European Journal of Logistics Purchasing and Supply chain Management
Vol.2, No.1, pp.42-61, March 2014
Published by European Centre for Research Training and Development UK (www.ea-journals.org)

SUPPLY CHAIN MANAGEMENT AND COMPLETION OF PETROLEUM PROJECTS IN NIGERIA

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ABSTRACT: *Projects are executed for several reasons. The elements of risk and uncertainty inherent in virtually all projects explain why the project characteristics like duration, cost and quality cannot be precisely predicted. These risks, uncertainty and other factors are responsible for the delays or even abandonment of several projects for which Nigeria is notorious. Procurement of goods and services is a crucial determinant of whether or not a project will be completed. With the Nigerian Petroleum Development Company as case study, this paper examined how project completion depends on supply chain management, of which procurement is an essential subset and proxy. The study was questionnaire-driven, and the Statistical Package of the Social Sciences was used to analyse the results vide chi square test, correlation and cross-tabulation. The research found that strict adherence to SCM practices, will facilitate prompt completion of petroleum projects with its attendant benefits to the stakeholders.*

KEYWORDS: Completion, Just-in-time, Nigeria, Petroleum project, Procurement, Supply chain management

INTRODUCTION

The execution of any project, large or small, requires the injection of different mixes of essential inputs such as materials, utilities and labour. These inputs must be supplied to enable the execution and completion of any project. The procurement strategy, approach, practice, activity, policy, process, procedure, effort, or norm that is adopted by any organization would greatly determine if, when and how a project would be completed (Goldsby & Martichenko, 2005). . Essentially, procurement ensures that these inputs are accessed and supplied to the project site in a timely manner. Hence, the nexus between procurement and early and effective completion of projects can therefore not be over emphasized.

The formal definition of a project includes a specification of the expected duration of such projects, and by implication, the start and the end of the projects (Agbadudu, 1996; Kothari, 2008). A number of factors determine if a project would be completed on time. These factors include, but are not limited to, the procurement policy adopted by the organization, the level and consistency of funding, and the effectiveness of the pre-project efforts like the requisite planning and scheduling activities (Massie, 1986). Of all these factors however, procurement factors (procurement volumes, procurement costs, and procurement patterns) in particular, appear to have important implications for the final cost of completed projects, the time of completing the projects and the quality of such completed projects.

It is in view of the above that this work examines the relationship between procurement practices and the completion of projects. The paper particularly focuses on the petroleum industry with the Nigerian Petroleum Development Company (NPDC) in Benin City as a case study.

Statement of the research problem

The success of any organization in realizing its objectives depends on many factors, including good procurement practices. The completion time of projects can be prolonged as a result of waiting for materials to arrive at site. Effective procurement practices ensure that adequate plans have been put in place to guarantee that these materials arrive on time. If the materials arrive too early and are yet to be used, they are stored in the company's warehouse from where they will be picked up and deployed whenever the materials are needed. Such warehousing of materials certainly has cost implications. If however the needed materials arrive late, or are not delivered at all, the project would either be completed late or even stalled altogether. The above scenario sufficiently underscores the problem that this study attempts to address.

Research questions

The following research questions have been formulated to guide this study:

i. What relationship is there between right sourcing of materials and prompt completion of projects?
ii. How does proper procurement strategy influence project cost efficiency?
iii. What is the relationship between the selection of suppliers and prompt completion of projects?
iv. What is the correlation between specification of long lead materials and the completion of projects?

Objectives of the study

The general aim of this study is to find out the relationship between procurement practices and completion of projects, while the specific objectives are to:

i. Ascertain the relationship between right sourcing of materials and prompt completion of projects;
ii. Confirm the association between proper procurement strategy and project cost efficiency;
iii. Establish the relationship between selection of suppliers and prompt completion of projects; and
iv. Verify the correlation between specification of long lead materials and the completion of projects.

Research hypotheses

i. H_{O1}: There is no significant relationship between right sourcing of materials and prompt completion of projects.
ii. H_{O2}: There is no significant association between proper procurement strategy and project cost efficiency.
iii. H_{O3}: There is no significant relationship between selection of suppliers and prompt completion of projects.
iv. $H_{O4:}$ There is no significant correlation between specification of long lead materials and the completion of projects.

Scope of the study

There are a host of local players that include both public sector and private petroleum companies. The impact of the public sector oil companies by far overshadows that of the private oil companies. The public sector oil companies include the NNPC and the following subsidiaries: National Petroleum Investment Management Services (NAPIMS); Nigerian Petroleum Development Company (NPDC); The Nigerian Gas Company (NGC); The Products and Pipelines Marketing Company (PPMC); Integrated Data Services Limited (IDSL); Nigerian Liquefied Natural Gas Limited (NLNG); National Engineering and Technical Company Limited (NETCO); Hydrocarbon Services Nigeria Limited(HYSON); Warri Refinery and Petrochemical Company Limited (WRPC); Kaduna Refinery and Petrochemical Company Limited (KRPC); and Port Harcourt Refining Company Limited (PHRC).

