challenge being encountered due to the late passage of annual budget by the federal Government and parastatals in Nigeria. In view of this, a strong political will with Government supports and professional involvement are needed as this was ensure a holistic economic transformation of the county. It is very heartwarming that critical National and International Institutions are now paying good attention to Nigeria procurement practice. The efforts of the World Bank, United Nations Development Programme (UNDP), United Nations Office on Drugs and Crime (UNODC), Nigeria Financial Intelligence Unit and Nigeria Economic Summit Group (NESG), among others, are commendable in sustaining procurement practice in Nigeria. What remains is Tertiary Institutions to join hands in developing and championing strategies that was sustain procurement, especially, combating public procurement corruption, which has been identified as its greatest challenge. To eliminate corruption in the procurement of plants and equipment and enhance delivery on the right time and place more strategies beyond, procurement act needs to be employed as a method of risk elimination and control.

Yeo and Ning (2002), a better management of time uncertainty in major equipment procurement in engineering construction projects can significantly contribute to project performance. A survey study shows that time buffer is a popularly used approach to protect project schedule from activity duration variation and uncertainty, there introduce various models of enhancing procurement performance. The problem is that there are repetitive time allowances inserted in the procurement supply chain process and these time buffers are used ineffectively, thus leading to considerable time wastage. In order to eliminate the time waste in the major equipment procurement process caused by the ineffective use of time buffers, it is proposed that the concept and method of critical chain project management be integrated with the supply chain management and brought to bear on the procurement of major equipment (Yeo and Ning, 2002).

Supply chain is becoming a vital entity to organizational performance measurement and, has received much attention in the area of research and development .Gunasekaran, Patel (2001) and McGaughy (2004) discussed the role of these measurement and metrics in the success of an organization cannot be over emphasized, because they affect strategic, tactical and operational planning and control of every organization.

Theoretical background

This research mainly focused on sustainable procurement practices in the educational sector in particular tertiary institution

Research methodology

The research design was a case study within Tertiary Institutions. The merit of using a case study is that it allows an in-depth understanding of the behaviour pattern of the concerned unit. Additionally a case study allows a researcher to use one or more of the several research methods depending on the circumstances. The study was used to identify the sustainable procurement practices in Tertiary Institutions and their role on performance of the organizational supply chain. The reason for this choice was based on the knowledge that case studies are the most appropriate for examining the processes by which events unfold, as well as exploring causal relationships and they provide a holistic understanding of the phenomena (Kitay & Callus, 1998).

This research adopted a stratified random sampling technique in selecting the sample. The use of sample enables the researcher to save time and costs associated with studying the entire population (Mark Saunders, et al, 2009). The selected respondents were issued with questionnaires. Both quantitative and qualitative data was collected in this study. Data was collected mainly through questionnaires. The questionnaires used for the study comprised of open and close-ended questions. The advantage of using both structured and unstructured questionnaires is that they are easier to analyse and they permit greater depth of response whereby respondents are given responsibility of giving their own personal response. The study also made use of secondary sources of information such as published reports, articles and journals. The questionnaires were delivered to the respective respondents with the help of research assistants.

Sample survey was carried out on several randomly selected establishment and relevant professionals to get information from all categories of Tertiary Institution, professionals, contractors and consultants, client as regard to plant and equipment procurement in Tertiary Institution within Kaduna State at the initial stage of the research and with the increase in the scope and research question Six tertiary Institutions will be investigated two Universities, two polytechnic and two federal colleges of education in the North West Nigeria.

This research will include oral interviews with the establishments, parastatals, and end users on the process involved in plant and equipment procurement cases of delay in supply and specification related problems and value for money with the present interview focusing on lean and agile implementation in tertiary institutions in the North West Nigeria

In accordance with Wiersman (1995) defined research as a process of systematic inquiry, investigation and analysis of data in order to increase knowledge, test hypothesis where necessary and to arrive at conclusion. The collection of data through inquiry and investigation, records of procurements and analyzing of the gathered data in order to find a solution to a specific problem.

