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Barriers to Plant and Equipment Procurement in Tertiary Institutions, Kaduna State as Case Study

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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 (2015) 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.

Keywords:- *Procurement, Equipment, Plant, Need Assessment.*

I. INTRODUCTION

This research is an important issue because, despite the perception of procurement as something of a policy panacea and repeated efforts to put procurement budgets to work to drive innovation, efforts have been met with limited success (NESTA, 2012). Barriers to effective implementation, including organizational, regulatory, skills and the inherent risk aversion of the public sector, have been documented in the literature (Wilkinson et al., 2005 and Rolf's tam, 2013). Some selected Nigerian Universities were allocated 1.3 trillion annually for Needs Assessment Funds on a three phase disbursement from 2013-2018 result of ASUU strike (NUC) yet equipment procurement is still a measure constrains to Tertiary Institutions.

However this evidence tends to be anecdotal, case-study based and at times not consistent. This article provides a contribution in that it uses a dedicated and original survey to capture the perceptions and experiences of a broad range of suppliers, including small firms and third sector organizations (not-for-profit and non-governmental organizations), across different sectors and areas of the public sector. This paper thus underpins, qualifies and amends existing evidence by shedding a quantitative light on these questions: What are the main barriers that prevent the government from capturing innovation through public procurement? How do different types of suppliers experience these barriers? More specifically, the paper investigates the influence of structural, market and innovation determinants on suppliers′ perceptions of these barriers.

In comparison with the procurement of off-the-shelf goods for the lowest possible price, the procurement of innovation requires a greater degree of in-house competence (Rothwell and Zegveld, 1981). A shortage of commercial skills among procurers has been commonly found to limit engagement with the marketplace and the development of closer supply relations. In a survey of public procurers in small countries in Europe, Georghiou et al. (2010) identified a lack of sufficient procurement expertise for complex purchases involving innovation as well as an absence of formal training for procurers. In the UK, a review for the Cabinet Office by Green (2010) noted that commercial skills were very inconsistent across central government.

A. Statement of the Research Problem

The Nigerian Universities has suffered a lot financial loses in the procurement of plant and equipment's due to delay in delivery and noncompliance to specification related issues. Procurement activities in most cases are usually not in line with the special conditions of contract, therefore incomplete supply of equipment that should come with all the necessary accessories as stated in the condition of contract are always missing. Insufficient technical details during procurement planning and need assessment of procurement also contribute to the problems of procurements in our institution, likewise equipment contract administrators negotiating equipment maintenance/service agreements is not always fully described in the scope of the work to avoid any misunderstandings or unsatisfactory levels of service. Terms and conditions that sometimes are agreed upon do not include working hours, labor, excluded services (what the supplier is not obligated to do), warranty, excluding parts, response time, loaner equipment, and appropriate insurance coverage. Procurement of plants and equipment in Nigeria has experienced a lot of financial wastages ,delay in completion and specification related issues due to incompetency of some of the contractors and contracting authorities, which encourage corruption and other procurement related delays and abandonment. The

financial wastages and delay in completion and supply of unspecified equipment has necessitated this research to show the barriers associated to the problems to avoid risk and have a better procurement system in our tertiary institutions.

B. Research Objectives

The primary objective of this research is to identify the barriers that influence the introduction of various strategies which impact on efficiency in plant and equipment procurement implementation:

- What is the current situation
- What are practices or activities that can be proved the barriers toward successful plant and equipment procurement

II. LITERATURE REVIEW

The difficulties associated with procurement of plants and equipment has 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 effective cost and alternatives to achieve the best approach in eliminating financial waste and enable right-in time job delivery (lekan 2015). The traditionally accepted objectives of procurement procedures and contract documents are to ensure that works are executed at the minimum cost that is consistent with the need to achieve a product of acceptable quality within an acceptable timeframe according to Rana Hennawy (2013).

A study points to problems in the procurement implementation side and concludes that 'Institutions are findings (e-procurement) implementation more complex, more expensive, and more time consuming than they originally envisioned' and that consultants have been widely criticized for overstating the business case for e-procurement (Conference Board, 2001). According to Risk Management Guide for DOD acquisition Sixth Edition (Version 1.0) August, (2006) Department of Defense, the role of the engineers in government establishment is to ensure that objectives relating to cost, quality and time are achieved. Mohamed and Tucker (1996) claims that the current practices and mechanisms of the construction industry are inherently inefficient, which inevitably leads to wastages, Lim's study on construction productivity in Singapore shows that the industry is perceived as a low-productivity sector.