The Companies listed above may be divided into four groups, viz: refineries and gas companies (WRPC, KRPC, PHRC, NGC, NLNG), a marketing company (PPMC), companies involved in providing services (NAPIMS, IDSL, HYSON), and Companies involved specifically in the execution of projects (NETCO, NPDC). Only the last two companies are relevant to our current research efforts. Of these two, "NETCO was established in December 1988 as a joint venture between Nigerian National Petroleum Corporation (NNPC) and American Bechtel Inc….The main object of establishing NETCO was to fulfill NNPC's strategic vision of developing in-country oil & gas engineering capability" (NETCO, 2004:2). NPDC on the other hand, established in November 1988, "is a wholly owned indigenous exploration and production subsidiary of the Nigerian National Petroleum Corporation (NNPC)….It was established… to retain the identity of an exploration and production company as the national oil company" (NNPC, n.d.: 12). NPDC is to profitably operate a petroleum exploration and production business both nationally and inter-nationally, using indigenous manpower and current technology. .

Significance of the study

This research is significant as it affects and is affected by a number of the people and organizations or stakeholders. These stakeholders include the customers or clients whose goals and objectives would have been achieved; the contractor with their suppliers and sub-contractors who would be elated to have successfully executed and completed another project thus enhancing their corporate image and profile; the investor (banks or other financial institutions including shareholders) who are thus more confident of having value for the investments; the

government that would have been encouraged by the enhanced employment opportunities in addition to having wider spectrum for internally generated via taxes ; as well as the host community whose lot would have been improved vide employment of their youths and provision of addition facilities. Equally important are staff working on the project. They have a stake in the outcome because project success or failure can (apart from contributing to job satisfaction) have implications for their future employment and careers (Lock, 2008).

Structure of the study

The rest of this work is structured as follows: The next section examines relevant literature that are related to the dependent variable (project completion) as well as the independent variable (procurement practices).The relationship between these two variables is then discussed. The succeeding section thereafter looks at the methodology adopted in the study. This includes a definition of the population, the sample and the sampling technique. This is followed by a consideration of the data presentation, the data analysis, and then the discussion of findings. The last section concludes the work and makes recommendations.

LITERATURE REVIEW/THEORETICAL UNDERPINNING

This section searches out previous works that have been undertaken to understand the factors that affect the dependent variable (project completion), and the independent variable (procurement practices). How the former is affected by the latter is also perused. In effect, the review of relevant literature should help to establish the possible relationships between these variables.

Types and classifications of projects

All projects small or large generally share common features such as risk, uncertainty, resource (especially funding) constraints, limit on the duration or time of completion, and possible abandonment before completion. Project abandonment is a common feature in Nigeria, and such failures are witnessed in all sectors of the economy. Different types of projects present different completion challenges. This section therefore attempts to distinguish between different project types.

Reynolds (2013) identifies the following three major project types:

i. Civil Engineering, Construction, Petrochemical, Mining, and Quarrying;
ii. Manufacturing Projects; and
iii. Management Projects.

In his opinion, projects in the Civil Engineering, Construction, Petrochemical, Mining, and Quarrying category are easily visible and incur special risks and problems of organisation. They also often require massive capital investment, and they deserve rigorous management of progress, finance, and quality. He adds that for very large industrial projects the funding and resources needed are often too great for one contractor to risk or even find, thus requiring the participation of many different specialists and contractors, often requiring the forming of a consortium or joint venture company. Petroleum sector projects easily fall into this category.

As for Category two, the manufacturing projects, these are aimed at producing a piece of equipment or machinery - a specially designed hardware which could even be purpose built, and could be an intermediate product for other subsequent manufacture (Reynolds, 2013).

The third class of projects arise when companies relocate their headquarters, develop and introduce a new hardware, launch a marketing campaign, or generally engage in any operation that involves the management and co-ordination of activities to produce an end result that is not identifiable as a visible, tangible creation or an item of hardware or construction. He identifies the six stages of a project as: definition, initiation, planning, execution, monitoring and control, and closure.

While Lock (2008.) classifies projects into four categories, his first three classes are similar to those of Reynolds (2013). He however adds a fourth category identified as 'Projects for Pure Scientific Research'. He notes that Pure Scientific Research projects are a special case that should not be confused with research and development projects. He reveals that these projects occasionally result in dramatically profitable discoveries, but could also consume enormous amounts of money over many years, yet yielding no practical or economic result. These projects according to him carry the highest risk because they attempt to extend the boundaries of human knowledge. He observes that these project types are not necessarily mutually exclusive. This is because projects of different categories may be associated with each other in a company's project programme or project portfolio.

Project completion

A project has been described as a "one-shot set of activities with a definite beginning and ending point(s)" (Agbadudu, 1996:1). He posits that in several business circumstances, a number of diverse activities need to be undertaken in a definite sequence in order to execute and complete the project. He notes further that some of these activities may be carried out in parallel that is they are performed simultaneously, while others may be done in series, in which case they are carried out in tandem, that is, one after the other. He however reveals that in reality, the set of activities that constitute a project is typically an amalgamation of both series and parallel elements.