Interview on Lean and Agile Implementation

The observation gave a great understanding and a comprehensive picture of the site that would be hard to obtain by just talking to people, which Simons (2009) also states. As Stake (1995) states, description and interpretation by others are two vital inputs in a case study, especially as own observations may not be sufficient. The main tool for this is the interview, which like no other method enables to get to the core as quickly as possible and in a greater depth (Simons, 2009; Stake, 1995). In line with Stake (1995), the interviews were planned as too informative interviews are hard to steer to ask the right questions and to get the right answers. The interviewees will beforehand given the list of questions with a short explanation of the purpose. This enabled the interviewees to be prepared and to understand the agenda, as Stake (1995) emphasizes. In line with Bryman (2002) and Stake (1995) and their emphasis of documenting the interviews, they will be recorded and transcripts will be written shortly afterwards. As Bryman (2002) and Stake (1995) explain, the recordings helped to focus on what the interviewees meant and not the exact words. Further, as the study was qualitative, and in line with Bryman (2002) and Simons (2009), the importance of the interviews structure was less important than it would have been if the study was quantitative. Further the importance in the interviews was to gain the understanding what the interviewees considered important, which is in line Bryman's (2002) and Simon's (2009) discussions. Thus were both semi and unstructured questions used and follow-up questions were important depending on the answers that were given. As Bryman (2002) and Simons (2009) emphasis, flexibility were thus important to be able to gathered the needed data.

Interviews were useful to capture how Tertiary Institutions understand lean and agile in order to gain a dynamic understanding on methods used and what they perceived as opportunities and hinders. By involving several participators, the insights were broader and showed angles from those who worked with procurement and those who were more in-directly involved.

Examining documents is important in almost every study where the thinking is the same as for the observation and the interview (Stake, 1995). However, documents are less used and exploited than observations and interviews, according to Simons (2009), who further explains that documents could be formal policies, rules, vision statements, annual reports, internal documents, etc. In line with Stake (1995), different documents will used to substitute for activities that cannot be observed or were more useful than interviews and observations. For instance was document analysis an efficient method in order to get a detailed description of for instance the design of kaizen events in the company, which was important as it is a big part of the lean work in the company. Also documents that were used to describe lean for suppliers will eased the understanding. Some documents and lists will be shown and discussed during the interviews, for instance some guidelines regarding quality, delivery and costs, the list of strategic suppliers and time plans for some procurement, plant and equipment procurement documents. Also general information about the institutions will be efficiently retrieved through contract documents and other sources.

Together, these three qualitative methods contributed to a wide picture of Tertiary Institution and the problem area. Interviews were essential to the study where observations and documents mainly can be seen as important complements.

Data Analysis

According to Crowther and Lancaster (2009), the data in a qualitative study can be quantified but with a more informal approach. One procedure is to quantify on how frequently something is occurring. It can be used to determine whether something normally happens or if it is a recurring event. If a phenomenon occurs more

frequently, the method can also be used to omit insignificant data. Another simple approach, according to Crowther and Lancaster is called scaling where the method is about labelling data as “important” or “not important”. The authors quantified the data to a certain extent, for instance when it came to describe certain behaviour or the overall culture at Tertiary Institutions, where the focus was on the general opinions that were received from the employees. If data was more frequently occurring or emphasized, the data was considered being more important. This was an efficient and a simple way to analyse what was important and based on interpretation of the recordings and consideration the theory.

As an overall strategy to the study, the authors aimed to develop an understanding and a conceptualization of implementing lean procurement, first based on the theory and then additionally by the case study. By analysing and comparing the theoretical study with the empirical, and understanding and conceptualization could be created. The summarizing model of opportunities, methods and hinders of the literature study was the basis for the analysis where it was challenged by the findings in the empirical study. Considering this, the study has its foundation in previous research and is further explored by a case study.

Lean

Lean has its origin in Toyota Motor Corporation and their Toyota Production System (Liker, 2004; Womack, Jones & Roos, 2007). The term lean was coined by John Krafcik in the late 80’s (Lean Enterprise Institute, 2009), but the philosophy came to the Western world’s attention already in the beginning of the 80’s as the automobile industry’s suffered by the competition from Japan with low prices and excellent quality (Liker, 2004).

One strategy for coordinating between firms with a focus on achieving efficiency, eliminating waste or overburden and creating value in products is the concept of lean management (Womack & Jones, 1996). Consequently, Vonderembse, Uppal, Huang, and Dismukes (2006), highlighted on the strategies and methodologies for designing supply chains that meet specific customer expectations.

In the procurement area, a lot of research of lean is available as well (Hines, 1996), and also regarding supplier partnership (Lamming, 1993; Liker & Choi, 2006) and lean logistics (Baudin, 2004). Hines and Taylor (2000), Lee (2003) and Ahlstrom (1997) have presented guidelines or sequences regarding the implementation. What these authors have in common is that they focus on larger enterprises. However, it is just as vital for smaller firms as for bigger firms to gain benefits by more efficient processes (Wilson & Roy, 2009).