- *Significance of the Study*

There are various surveys that highlighted plant and equipment procurement represents a critical connecting function between engineering and plant and equipment, as procurement of equipment provide the anchors for the construction facilities. Material costs represent a major portion of the total construction costs in Nigerian Universities and in turn, a high percentage of procurement expenses go into equipment purchases. Equipment procurement requires expediting on the manufacturers' progress to ensure on-time delivery and regular communication and occasional re-negotiation with the vendors. It is also generally agreed that successful procurement management can lead to improved performance in overall project cost and delivery. The two propositions demonstrate only two relevant aspects of major plant and equipment procurement and associated uncertainty management. To investigate the current practice in tertiary institutions, addition of buffer in proportion to the equipment delivery lead-time that may in fact contribute time waste from a supply chain point of view involving a constellation of supplier and his supply. The non-availability of proper need assessment, brand name and other specification related issues by the procuring entity also contribute to the time wastages, abandonment of project and supply of plant and equipment that can be rejected by end users which affect the procurement supply chain process. Procurement process is used inefficiently due to task fragmentation and problems in interfaces or boundaries along the supply chain. Current uncertainty management practices pay too much attention to prevent the negative impact of uncertainty, but give too little attention to exploit the positive aspect of uncertainty as opportunity. The theory of aggregation (Goldratt, 1997) of pluses and minuses of time variation may allow considerably shorter overall procurement lead-time. This research will assist the tertiary institutions in conducting an efficient plant and equipment procurement for value for money through stake holder participation in procurement activities and give a guide to achieving an effective and efficient system by knowing the challenges of procurement. With a view to improve productivity in engineering procurement projects, there are limited previous research efforts being devoted to developing new models, approaches and techniques. This research focused on improvements in major equipment procurement process. The procurement performance and delivery processes can be defined both at the corporate and project levels. These processes can be partly represented as corporate systems, policies and procedures which are influenced by the prevailing, functional operational activities.

III. METHODOLOGY

Secondary data for this research was obtained from comprehensive literature review, to gain the general overview of various procurement models and identifying barriers hindering the procurement of plant and equipment in tertiary institutions, while taking the objective of the research to serve as a basis for the preparation of questionnaire. The primary data was collected from stakeholders within the tertiary institutions, using questionnaire and with an interviews, all data collected were analysed using (SPSS) and related to the plant and equipment's procurement activities and design the communication procedure and methods. The design was refined through interviews with numerous managers, both users and suppliers, professionals involved in procurement and to check available documents. These interviews were also used to ensure that the questionnaire addressed the most

relevant issues in plant and equipment procurement technology. The questionnaire design was also pre-test the questionnaire design, before final version of the questionnaire was administered.

In this research, some procedures known as result based management techniques were employed. In this research cluster sample techniques were employed. Data collection was by the use of both primary and secondary data collection instruments. For harmonization of responses from questionnaires, personal interviews with stake holders and end users, procurements document reviews were conducted. The data were presented and analyzed using descriptive statistics. SPSS was involved the use of framework in procurement elements (goals, objective, outputs, outcomes) their causal relationship and the external factors that may influence success or failure of procurement. It was used to create a conceptual framework to show the relationship factors that were believed to impact or lead to target condition. The evaluation of the input, process, output, outcome, and impact to help identify strategic elements of procurement and causal relationships and the external factors that may influence success to provide a basis for monitoring progress achieved and evaluating procurement results by international financial reporting standard 2015.

Sample survey was carried out on several randomly selected establishment and relevant professionals to get information from all categories of Tertiary Institution within Kaduna state, professionals, contractors and consultants, client as regard to plant and equipment procurement. The barriers to introducing and implementing Plant and Equipment procurement model in the Tertiary Institutions. Using a scale 1 to 4, where 1 represents “never exist ”, 2 represents “rarely exist ”, 3 represents “sometimes exist ”, 4 represents “most of the times exist ”, indicate respondents assessment of the level of existence of each of the barriers within the Tertiary Institutions studied.

This research include oral interview 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.