Massie (1986) infers that project execution requires the "designing, planning, coordination, controlling and making decision(s)" of various types at different times in order to complete the project (p. 173). He further discloses that project execution requires the implementation of a sequence of activities in a bid to accomplish the project, but remarks that such sequencing activities are usually part of the well known network analysis techniques which are often applied to manage projects that are concerned with optimizing some measure or performance of the system such as the total completion time of the project and the overall cost. Massie (1986) finally explains that the technique is useful for describing the elements in a complex situation such as is encountered in routine project executions. Confirming the importance of network analysis in the execution of projects, Sivarethinamohan (1964) describes network analysis as "a logical extension of the famous Gnatt chart" and that "network analysis is being widely used as a tool of project management planning and control" (p.415). Schellenberger (2007.) indicates that "Network analysis is specially suited to projects which are not routine or repetitive and which will be conducted only once or a few times" (p.306).

Sivarethinamohan (1964) notes that 'Describing the Project' and 'Diagramming the Network' are two important prerequisites to executing and completing the project. He observes that the project manager must initially describe the project in clearly and easily understood terms. This description should include identifying the project's end-point(s), and that the details should just be enough to ensure making the right 'scheduling and resource allocation decisions'. Diagramming the network on the other hand "requires establishing the precedence of relationships between the activities ,… and thus shows the dependencies between the activities in a project. He posits that diagramming the network helps to schedule activities, to plan the optimum use of resources, and also gives information about the timing of each activity. Citing Lake (n.d) he identifies that diagramming the network makes it possible to:

i. Arrange activities so that the project can be completed in the shortest time;
ii. Make the best use of resources;
iii. Predict how long the whole project will take; and
iv. Construct a detailed schedule (p.418)

It is noted that the "Two most important popular forms of this (network analysis) technique now used in many scheduling situations are the Critical Path Method (CPM) and the Programme (or Project) Evaluation and Review Technique (PERT)" It is realized that "PERT now assists a business manager in planning and controlling a project. It allows a manager to calculate the expected total amount of time, the entire project will take to complete, at the stage of formulation and planning a project and at the same time highlights the critical or the bottleneck activities in the project so that a manager may either allocate more resources for them or keep a careful watch on such activities as the project progresses". Furthermore, it has been stated that "A network is a series of related activities which result in some product (or service)" (Kothari, 2008, p.428). While an activity is said to represent some actions and as such is a time consuming effort necessary to complete a particular part of the overall project, an event is seen as a specific instant of time that denotes the beginning and end of an activity.

Every network analysis requires the formulation of a problem a statement of the project objectives. The starting point of the formulation is the specification of the data which include the following: the definition of the project or the end result; identification of the activities necessary to achieve the end result of the project; estimation of the time required for each activity, and any other special constraints, such as limitations on the time starting date; evaluation of the particular activity or the amount of labour involved; and the logical inter-relationship between events and activites. The major objectives of these techniques is to minimize total completion time, to minimize total costs involved, and to minimize idle resources. (Agbadudu, 1996: p.3)

While Bronson and Naadimuthu (1982) consider a project to be a set of activities which need to be "performed in a specific sequence to completion", they add that "an activity is a task to be executed using time and resources", with the objective of project management being to minimize the total project time subject to resource constraints (p.231). Eck (1976) on the other hand sees a project as "a task or effort that is usually, but not always, of a nonrepetitive nature", and that "the completion of a substantial project often requires the scheduling and coordination of many related activities" (p.44).

Lucey (2002) indicates that network analysis is a generic name for a family of related techniques developed to aid management to plan and control projects. These techniques show the inter-relationships between jobs or tasks which make up the overall project and clearly identify the critical paths of the project. They can provide planning and control information on the time, cost and resource aspects of a project. Network analysis is likely to be of most value where projects are:

i. Complex, i.e. they contain many related and interdependent activities; and/or
ii. Large, i.e. where many types of facilities, high capital investments, many personnel are involved; and/or
iii. Where restrictions exist, i.e. where projects have to be completed within specified time or cost limits, or where some or all of the resources (material, labour) are limited (374).

From the above, it is apparent that a project is a series of related activities which results in some product or service (Kothari, 2008; Ochonma, 2010). Such activities are usually based on a defined sequence or a scheduling program (Sivarethinamohan, 1964; Eck, 1976; Bronson and Naadimuthu, 1982), and are generally of a non-routine or repetitive nature (Schellenberger, 2007); Eck, 1976). The completion of such projects requires management planning and control (Sivarethinamohan, 1964; Lucey, 2002), and important variables that define the performance of the projects, and by implication the effectiveness of the procurement effort, include the total completion time (Bronson and Naadimuthu, 1982; Massie, 1986; Agbadudu, 1996; Lucey, 2002); the overall project cost (Massie, 1986; Agbadudu, 1996; Lucey (2002)), as well as the specification of the requisite resource inputs (Sivarethinamohan, 1964; Bronson and Naadimuthu, 1982); Agbadudu, 1996; Lucey, 2002).

Procurement and supply chain management practices

In this section, attempt is made to sufficiently describe and define procurement and related terms and concepts. The terms purchasing, Just-In-Time (JIT) delivery of items and Supply Chain Management (SCM) are often used in close association. These terms or concepts need to be differentiated, and the factors that impinge on this independent variable also examined.