The National Institute of Science and Technology (NIST/MEP, 1998) defines Lean as systematic approach to identifying and eliminating waste through identification of non-value added activities by continuous improvement following the product at the pull of the customer in pursuit of perfection” (Buzby, Gerstefeld, Voss & Zeng, 2002). Another sampler definition of lean means to create more value for customers with fewer resources, in other words, the fundamental ideas is to maximize customer value while minimizing waste. Actually, the word “Lean” was first used in the Future Car Investigation by MIT professors to interpret Japan’s new production system that do away with mass production (Womack et al., 1991; Macduffie & Helper, 1997; Conti et al., 2006) since it produces much waste. The eight wastes highlighted in TPS are overproduction, waiting, conveyance, over processing, excess inventory, movement been highlighted by Anand and Kodali (2008) that the theory and defects and unused employee creativity, and the biggest one being overproduction (Monden, 1998; Liker, 2004).

Lean Basic

Lean is a philosophy with an integrated set of activities (Arnold & Chapman, 2004; Langley et al, 2008). Liker (2004) states that lean is based on tools and quality improvement methods but its most vital parts are kaizen (continuous improvements) and respect for people. Its essence is, according to Lean Enterprise Institute (2009), to maximize customer value while minimizing waste and can shortly be described as creating more value for customers with fewer resources. With its system-wide philosophical approach, organizations should be managed as a system and not as a set of incoherent activities (Arnold & Chapman, 2004). As a business system, lean organizes and manages product development, operations, and supplier and customer relations (Lean Enterprise Institute, 2008).

Agile

Agile management, agile process management, or simply agile, refers to an iterative, incremental method of managing the design and build activities of engineering, information technology and other business areas that aim to provide new product or service development in a highly flexible and interactive manner (Agile project management handbook). An example is its application in Scrum, an original form of agile software

development. It requires capable individuals from the relevant business, openness to consistent customer input, and management openness to non-hierarchical forms of leadership. Agile can in fact be viewed as a broadening and generalization of the principles of the earlier successful array of Scrum concepts and techniques to more diverse business activities.

Identifying Value

The principle of value in procurement is considered from the point of view of the customer's perception i.e. specifying value from the customer's perspective. The definition of value in procurement is subjective and complex. Koskela (2000) explored the use of the term value and deduced that value can be related to either market value or utility value. This perception of value is supported by many other researchers as presented in lean construction procurement papers. Value Management is described as, Conceptualisation of production (from value viewpoint): As a process where value for the customer is created through fulfilment of his requirements? (Bertelsen and Koskela, 2002: 3). Value engineering refers to the analysis of technical building design to reduce cost but maintain fitness for purpose. Value management is concerned with understanding how the brief for a design can be developed so that a client's requirements can be captured in the design (Kelly and Male, 1993) thereby improving the value perception of the client. Ballard and Howell (1998) stated that value is generated through a process of negotiation between customer's ends and means. According to Lindfors (2000), value is the products or services that increase profit, decrease time and cost, and improve quality for the company and generate profit.

Value Stream Mapping

Mapping the value stream is the second principle of lean thinking. A value stream identifies every step necessary to create and deliver a product to the customer (Womack and Jones, 1996). The first step to understanding this is mapping the current state. Thus, identifying and mapping the value stream is a key requirement to implementing lean thinking. The value stream map is therefore an outline of operations that lead to valuable achievement of product and identifies alternative routes to maximise performance in the construction process (Dulaimi and Tanamas 2001; Forbes and Ahmed 2011). As noted by Fewings (2013), value stream entails all the value-adding steps required to design, produce and provide the product. In achieving an effective delivery process in a construction project, all the non-value adding activities must be minimised i.e. those activities that do not add value to the customer. The non-value adding activities consume resources such as time, space and money without adding value to the product (Forbes and Ahmed, 2011).

Pursuing Perfection

This is a key concept at the strategic level because it defines the need for the way of working and organising to deliver procurement of plant and equipment to become a way of life with an inherent culture. 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 and Jones, 1996; Dulaimi and Tanamas, 2001). The principle of perfection involves producing exactly what the customer wants in terms of quality and quantity at the right time at a fair price and with minimum waste; the real target is zero waste (Bicheno, 2000). Perfection can be achieved through a continuous improvement in eliminating all forms of obstacles and non-value adding tasks along the flow process (Dulaimi and Tanamas 2001).

Research limitations

Limitations of the study are connected to the delimitations of the study itself. When focusing on selecting some tertiary institutions, there is always a reason to question whether the study is applicable in other tertiary institutions in the same or similar situation. However, the results of this research will be developed with the inputs from Tertiary Institution experience, and also more aimed to complement and make practical sense of the literature. The research has a function to be able to challenge the opportunities, methods and hinders for lean and agile procurement based on the findings in the literature study.