The relevant procurement documents in tertiary institutions and published articles, books, seminar papers, interviews, were also tool used for data collection. The questionnaire was tested the pre-final version 30-40 individual tested on each subject and complete the questionnaires and be interviewed about the meaning of each item which was used as a rough evaluation of the content validity submission of documentation coordinating experts for appraisal of the adaption process to check steps followed and fully documented and a primary pilot testing was conducted. The research questions validated strictly the level of involvement of the respondents in planning and procurement, so as to ensure the validity of responses that would be obtained from them with the main focus of the inquiry being numerical, that is, the survey yields quantitative result.

This presents the results and discussion of the analyzed data collected for this study which was based on “development of a conceptual procurement models for plant and equipment in Tertiary Institution in Kaduna State”. 200 questionnaires were distributed, however, only 140 were correctly field and returned giving a response rate of 70%. For assessment of the objective, a summary of the investigated variables which was obtained in the data as our average mean, the practices as rated by the respondents is presented subsequently. For assessment, the four point scale was used for the rating. An average mean score of 3.2 was therefore used in this research as the decision for and against. A mean score of 3.2 and above would mean agreement while mean score lower than the 3.2 midpoint would imply disagreement. This midpoint (3.2) the mode as a measure of central tendency between all the data and was considered as the threshold in the range on all the items in providing solution for the research question It is possible to test for order correlation with ranked data. In accordance with Coombs (1953) the two main methods are Spearman's Ranked Correlation Coefficient and Kendall's Coefficient of Concordance. Using either procedure one can, for example, ascertain the degree to which two or more survey respondents agree in their ranking of a set of items. The researcher might wish to measure similarities and differences in the rankings of pesticide brands according to whether the respondents' farm enterprises were classified as "arable" or "mixed" (a combination of crops and livestock). The resultant coefficient takes a value in the range 0 to 1. A zero would mean that there was no agreement between the two groups, and 1 would indicate total agreement. It is more likely that an answer somewhere between these two extremes would be found. . However, table 1 is the presentation of the analyzed data the response to the questionnaire is however as stated in the tables from 1.2 to 3.0 the canonical correlation with detailed of research questions.

A. Descriptive statistic

Descriptive statistical analysis was employed in order to summarize data and show the distribution of variables based on their mean and standard deviation. This is done to achieve objective of understanding the levels at which each Institutions is or are and quantify the degree of inefficiency.

Level of Completion Cost and Duration	Frequency	Percentage
Completed within cost estimate and time	42	26.1
Completed outside cost estimate and time	72	53.7
Abandoned	26	20.2
Total	140	100.0

Table 1:- Plant and Equipment Procurement Cost and Completion

As observed in table table: 1, is showing the degree inefficiency with regards to plant and equipment procurement in terms of cost and duration in the Tertiary Institutions and in consultation to contracts documents, more than half of the procurements cost and contract completion are completed outside cost estimate and time, this is observed from the response of 53.7% respondents which constitute the majority. Furthermore, only 26.1% respondents pointed out that, project are being completed within cost estimate and time while 20.2% reported that project cost and contract completion are being abandoned. Thus, it can be said that more than half of the project cost for completion are being completed outside cost estimate and time. However, only one quarter are completed within cost estimate and time while roughly one quarter as well abandoned.

Level of Completion and Specification	Frequency	Percentage
Completed within specification	22	10.5
Completed outside specification	67	49.2
Rejected by client or Accepted but not in use	51	40.3
Total	140	100.0

Table 2:- Plant and Equipment Procurement Completion and Specification

As observed in table 2 from our interviews with the respondents about their experience with regards to plant and equipment past procurement in relation to completion cost and specification in the Tertiary Institutions and our consultation to contracts documents, 49.2% of the procurements are completed outside the specification and 40.3% are neither reject nor not in use by the end user which is clearly indicating that there is no value for money on the procurements, Furthermore,10.5% respondents pointed out that the procurement are completed within specification, this show a very high level of financial wastage.