The place of procurement in organisations may be accentuated by the fact that purchasing accounts for over half of most organizations' total monetary expenditures (Encyclopedia of Business, 2013). Indeed the Chartered Institute of Purchasing and Supply (CIPS) asserts that many organisations now have as much as 80% of their turnover comprising bought-in goods and services (CIPS, n.d.). Simply put, procurement is the acquisition of goods, services or works from an external source. It is proper that the goods, services or works are appropriate and that they are procured at the best possible cost to meet the needs of the purchaser in terms of quality, quantity, time, and location. Procurement practices may therefore be seen as the sum total of the strategies, approaches, practices, activities, policies, processes, procedures, efforts, or norms that are put in place in order to ensure that effective and efficient procurement of inputs is achieved to enable timely completion of the project in question. While a policy may be regarded as a 'statement of management that guides decision making', a strategy is regarded as 'a line of action chosen by management to achieve results' (Inegbenebor, 2013). Strategy has also been defined as the "the *direction* and *scope* of an organization over the long-term***:*** which achieves

advantage for the organization through its configuration of resources within a challenging environment, to meet the needs of markets and to fulfil stakeholder expectations" (Johnson and Scholes, 2001:10). It has also been considered as the techniques that an organization uses to achieve its goals and objectives (Oladipo, 2007).

Procurement issues have been sufficiently examined by a number of researchers. Some authorities perceive procurement as the technique that an organization puts in place to get the needed materials from the right source, using the right supplier, at the right time, at the right price, with the right quantity, at the right quality and with the right specification (Goldsby and Martichenko, 2005; Afemikhe, 2011).

Strategies, policies and processes that encapsulate these important ingredients would help to ensure early and timely completion of projects with the consequent benefits. Indeed, good procurement practices are aimed at early and timely completion of projects; value for money for all transaction; efficiency and effectiveness; fairness; transparency; accountability; human capacity development, motivation and deployment; local content and capacity development; attainment of national and international development goals; establishment of internationally accepted standards of business practice and ethics; and modernization and optimization of key procurement systems, tools, processes and strategies.

The **Encyclopedia of Business notes that** purchasing and procurement as a single factor is used to denote the function of and the responsibility for procuring materials, supplies, and services. This source further notes that, from the point of view of professional capacity, it is more common to refer to the process of purchasing and procurement as “supply management".
Historically, early in the twentieth century, discussions in the industry appeared to focus on purchasing practices. Within the second decade of the century in the USA, The National Association of Purchasing Agents was founded. This Association was later renamed ‘The National Association of Purchasing Management’ (NAPM). This Association eventually metamorphosed into the present Institute for Supply Management (ISM).
With the advent of the two world wars, more attention focused on the tasks and functions of purchasing personnel. About the early 1970s, purchasing personnel became increasingly more connected with purchasing systems, especially as materials became a part of management’s strategic planning.

In the 1980s, the concept of just-in-time purchasing was introduced into purchasing practices. This concept highlighted supplier quality, quantity, timing, and dependability, and turned purchasing into a core instrument of competitive strategy
By the 1990s the expression "Supply Chain Management" was introduced. This replaced the terms "purchasing," "transportation," and "operations," with purchasing becoming responsible for acquiring the right materials, services, and technology from the right source, at the right time, in the right quantity (Encyclopedia of Business, 2013). It has been argued that “SCM is much more than materials movement and transportation” (Quiett, 2002:40), and that it is a new way of conceptualising business relationships to ensure success, arising from effective cooperation between firms that have networked in the supply chain (CIPS: Positions on practice, 2009).

It may be noted that since procurement is an integral part of SCM, in this study the former may be used as a proxy for the latter.

Strengths and weaknesses of SCM systems

SCM systems are characterised by some strengths and weaknesses:

The strengths include the fact that SCM:

i. Provides novel concepts of business relationships that ensure success of the cooperation between firms far and beyond just the movement and transportation of materials (Quiett, 2002:40)
ii. Provides radical new opportunities to create marketplace advantage by leveraging supply channel partnerships, information and communication technologies, and the knowledge and innovative capabilities of the entire chain's resources (Yeo and Ning, 2002).
iii. Besides providing for the flow of products, and also providing a channel for the flow of customer requirements (CIPS: Positions on practice), it improves both efficiency (cost reduction) and effectiveness in a strategic context (Quiett, 2002).

The weaknesses of SCM include the fact that:

i. The concept of SCM is often confused with logistics, even though logistics is only a part of the SCM approach (Lambert and Cooper, 2000).
ii. The use of complicated terminologies tend to limit management's understanding of SCM concepts and their practical application (Ross, 1998).
iii. The practices most widely applied in today's traditional SCM focuses on optimising individual links in the chain, an approach that is inadequate in today's competitive world (Tompkins, 2000).

Drivers and essence of SCM systems

It has been revealed that there are three primary drivers of effective SCM. These are:

i. real time information sharing;
ii. co-ordinated procurement processes in the whole chain; and
iii. a collaborative attitude among all of the chain members (Yeo and Ning, 2002).

Similarly, three essences of SCM as:

i. enhancing trust among supply chain members;
ii. re-engineering the business process to build a networked enterprise model; and
iii. employing IT/IS to accelerate information flows both intra and inter-organisations.