Research findings and discussions

The study sought to investigate the implementation of lean and agile strategies in plant and equipment procurement in tertiary institution in North Western State of Nigerian. Interviews were conducted

employees ,consultant and contractors according to their different levels of functions and collected in the same manner and the analysis of the data was based on a general

The researcher interview 25 respondents from the institutions out which 6 met the criteria and are available for the interview, two institutions were selected 2 polytechnic 2 Federal college of Education and 2 University. Data was be obtained from stakeholders, end-users, consultants, contractors, where necessary, other client bodies within the selected tertiary institutions in the North West, Nigeria. The research focuses more on the adoption of lean in the demand management, standardization, waste and culture across the supply chain behaviours. Lacking of poor and inadequate practices of Lean philosophy and common organization practices are major concerns on Supply Chain improvement Supply Chain Visions, Oracle Corp. and Georgia Southern University, 2004).

Table: 1 Interview results

Interviewer	Project manager, Director, end user Age (year)	Procurement of Plant and Equipment experience (year)	Lean and agile experience (year)	Lean and agile implementation in procurement of plant and equipment	Lean and agile implementation in procurement process
A	40	10	1	✓	✓
B	45	25	0	X	✓
C	50	20	0	X	X
D	53	30	0	X	X
E	56	35	0	X	X
F	43	15	0	X	✓

Table 1.0 is showing the result of an interview conducted on stakeholders involved in procurement of plant and equipment in tertiary institution.

Table 2.0 discussed about the use of the lean and agile procurement practice, it showed that the overall procurement practice is good. This is because their cumulative mean response of 3.816 is above the decision/standard mean of 3.0. Specifically the supplier relationship management is very good as this ranked first with the highest mean response of 4.632, while 109 consider this good 6 considers this bad and 10 considers it moderate.

S/No	Items	Response categories					Mean	Ranking
		VG	G	M	B	P		
1	Proper planning and need assessment	50	22	36	14	3	3.864	3
2	Supplier relationship management	7	102	10	4	2	4.632	1
3	Continuous improvement	107	5	4	3	6	3.176	6
4	Value stream analysis in procurement	10	9	102	1	3	2.024	7
5	Procurement models	18	7	12	11	77	1.208	9
6	e-procurement knowledge	0	1	0	23	101	1.904	8
7	Total Quality Management strategy	12	5	12	26	70	3.584	5
8	Value for money analysis	55	7	27	28	8	3.920	2
9	Fitness for purpose	5	110	7	1	2	3.816	4
Cumulative mean							3.125	

Table 2.1: Perception of respondents on the use of lean and agile procurement practice

Decision mean = 3.000

The table 2.2 showed the level of respondents' agreement level with the statements in relation to lean and agile procurement performance. It showed that rating of statements in relation to lean and agile procurement performance in the institutions is generally high as the cumulative mean response of 4.242 is above the 3.000 decision mean. Specifically, Lean and agile procurement systems allow a procurement to not only to be more efficient, but also faster and responsive, as this was rated first with mean of 5.000 as all the 125 respondents strongly agreed with this view.

Table 2.2 to what extent do you agree with the following statements in relation to lean and agile procurement performance in your institution?

S/No	Items	Response categories					Mean	Rank
		SA	A	UD	D	SD		
1	Lean and agile deliveries are flexible help procurement to meet changing demand between manufacturer and user	78	15	19	10	3	4.240	7
2	Lean and agile can help to minimized need assessment and planning time and expense	2	105	5	8	5	3.728	10
3	Lean and agile procurement reduces lead time	113	3	6	0	3	4.784	3
4	Lean and agile procurement reduces wastages in the procurement process	72	24	11	13	5	4.160	8
5	Lean and agile procurement systems allow a procurement to not only to be more efficient, but also faster and responsive	125	0	0	0	0	5.000	1
6	Lean and agile create a good procurement satisfaction	124	1	0	0	0	4.990	2
7	Lean and agile strategy reduced overall procurement cost	105	5	13	0	2	4.688	4
8	Lean and agile strategy give end-user satisfaction	78	44	3	0	0	4.600	5
9	Ease the procurement activities through new approach(software)	48	74	3	0	0	4.360	6
10	Ability to envisage problems and provide alternative solution	0	0	42	25	58	1.872	10
Cumulative mean							4.242	

Decision mean = 3.000

Table 2.3 showed the respondents agreement on the challenges toward the introduction of lean and agile procurement which determine the challenges facing plant and equipment procurement in their institutions. Generally, they are in agreement with the challenges as their cumulative mean response of 4.034 is above the 3.000 decision mean.

Table 2.31: To what extent does institution face the following challenges toward the introduction of lean and agile procurement determine the challenges facing plant and equipment procurement in your institutions?