Response	N	Mean	Std. Deviation
Client's interest in the use of the procurement models	140	3.2	1.424
Availability of well-trained individuals to act as facilitators	140	3.0	1.292
Government policy support through procurement Act 2007	140	3.2	1.233
Public awareness by the stakeholders on the benefits of the Plant and Equipment procurement models	140	3.0	1.112
Other stakeholders interest/support in the use of the Plant and Equipment procurement models	140	2.8	1.170
Commitment and cooperation of professional bodies to the implementation of the Plant and Equipment procurement models	140	2.9	1.209
Advantage of the Plant and Equipment procurement models over conventional process	140	2.9	1.252
Alignment of stakeholders objectives in the Institutions	140	2.8	1.143
Is the environment conducive for good procurement	140	3.1	1.272
Roles and Standard of procurement process	140	2.8	1.105
Just in time delivery and proper need assessment	140	2.9	1.174
Management commitments to new procurement technology	140	2.9	1.197
Contractors compliance to new technology in procurement	140	3.2	1.165
Are the procurement base on value for money	140	2.9	1.161
Supplier performance measurement and improvement	140	2.9	1.244
knowledge about Strategic sourcing	140	2.8	1.289
Assessing supply market knowledge	140	3.2	1.242
Idea about how Engineer can procure and install	140	3.2	1.306

Table 3:- Drivers/facilitators to procurement model introduction

Considering the threshold, table 3 above shows that, (a) clients have interest in the use of the procurement models and the support of government policy through procurement Act 2007 (b) contractors complies to new technology in procurement (c) assessing supply market knowledge and engineer to have idea on how to procure and install during plant and equipment procurement using direct procurements as a solution to procurement problems. All these response by the respondents are recorded with the mean score above 3.2 which means respondents agree to the questions. However, respondents disagreed to the following research questions from the questionnaire appendix (i): (a) availability of well-trained individuals to act as facilitators (b) public awareness by the stakeholders on the benefits of the plant and equipment procurement models (c) Other stakeholders interest/support in the use of the Plant and Equipment procurement models (d) commitment and cooperation of professional bodies to the implementation of the Plant and equipment procurement models.(e) advantage of the plant and equipment procurement models over conventional process (f) alignment of stakeholders objectives in Institutions . (g) conducive environment for good procurement (h) Roles and Standard of procurement process (i) Just in time delivery and proper need assessment (j) Management commitments to new procurement technology (k) procurement base on value for money (l) supplier performance measurement and improvement and knowledge about strategic sourcing. This is observed from the reported mean score which falls below 3.2 as the level of disagreement to these research questions.

Response	N	Mean	Std. Deviation
Plant and Equipment procurement schedule	140	3.4	1.064
Institutional resistance for change to Plant and Equipment procurement models process	140	3.4	1.207
Plant and Equipment procurement models knowledge	140	3.2	1.263
Communication problems	140	2.8	1.373
Failure to use Plant and Equipment procurement models in project execution	140	3.1	1.241
Misunderstanding of Plant and Equipment procurement models concept	140	3.0	1.108
Uneven commitment	140	2.9	1.207
Continuous procurement improvement	140	2.9	1.126
Inefficient problem solving procedure	140	3.1	1.223
Inadequate training and management support	140	3.1	1.159
Strategic sourcing	140	2.6	1.106
Appropriate skills and competencies	140	3.3	1.240
Incompatible Institutional structures and cultures	140	2.7	1.133
Incompatible procurement engineers	140	2.7	1.101
Plant and Equipment procurement and without risk mitigation	140	2.6	.969
Legal/Legislative considerations	140	2.7	1.119
Difficulties in establishing mutual objectives by all project team and members Institutions	140	2.7	1.071
Difficulties in the involvement of all key engineering stakeholders in procurement processes	140	2.7	1.187
Stakeholders resistance to introduction and implementation of new strategies in procurement	140	2.9	1.188

Table 4:- Barriers to plant and equipment procurement models implementation

Table 4 reported that, regarding respondents response to the research question on barriers hindering the implementation of plant and equipment procurements models based on the threshold of 3.2 as agreement and less than 3.2 as disagreement: (a) Improper Plant and Equipment procurement schedule (b) Adequate Institutional resistance for change to Plant and Equipment procurement models process (c) Plant and Equipment procurement models knowledge (d) Appropriate skills and competencies, this was observed from the reported mean score (≥3.2). However, the following are not considered as barriers to procurement (a) Communication problems, (b) Failure to use Plant and Equipment procurement models in project execution (c) Misunderstanding of Plant and Equipment procurement models concept (d) Uneven commitment, continuous procurement improvement, (f) Inefficient problem solving procedure (g) Inadequate training and management support (h) Strategic sourcing (i) Incompatible Institutional structures and cultures, Incompatible procurement engineers (g) Plant and Equipment procurement and without risk mitigation (h) Legal/Legislative considerations (i) Difficulties in establishing mutual objectives by all project team and members Institutions (j) Difficulties in the involvement of all key engineering stakeholders in procurement processes (k) Stakeholders resistance to its introduction and implementation of new strategies in procurement.