Performance Measurement of SCM systems

The ability to measure the variables of interest in any study helps to enhance the reliability and validity of such studies. The following are some suggestions on how to measure the SCM for which we may sometimes use procurement as proxy:

i. Some of the metrics for benchmarking supply chain performance include inventory turns, availability of goods, and SKU system costs (Slone et al., 2007).
ii. Other metrics include Cost to serve (determined on an activity basis), and total assets employed, including both physical and working capital (Slone et al., 2007).

Slone et al. (2007:8) have suggested a 7-question survey for evaluating the level of supply chain leadership in a company and whether SCM is being leveraged as a core competence.

Key elements of SCM and steps in the SCM process

The five key elements of SCM that some authors have identified include:

i. Strategy - aligning the supply chain with business goals,
ii. Process - describing the activities involved and the links between them,
iii. Model - showing structures, roles and responsibilities,
iv. Information - IT supporting operations,
v. Performance - a balanced set of indicators (CIPS: SCM & networks).

The steps required to successfully operate SCM, include implementing the right training and structure; choosing the right team; rightly aligning with the strategic plan; piloting SCM and achieving balance (Quiett, 2002; Chopra and Meindl, 2009; Slone et al., 2007).

a. Lysons and Farringdon (2006) posit that if an organisation is to successfully adopt SCM then it needs to key into the following four essential requirements in SCM: Connectivity – ensuring inter-organisational collaboration by enhancing the capability to exchange information with external supply chain partners;
b. Integration - the combination or coordination of separate functions or processes to enable them to interact seamlessly;
c. Visibility - the ability to access relevant data in terms of its relevance and importance to the supply chain; and
d. Responsiveness - the ability to react quickly and effectively to customers.

Implementation of SCM

In this respect, Slone et al., 2007 recommend the following:

i. Picking the right leaders by adopting the best-and-brightest principle which ensures that every employee including senior supply chain executives are exposed to the fundamentals of SCM, through formal education, significant experience, or both.
ii. Initiation of benchmarking and selection of metrics by applying best-practice benchmarking on key elements of supply chain performance, and setting goals for metrics based on benchmarking.
iii. Setting incentives by establishing rewards to encourage suppliers and employees to support the goals of the supply chain.
iv. Understanding how a firm is currently using technologies, and asking challenging questions before adopting new tools.
v. Making supply chain considerations the core components of operations, sales and marketing planning, as well as contract negotiations with customers and partners.

The NNPC and NPDC

The NNPC with a population of about 15,000 people nationwide undertakes exploration activities, and has operational interests in refining, petrochemicals and products transportation and marketing. The NNPC manages the joint venture (JV) agreements between the Nigerian government and the Multinational Oil Companies (MNCs), and through them conducts exploration and production (E & P) activities. The NNPC and/or its subsidiaries equally have Production Sharing Contracts (PSCs) with some of the MNCs. (Nwokeji, 2007, NNPC, 2002).

The NNPC is divided into the following six directorates:

i. Exploration and Production Directorate consisting of five companies
ii. Refining and Petro-chemical Directorate made up of four companies
iii. Engineering and Technology Directorate consisting of six companies

iv. Commercial and Investment Directorate made up of five corporate entities
v. Finance and Accounts Directorate consisting of three companies, and
vi. Corporate Service Directorate consisting of four companies

Relevant to this study is the Exploration and Production (E & P) Directorate which consists of the following five companies:

a. National Petroleum Investment Management Services (NAPIMS)
b. Nigerian Petroleum Development Company (NPDC)
c. Integrated Data Services Limited (IDSL)
d. Nigerian Gas Company (NGC)
e. Crude Oil Sales Department (COSD).

The Nigerian Petroleum Development Company Limited (NPDC) a wholly owned commercial subsidiary of the NNPC was set up in 1988 to engage in the exploration and production (E and P) business nationally and internationally. NPDC took over operation from Mobil in 1988, and has been assigned five (5) concessions in the Niger-Delta. NPDC went into a number of Service Contract (SC) agreements, as well as Production Sharing Contracts (PSC) with some of the MNCs.

RESEARCH METHODOLOGY

This section explains the procedures adopted in the course of the research work to ensure that the research objectives are met. It makes copious reference to, and leverages on the methodology, data collection and analysis adopted by Areloegbe (2013).

Description of the population

Of the five subsidiaries in the Exploration and Production (E & P) Directorate, the NPDC is the one most involved in executing projects. The population of study is therefore derived from this directorate. Besides, the departments in this directorate that are directly involved in procurement and/or project execution activities are the Supply Chain Management Department and other end users in the Drilling Department, the Petroleum Engineering Department, Technical Services Department, and the Joint Venture Division. The exact number of staff in these listed sub-units is unknown but has been estimated to be about three hundred (300). These therefore constitute the population of study (Nwokeji, 2007, NNPC, 2002).

Description of the sample and the sampling method

In circumstances like this when the population size (in this case the exact number of staff in the operations division) is unknown, the literature suggests that a sample of one hundred (100) and above is a good representation of the population being investigated (Hill, Barley and McDougall, 2003).