S/No	Items	Response categories					Mean	Std.Err
		SA	A	UD	D	SD		
1	Lack of support from suppliers, stakeholders, top management	50	53	20	0	2	4.192	1
2	Resistant to change	54	41	15	13	2	4.056	4
3	Poor planning	47	49	19	0	10	3.984	5
4	Lack of adequate resources	50	42	16	14	3	3.976	6
5	Lack of skills and expertise	50	51	22	1	1	4.184	2
6	Lack of clarity of plant and equipment procurement waste	61	40	12	8	4	4.168	3
7	Lack of communication between stakeholders	49	40	20	5	11	3.888	7
8	Lack of enough research, which leads to poor procurement performance	55	25	24	10	11	3.824	8
Cumulative mean							4.034	

Decision mean = 3.000

The summary shown in table 2.41 indicate that the rating level of measures in plant and equipment procurement performance in their organization was very low. This is because the cumulative mean response of 2.261 is below the 3.000 decision mean. Specifically installation and training measure is very low as this had the least mean of 1.120 as all the 125 respondents rated this as bad or poor.

Table 2.41: How do you rate the following measures of plant and equipment procurement performance in your organization?

S/No	Items	Response categories					Mean	Std.Err
		EX	G	M	B	P		
1	Customer satisfaction	0	0	6	20	99	1.256	6

2	Cost and flexibility	3	78	0	23	21	3.152	3
3	Waste reduction	0	1	3	21	100	1.240	7
4	Value for money	3	0	18	77	27	2.000	4
5	Fitness for purpose	3	0	18	13	91	1.488	5
6	Quick delivery	0	103	0	13	9	3.576	2
7	Installation and training	0	0	0	15	110	1.120	8
8	Process improvement	101	0	0	3	21	4.256	1
Cumulative mean							2.261	

Decision mean = 3.0000

The regression analysis in table 3.0 shows that there is significant relationship between the measures adopted for plant procurement of equipment and the Value for Money. This is because the calculated p value of 0.000 is lower than the 0.05 alpha level of significance and the computed F value of 637.361 is higher than the 3.00 F critical value. The Model summary analysis showed that the relationship between the value for money and the independent variable (the measures adopted for plant procurement of equipment) is very strong this is because the computed R value of 0.816, the computed R square value of 0.738 and the Computed Adjusted R value of 0.737 are all higher than the 0.838 standard R. Therefore the null hypothesis which state that there is no significant relationship between the value for money (dependent variable) and the measures adopted for plant procurement of equipment, is hereby rejected.

Table 3.1: Residual statistics for multiple regression analysis.

Variables	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	58.5999	77.9494	69.5600	3.84358	125
Residual	-3.45513	9.54487	.00000	1.61879	125
Std. Predicted Value	-2.852	2.183	.000	1.000	125
Std. Residual	-2.100	5.800	.000	.984	125

a. Dependent Variable: VALUE_FOR_MONEY

Results of the multiple regression analysis in table 4.26 showed that there is significant relationship among all the variables when related with Value for money. Reasons being that the computed p value of 0.000 is lower than the 0.05 alpha level and the computed F ratio value of 169.127 is higher than the 3.000 critical F value. In the same vein, the Regression value of 0.922, the computed R square value of 0.849 and computed Adjusted R square value of 0.849 are all higher than the 0.40 Standard Regression critical value.

Therefore the null hypothesis which state that there is no significant multiple relationship between the dependent variable of value for money and all the other remaining variables is hereby rejected.

Table 3.2: Residual startistics for multiple regression analysis.

Variables	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	58.5999	77.9494	69.5600	3.84358	125
Residual	-3.45513	9.54487	.00000	1.61879	125
Std. Predicted Value	-2.852	2.183	.000	1.000	125
Std. Residual	-2.100	5.800	.000	.984	125

a. Dependent Variable: VALUE_FOR_MONEY

Conclusion

1. Significant relationship exist between the value for money (dependent variable) and the independent variables of measures of plant and equipment procurement, challenges of lean procurement, use of procurement practices and the challenges of lean procurement.
2. There is significant relationship between the value for money (dependent variable) and the use of lean and agile plant and equipment procurement practices.
3. There is significant relationship between the value for money (dependent variable) and the plant and equipment procurement performance.
4. There is significant relationship between the value for money (dependent variable) and the challenges of lean and agile procurement in plant and equipment procurement.
5. There is significant relationship between the measures adopted for plant procurement of equipment and the Value for Money. This is because the calculated p value of 0.000 is lower than the 0.05 alpha level of significance and the computed F value.

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