1	**Appropriate skills and competencies**	**Positive Barriers**
2	**Plant and Equipment procurement schedule**	
3	**Institutional resistance for change to Plant and Equipment procurement models process**	
4	**Plant and Equipment procurement models knowledge**	

Table 5:- Identified positive barriers

The table above show the identified positive barriers which was not available at the time of the study thus is a major influence to the plant and equipment procurement in tertiary institutions studied.

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	.80486	.87334	126.00	847.00	.829
Hotelling's	.98180	.88273	126.00	793.00	.808
Wilks	.41227	.87756	126.00	765.49	.819
Roys	26951				

Table 6:- Full canonical model on Barriers and cultural issues [Effect size (1-λ) = 0.588]

As reported barriers and cultural issues of respondent are not significantly relatedλ,F(126,765.5)=0.878,p>0.05 however, a large effect size i.e. the proportion of variance shared between the variable sets across all canonical functions of 0.588 is observed. Given the effect for each function, only the first function is considered noteworthy in the context of this study (27.1%) of shared variance.

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	1.01898	1.29204	114.00	720.00	.030
Hotelling's	1.30865	1.30100	114.00	680.00	.027
Wilks	.31656	1.29860	114.00	669.38	.028
Roys	.28946				

Table 7:- Full canonical model on Barrier and top management support [Effect size (1-λ) = 0.683]

B. Relationship between Barriers and Cultural Issues

As reported, barriers and cultural issues of respondents are not significantly related (Wilks's, λ, F(126,765.5)=.878, p > .05). However, a large effect size i.e. the proportion of variance shared between the variable sets across all canonical functions of 0.588 is observed (See, Table 1.4.2).

Given the effects for each function, only the first function is considered noteworthy in the context of this study (27.1% of shared variance). The remaining 6 functions only explained 18.0%, 14.0%, 10.0%, 5.0%, 4.0% and 3.0% respectively, of the remaining variance in the variable sets after the extraction of the prior functions. Therefore table below presents the standardized coefficient, structure coefficient and the squared structure coefficient on function (1)

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Variable	Function 1		
	Coef.	R_s	R_s^2%
Plant and Equipment procurement schedule	-0.21	-0.09	0.81
Institutional resistance for change to Plant and Equipment procurement models process	0.18	.019	3.52
Plant and Equipment procurement models knowledge	-0.16	-0.19	3.47
Communication problems	0.02	-0.07	0.47
Failure to use Plant and Equipment procurement models in project execution	0.11	0.12	1.46
Misunderstanding of Plant and Equipment procurement models concept	-0.37	-0.23	5.11
Uneven commitment	0.44	0.42	17.97
Continuous procurement improvement	-0.07	-0.08	0.60
Inefficient problem solving procedure	0.18	0.12	1.34
Inadequate training and management support	0.34	0.42	17.65
Strategic sourcing strategies	0.42	0.30	9.16
Appropriate skills and competencies	-0.27	-0.05	0.30
Incompatible Institutional structures and cultures	0.58	0.53	28.36
Incompatible procurement engineers	0.07	0.06	0.35
Plant and Equipment procurement and without risk mitigation	0.06	0.09	0.82
Legal/Legislative considerations	0.02	0.13	1.59
Difficulties in establishing mutual objectives by all project team members in the Institutions	0.01	0.07	0.48
Difficulties in the involvement of all key engineering stakeholders in procurement processes	-0.07	-0.03	0.11
R^2_c			27.0
Our Institutions members embrace changes which the Institutions undergo and the opportunities it brings easily	-0.13	-0.17	3.50
Our Institutions s do recognize and value the cultures of all other stakeholders participating in engineering procurement.	0.67	0.50	25.05
There are no complex and complicated bureaucratic procedures as policies in our Institutions.	-0.41	-0.37	13.75
We are prepared for cultural change and the adoption of mutually agreed culture as a result of collaborative working arrangement between our Institutions and others	0.70	0.49	24.08
Our current Institutions al structure provides an environment that suit the adoption of Plant and Equipment procurement principle in the management of projects	0.04	0.09	0.81
We do attend jointly organized social/cultural activities between procurement stakeholders	-0.45	-0.28	8.06
There is compatibility between our Institution cultures/structures with other participating Institutions s in our current and past engineering procurement	-0.13	-0.11	1.11