A well-structured questionnaire was the main instrument for collecting the primary data. To ensure adequate representation of the procurement department, and the departments actually involved in the project execution process, questionnaires were given to these departments in proportion to their assumed populations. Simple random sampling approach was used to select samples from the earlier defined population of study. This was achieved by writing the names of staff from each selected department on a piece of paper. The papers were folded and dropped

inside a basket and shaken together. An employee was appointed to pick one hundred (100) of these names at random. To make sure that only staffs who are directly involved in procurement and oil and gas projects complete the questionnaires, care was taken to ensure the selection of a reasonably large number of staff from the procurement as well as the end-user departments. The number of questionnaires administered to those sampled in the different departments mentioned above reflected the relative proportion of the staff strength in the departments of interest. This sampling method should enhance the integrity and reliability of the study.

RESULTS/FINDINGS

Data was collected using questionnaire instruments. Applying SPSS software, the data collected from the study was subjected to ratio, Chi-square and correlation analyses. The study examined the relationship between supply chain management (SCM) and the completion of petroleum projects in Nigeria, with the Nigerian Petroleum Development Company (NPDC) as case study. Leveraging on the work of Areloegbe (2013), and recognizing that procurement practices, strategies and processes are integral parts of SCM, these elements of procurement were used as proxies for SCM. Ratio analysis, Chi square test and correlation analysis were used to test the hypotheses formulated.

Presentation of results

One hundred (100) questionnaires were administered, out of which eighty (80) were returned. A summary of the data received from the respondents is shown in Table-1.

Table 1: Summary of data collected

S/N	Department	No. of Questionnaire Issued	No. of Questionnaire Returned
1	Exploration Department	15	15
2	Drilling Department	20	20
3	Petroleum Engineering Department	15	15
4	Supply Chain Management Department	30	25
5	Joint Venture	10	3
6	Technical Services Department	10	2
	Total	**100**	**80**

Source: Areloegbe (2013).

Analysis of results

The results of the ratio analysis, chi square tests and correlation analysis are highlighted hereunder.

Ratio and chi square analyses

Applying ratio-analysis to the data collected, it was found that a significantly larger proportion, 75 out of 80 respondents constituting 93.75%, agreed that right sourcing positively affects prompt completion of petroleum projects. This position is further confirmed by the Chi-square

(χ^2) computation where the calculated χ^2_{cal} is 31.78, while at a 5 degree of freedom (df) the critical or table values of χ^2_{tab} for 1%, and 5% levels of significance are 15.09 and 11.07, respectively.

Since, χ^2_{cal} (31.779) > χ^2_{tab} (15.09 or 11.07, df= 5, p < 0.000), we reject the Null Hypothesis (H_O) which states that there is no significant relationship between right sourcing of long lead items and prompt completion of oil and gas projects but instead accept the Alternative Hypothesis (H_A) that there is significant relationship between right sourcing of long lead items and prompt completion of petroleum projects.

It is observed that right sourcing is a strategic initiative to develop sourcing strategies that are not only efficient and cost effective but that enhance the level of customer satisfaction and the maximization of shareholders wealth. Right sourcing literally means choosing the correct source, and it implies selecting the best way to procure a good or service and deciding whether a company is best served by performing a business requirement in-house or by contracting it to a third party.

Applying ratio-analysis to the data collected, it was found that a significantly larger proportion of respondents, 72 out of 80 constituting 90%, agreed that proper strategic planning positively affects cost efficiency of petroleum projects. From the Chi-square (χ^2) analysis, the calculated χ^2_{cal} is 80.01, while at 9 degrees of freedom (df) the critical or table values of χ^2_{tab} for 1%, and 5% levels of significance are 21.67 and 16.92, respectively.

Since χ^2_{cal} (80.01) > χ^2_{tab} (21.67 or 16.92, df = 9, p < 0.000), we reject the Null Hypothesis (H_O) that there is no significant relationship between proper procurement strategic planning and cost efficiency of petroleum projects but instead accept the Alternative Hypothesis (H_A) which states that there is significant relationship between proper procurement strategic planning and cost efficiency of petroleum projects. This assertion is confirmed by the fact that strategic procurement planning provides options for achieving organizational objectives and goals within the set time and increases an organization's potentials for enhanced cost efficiency (Aliyu, 2001).

The result of the chi-square cross tabulation test carried out to test the hypothesis that there is no relationship between selection of suppliers and prompt completion of petroleum projects showed that there is a significant relationship between the selection of suppliers and prompt completion of oil and gas projects. This fact is also confirmed by the revelation that when suppliers that have technical knowledge of the required materials are selected, the supplies of the materials are facilitated. This in turn leads to prompt delivery of such materials and early completion of the projects can be guaranteed (United Nations Procurement Handbook, 2001).

Table 2: Summary of data collected

Variables	Statistics	Procurement right sourcing	Early completion	Technical knowledge	Reduction of cost	Supply according to specification	Inability to deliver on schedule	Effective procurement strategy
Procurement right sourcing	**Pearson Correlation**	1	0.290**	0.533**	0.532**	0.505**	-0.358**	0.607**
	Sig. (2-tailed)		0.009	0.000	0.000	0.000	0.001	0.000
	N	80	80	80	80	80	80	80
Early completion	**Pearson Correlation**	0.290**	1	0.227*	0.344**	0.296**	0.099	0.415**
	Sig. (2-tailed)	0.009		0.043	0.002	0.008	0.385	0.000
	N	80	80	80	80	80	80	80
Technical knowledge	**Pearson Correlation**	0.533**	0.227*	1	0.551**	0.508**	-0.564**	0.738**
	Sig. (2-tailed)	0.000	0.043		0.000	0.000	0.000	0.000
	N	80	80	80	80	80	80	80
Reduction of cost	**Pearson Correlation**	0.532**	0.344**	0.551**	1	0.610**	-0.451**	0.664**
	Sig. (2-tailed)	0.000	0.002	0.000		0.000	0.000	0.000
	N	80	80	80	80	80	80	80
Supply according to specification	**Pearson Correlation**	0.505**	0.296**	0.508**	0.610**	1	-0.495**	0.565**
	Sig. (2-tailed)	0.000	0.008	0.000	0.000		0.000	0.000
	N	80	80	80	80	80	80	80
Inability to deliver on schedule	**Pearson Correlation**	-0.358**	0.099	-0.564**	-0.451**	-0.495**	1	-0.535**
	Sig. (2-tailed)	0.001	0.385	0.000	0.000	0.000		0.000
	N	80	80	80	80	80	80	80
Effective procurement strategy	**Pearson Correlation**	0.607**	0.415**	0.738**	0.664**	0.565**	-0.535**	1
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	
	N	80	80	80	80	80	80	80

Source: Areloegbe (2013).

Remarks: 1. **Correlation is significant at the 0.01 level (2-tailed), and
. 2. *Correlation is significant at the 0.05 level (2-tailed)

Arising from the above finding, the null hypothesis that there is no significant relationship between the selection of suppliers and prompt completion of petroleum projects is therefore

rejected and the alternative hypothesis which states that there is a significant relationship between the selection of suppliers and prompt completion of petroleum projects is accepted.

Correlation analysis

Pearson correlations coefficients derived from the correlation matrix in Table-2 helped to decide the level of association or relationship between the variables of interest. Generally, the values of the correlation coefficient (r) indicate the strength of the relationship between the variables as follows:

$0.10 \leq r \leq 0.29$ suggests weak relationship;
$0.30 \leq r \leq 0.49$ indicates moderate correlation; and
$0.50 \leq r \leq 1.0$ implies strong association.
The direction of the relationship is indicated by the sign of 'r'. Hence the range: $\mathbf{-1.0 \leq r \leq +1.0}$

From Table-2, the correlation result agrees with the a priori expectation that there is good and positive correlation between Procurement right sourcing on one hand and each of Technical Knowledge, Reduction of Cost, Supply according to specification, and Effective Procurement Strategy on the other hand. The negative relationship between Procurement right sourcing and Inability to Deliver on Schedule also conforms to a priori expectations. The low correlation (r = 0.290) between Procurement Right Sourcing and Early Completion of Projects is however surprising and may need to be investigated further.

DISCUSSION OF FINDINGS

Hypothesis one (correlation)

This hypothesis indicates that there is no significant correlation between right sourcing of long lead items and prompt completion of petroleum projects. From Table-2, it is however seen that the relationship is positive and significant at the 1% level (since sig. = 0.009). The strength of the relationship however appears to be weak with r= 0.290.

In view of the above, we reject the null hypothesis and accept the alternative hypothesis which is that there is significant relationship between right sourcing of long lead items and prompt completion of petroleum projects. The organization however needs to improve on its right sourcing strategy in order to obtain optimal results.

Hypothesis two (correlation)

Correlation analysis was used to test not only the hypothesis that there is no significant association between proper procurement strategy and project cost efficiency, but it was also used to investigate the strength of the relationship between these variables. From Table-2, it is however seen that the relationship is positive and significant at the 1% level (since sig. = 0.000), and the strength of the relationship is also moderate with r= 0.505.

From the foregoing therefore, we reject the null hypothesis and accept the alternative hypothesis which states that there is significant relationship between proper procurement strategy and project cost efficiency of petroleum projects; a decision that agrees with that arrived at with the chi square analysis.

Hypothesis three (correlation)
Correlation analysis was used to test the hypothesis that there is no significant relationship between the selection of suppliers and prompt completion of projects and to confirm the strength of the relationship between these variables. From Table-2, it is however seen that the relationship is positive and significant only at the 5% level (since sig. = 0.043), and the strength of the relationship is also weak since r= 0.227.

Hypothesis four (correlation)
Using correlation analysis, the null hypothesis that there is no significant correlation between specification of long lead materials and the early completion of petroleum projects was examined. The strength of the relationship between these variables was also checked. From the correlation matrix in Table-2, it is seen that the relationship between the variables is positive and significant at the 1% level (since sig. = 0.008). The strength of the relationship is however weak, with r= 0.296.

From the foregoing, the null hypothesis is rejected while the alternate hypothesis which states that there is significant relationship between the specification of long lead materials and completion of petroleum projects is accepted. The result confirms the a priori expectation that the more accurately the specifications of long lead materials are detailed the earlier projects are completed.