Table 8:- Canonical solution for cultural issues predicting Barriers of function 1 [$R_c^2\%$ > 10.0 are considered]

From the squared structure coefficient as reported in the primary criterion (dependent) variables are incompatible Institutional structures and cultures with 28.36%, inadequate training and management support with 17.7 % and Uneven commitment with 18%, all these have positive relating nature. However, from the predictor variables: Our Institutions s do recognize and value the cultures of all other stakeholders participating in engineering procurement, we are prepared for cultural change and the adoption of mutually agreed culture as a result of collaborative working arrangement between our Institutions and others are equally observed to be the primary contributing variables to the effect size on the canonical model, 28.08% and 25.05% respectively.

Thus, it can be said, the inability of Institutions is not recognizing and value the cultures of all other stakeholders participating in engineering procurement also the inability of respondents been prepared for cultural change and the adoption of mutually agreed culture as a result of collaborative working arrangement between Institutions s and others, might lead to barriers such as:

- Incompatible Institutional structures and cultures
- Inadequate training and management support
- Uneven commitment

C. Relationship between Barrier and Top Management Support

Between barriers and top management support, a statistical significant relationship is observed (Wilks'sλ, F (114,669.38) =1.299, p < .05). However, by taking (1-λ), a large effect size of 0.683 is observed(see,table 3). Having identified a noteworthy relationship between barrier and top management support, further examinations were made.

From the effects for each function, only the first two functions are considered fit (28.9% and 25.7% of shared variance) which explains 54.6% of the shared variance. The remaining 4 functions explained only 45.4% in total of the remaining variance in the variable sets after the extraction of the prior functions. Therefore table below presents the standardized coefficient, structure coefficient and the squared structure coefficient on function 1 and function 2.

Variables	**Function 1**			**Function 2**			
	Coef	**r_s**	**R^2_c%**	**Coef**	**r_s**	**R^2_c%**	**h^2%**
Plant and Equipment procurement schedule	-0.09	0.03	0.09	-0.02	0.11	1.21	1.3
Institutional resistance for change to Plant and Equipment procurement models process	0.12	0.07	0.49	-0.33	-0.23	5.29	5.78
Plant and Equipment procurement models knowledge	0.38	0.37	13.69	0.18	0.15	2.25	15.94
Communication problems	-0.15	-0.16	2.56	0.11	0.13	1.69	4.25
Failure to use Plant and Equipment procurement models in project execution	-0.37	-0.16	2.56	0.34	0.25	6.25	8.81
Misunderstanding of Plant and Equipment procurement models concept	-0.23	-0.17	2.89	-0.27	-0.30	9	11.89
Uneven commitment	0.38	0.20	4	0.20	0.14	1.96	5.96
Continuous procurement improvement	-0.35	-0.24	5.76	0.38	0.48	23.04	28.8
Inefficient problem solving procedure	0.43	0.43	18.49	-0.12	-0.10	1	19.49
Inadequate training and management support	0.06	0.12	1.44	-0.01	-0.02	0.04	1.48
Strategic sourcing	-0.03	-0.16	2.56	0.53	0.39	15.21	17.77
Appropriate skills and competencies	-0.01	-0.10	1	0.17	0.21	4.41	5.41
Incompatible Institutional structures and cultures	0.01	0.04	0.16	0.35	0.26	6.76	6.92
Incompatible procurement engineers	0.14	0.14	1.96	-0.06	0.13	1.69	3.65
Plant and Equipment procurement and without risk mitigation	0.07	0.15	2.25	-0.07	0.06	0.36	2.61
Legal/Legislative considerations	-0.55	-0.44	19.36	-0.35	-0.26	6.76	26.12
Difficulties in establishing mutual objectives by all project team members Institutions	0.21	0.22	4.84	-0.11	-0.17	2.89	7.73
Difficulties in the involvement of all key engineering stakeholders in procurement processes	0.23	0.27	7.29	0.25	0.24	5.76	13.05
Stakeholders resistance to introduction and implementation of new strategies in procurement	-0.01	0.07	0.49	0.03	0.11	1.21	1.7
Covariates			28.9%			25.7%	
Top Management support and commitment Our top management are interested in collaborative working arrangement	0.25	0.11	1.29	0.38	0.06	0.36	1.64
There is consistent and effective support from the top management which could encourage the introduction and implementation of collaborative Plant and Equipment procurement working arrangement	-0.46	0.05	0.26	-0.40	0.00	0.00	0.26
There is commitment from the top management to Plant and Equipment procurement working principles	-0.16	-0.33	10.61	-0.09	-0.22	4.80	15.40
Management willingness to provide financial and other relevant resources to ensure successful introduction of Plant and Equipment procurement procedures	-0.60	-0.01	0.01	-0.61	-0.03	0.10	0.11
We do assign appropriate duties to our staff which best ensure smooth achievement of procurement objectives	0.49	0.38	14.81	0.55	0.26	6.98	21.79
We have change management strategy that ensure smooth introduction of new techniques	0.23	-0.94	87.75	0.29	-0.88	76.60	164.36