The research findings are that:

i. There is significant relationship between right sourcing of materials and prompt completion of petroleum projects;
ii. There is significant correlation between proper procurement strategic planning and cost efficiency;
iii. There is significant connection between the selection of the right suppliers of long lead materials and completion of petroleum projects; and
iv. There is a strong relationship between specification of long lead materials and prompt completion of petroleum projects.

IMPLICATION TO RESEARCH AND PRACTICE

The above findings and discussions have vital implications for research and for practice.
Based on the findings of this research, the following are hereby recommended:

1. That corporate organizations in the petroleum industry should strive to reinforce or else put in place effective SCM practices in their project execution efforts, as these have tangible cost benefits;
2. That managements of companies executing projects in the petroleum sector should endeavour to select suppliers that have technical knowledge of long lead materials as this policy will promote ability to deliver on schedule, and guarantee prompt completion of projects; and
3. That proper and well-monitored contract be put in place to ensure compliance with regards to the right specification of materials and intangibles. This policy should facilitate prompt completion of projects

S/N	Variable	Range of r	Value of r for Inability to Deliver
1	Procurement right sourcing	(0.290 to 0.607)	-0.3580
2	Early completion	(0.099 to 0.227)	0.099
3	Technical knowledge	(0.227 to 0.551)	-0.564
4	Reduction of cost	(0.344 to 0.610)	-0.451
5	Supply according to specification	(0.296 to 0.610)	-0.495
6	Inability to deliver on schedule	(-0.358 to -0.564)	0.099
7	Effective procurement strategy	(0.415 to 0.738)	-0.535

Table 3: Range of values of correlation coefficient 'r' (Derived from Table 2)

Table 3 shows that 'reduction of cost' has the highest positive impact on all other variables since its r-value varied from 0.344 (moderate impact) to 0.610 (high impact). It also has the highest inverse relationship having r-value equal to -0.564 with 'inability to deliver on schedule'. The importance of this in practice is that managers should continuously seek ways of cutting costs if target completion times for projects are to be achieved. From a research view point, researchers need to survey the potentials of applying various cost reduction models to project scheduling. Also from Table 3 the 'Early completion' variable has the lowest positive impact on all other variables with its r-value ranging from 0.099 to 0.227, which indicates quite low strength. Its relationship with 'inability to deliver on schedule' is however positive but very low (r = 0.099).Researchers have a responsibility to examine this low correlation between 'Early completion' and other project execution variables with a view to greatly improving same. In the field, practitioners, particularly in the Nigerian context, need to take advantage of the vast tools that are currently available to chart their project efforts right from the conception (planning stage) to project delivery (commissioning/handover of project).

For the other variables, their r-value ranges have the following mean values (r_{mean}): Procurement right sourcing r_{mean} = 0.4485; Technical knowledge r_{mean} = 0.389; Supply according to specification r_{mean} = 0.453; and Effective procurement strategy r_{mean} = 0.5765. These values only indicate moderate strength implying that a lot still needs to be done both from thepoint of view of research and field work.

CONCLUSION

It was realized from the research that proper procurement strategies when put in place will not only be cost efficient but will also help the organization to readily achieve its set objectives and goals. Focus on reducing the delays in completing projects would help to reduce the problem of white elephant and abandoned projects that are so prevalent in Nigeria. They would also enhance job creation and employment opportunities. Besides, they will drastically reduce the resources spent on heavy litigation processes (Al-Khalil and Al-Ghafly, 1999; Phua and Rowlinson, 2003; Williams, 2003). This development would also increase the spectrum of beneficiaries- the organization that experiences growth; the government that receives more revenue from tax paid by the organization; the host community that reaps 'dividends' from the companies exercise of corporate social responsibility; stakeholders (specially financiers) whose investment is now safer with enhanced opportunities of earnings from the investment; and the nation at large.

RECOMMENDATIONS/FUTURE RESEARCH

Based on the findings of this research, the following are hereby recommended:

1. That corporate organizations in the petroleum industry should strive to reinforce or else put in place effective SCM practices in their project execution efforts, as these have tangible cost benefits;
2. That managements of companies executing projects in the petroleum sector should endeavour to select suppliers that have technical knowledge of long lead materials as this policy will promote ability to deliver on schedule, and guarantee prompt completion of projects; and
3. That proper and well-monitored contract be put in place to ensure compliance with regards to the right specification of materials and intangibles. This policy should facilitate prompt completion of projects.
4. That the copious scope exists for researchers to find out how much of SCM practices are actually undertaken in the key industries of the economy and what to do enhance SCM practices in these industries. The way to domesticate extant SCM practices should be of research interest to the academia. The so called 'Nigerian factor' could be an important variable in such future research works.

ACKNOWLEDGEMENTS

This article derives from the unpublished thesis written by the co-author and submitted in October, 2013, to the Department of Business Administration as part of the requirements for the award of the Master of Business Administration (MBA) degree of the Benson Idahosa University, Benin City, Nigeria.

The authors would also like to acknowledge the contribution of Mr. A. E. Odion of the Computer Department of the University for his support particularly with regards to the data analysis.

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