Table 9:- Canonical solution for top management support predicting Barriers [$R^2_c\%$ > 10.0 are considered]

From Table 9 under function $1R_c^2\%$, one sees that relevant criterion variables were 'Plant and Equipment procurement models knowledge', 'inefficient problem solving procedure' and 'Legal/Legislative considerations' contributing to the synthetic criterion variable. Furthermore, with the exception of Legal/Legislative, all other variables' structure coefficients had the same sign, indicating that they were all positively related. Regarding the predictor variable set in Function 1, 'there is commitment from the top management to Plant and Equipment procurement working principles', and change management strategy that ensure smooth introduction of new techniques' have negative relating nature while assign appropriate duties to our staff which best ensure smooth achievement of procurement objectives' have positive relating nature. Moving to Function 2, the coefficients in Table 9 suggest that the only criterion variables of relevance were continuous procurement improvement and strategic sourcing, these are positively related. On the side of predictor variable, only change management strategy that ensure smooth introduction of new techniques' is considered as the constringe variable to the synthetic variable.

Thus, barriers such as ' Plant and Equipment procurement models knowledge', 'Continuous procurement improvement', 'Inefficient problem solving procedure' and 'strategic sourcing' are increasing which might be due to the decrease in 'commitment from the top management to support Plant and Equipment procurement working principles and 'change in management strategy that ensure smooth introduction of new techniques. However, result further show that, as the 'assigning of appropriate duties to staff which best ensure smooth achievement of procurement objectives' increase, 'Legal/Legislative considerations' decreases, this might be due to the fact that the duties assigned are to incompetent staff, hence legal/legislators loss interest in consideration.

IV. CONCLUSION

The overall respondent perception is that procurement models technologies and any other procurement strategy will become an important element in the management of plant and equipment procurement in Tertiary Institutions but the identified barriers need to be addressed. Except for a small group of Tertiary institution that have chosen to sit on the side and let others experiment, none of this institutions are actively involved in these technologies or solution strategies which may increase the barriers toward efficient procurement . Most organizations are participating in traditional ways of procurement and lacks of involvement of professionals do not allow them to be aware of new developments in the area and to develop the required capabilities to move into these technologies is also a barrier. A selected group, however, the group is ready for changing the traditional procurement technologies with the expectation of deriving the promised benefits ahead of institutions in securing funding.

RECOMMENDATION

Based on findings and analysis carried out in this research the researcher strongly recommends that:

- Further research should be carried out on software development to ease plant and equipment procurements using information technology.
- Professional engineers most be involved in plant and equipment procurement as consultant to reduce cost and delay in completion likewise, quality, risk control and management.
- From the researchers investigation it shows that the need for re-orientation of the members of Tertiary institutions with regards to plant and equipment's procurements.
- The review of Government policy on plants and equipment procurements in Nigeria with regards to direct procurements
- Creation of new procurement model that will enhance just-in-time delivery of projects and reduce procurement process timelines.

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