PAPER TITLE: ECONOMIC APPRAISAL AND CONTRACT MANAGEMENT PROCESS: ENGINEERING PROCUREMENT AUDITS

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CONTENTS

1.0: INTRODUCTION – ENGINEERING PROJECT AND CONTRACTS

2.0: LITERATURE REVIEW- ECONOMIC IMPACTS’ EVALUATION

3.0: ENGINEERING DESIGN, SPECIFICATIONS, AND STANDARD

4.0: PROCUREMENT PROCESS AND CONTRACT FORMALITIES

5.0: CONCLUSION; ECONOMIC APPRAISAL

**1.0: INTRODUCTION – ENGINEERING PROJECT AND CONTRACTS**

Engineering contract, is a method of executing projects because of the associated huge responsibility of ensuring that, the client requirements (ie, economy and taste), are satisfied, and according to engineering standards and specifications necessary for the project. These enables the procurement a routine process in engineering projects, of ensuring competency, safety, reliability and resource management. The client/project sponsor must also ensure, that the financial supports to undertake the project successfully is possible and made available during the project execution by the contractor, similarly the contractor implementing the project task must be equipped to do the work according to standard and engineering specifications.

The procurement methods, are used in the selection of competent consultants and contractors, with adequate skills, manpower and resources for specific projects, using the general guide-lines and/or according to contract formalities and statement of work (SOW). Also, to prevent instance of substandard work in project task execution, adequate measures are necessary to ensure quality work and cost effective management, which includes testing, monitoring and evaluation of work progress during the project implementation.

**1.1: PROCUREMENT AUDITS;** The systemic and independent analysis of an engineering process, to determine, if the activities and the result of the inputs to these activities, corresponds to the planned standard of work, and also it’s a measure of the task (work) execution effectiveness, and the principles used (ie, the efficiency). In Finance, an audit involves the systematic examination of books, statutory records, accounts, documents, and vouchers of an organization to determine, how far the financial statements, as well as, non-financial records (ie,planned, proposed expenditure,) present a true and fair view as expected. It also ensures, that the account books and financial records are properly maintained, expressed and documented as required by law and the projects.

**1.2: PROCUREMENT PERFORMANCE;** Procurement is the act of acquiring, buying, of goods, services or works from an external source (out-sourcing). It is expected that the goods, services or works are appropriate, and that they are procured at the best possible cost, that will meet the needs of the project/program in terms of location, quantity, quality, and, time. The institute of supply management (ISM), defines procurement as an organizational function that includes specification development, value analysis, supplier market research, negotiation, contract administration, inventory control, and storing systems etc. Similarly, ISM consider purchasing as the major function of an organization that is responsible for acquisition of required materials, services and equipments.

Procurement Performance, is the administrative methods of evaluating the procurement process, and which involves managing the ordering, receipt, and approval or items used, and in Financial analysis, it relates the budget sum to the expenditure cost of activities and work task within a project.

 **PERFORMANCE =** $\frac{Expenditure}{Budget}$ **x 100%**



**Fig. 1.1: AUDIT PROCESS/PROCEDURES**

**1.3: PROJECT TASK AND ACTITVITIES –** The descriptions of basic terms in project execution evaluation.

**STATEMENT OF WORK (SOW);** A statement of work, is a formal document that describes the work activities, deliverables, and the timeline the contractor, will use to execute a specific project work. It usually includes detailed requirements of the contract and pricing methods (BoQ/BEME), with standard regulatory terms and conditions of the project work.

**TASKS/SUBTASKS;** A task is an activity within the project, that must be accomplished within a defined period of time, usually a deadline to work towards work-related goals. A task can be broken down into subtasks, which should also have a defined start and end time-period or deadline of completion. Tasks can be linked together to create dependencies, (especially in determining the efficient means of execution), and which implies some task will rely on the outcome of others to commenced.

**DELIVERABLES AND WORK PACKAGE;** A work package (WP), is a subset of a project that can be assigned to a specific part for execution within certain time period. Deliverables are tangible or intangible object that can be produced within a project, which often are known as actitivities or the process of identifying the specific schedule of work that will be performed, to execute the project.

**WORK BREAKDOWN STRUCTURE (WBS);** This is a hierarchical incremental decomposition of the project into phases, deliverables and work parkages. It is a tree structure which shows a subdivision of effort required to achieve an objective within the project. WBS is developed by starting with the end objective and successfully subdividing it into manageable components in terms of size, duration and responsibility.

**PROJECT WORK SCHEDULE;** The project schedule, is the tool that communicates what work needs to be performed, which resources of the organization will be used, and the time frames in which that work will be performed, and it must also indicate all work task, associated with the delivering of the project according to the time schedule. The project schedule assist in the planning of construction work activities, financial resources, and labour (skilled/unskilled) necessary for the project.

**2.0: LITTERATURE REVIEW – ECONOMIC IMPACTS’ EVALUATION**

**2.1: White, H (2009),** advocated the application of theory-based approach to impact evaluation as means to improve policy relevant to impacts of infrastructure development, using the following six evaluation principles,.

(1) Establish the context, including the social, political and economy of the intervention

(2) Identify the sub-groups within the development, and adjust the sample size and observations to account for the levels of disaggregation, and measurement.

(3) Detailed evaluation of impact using credible counter-factual analysis, which is a comparison between events, and what would have happened in the absence of an intervention.

(4) Detailed factual analysis of links in the causal chain. The factual knowledge is justified affirmation of an event at present and existing, etc.

(5) Mixed methods of analysis are necessary for detail impact evaluation (ie,the combination of quantitative and qualitative methods).

**2.2; Theory Based Impact Evaluation**; It involves, mapping out the causal chain from inputs to outcomes, and determining the impacts by testing the following assumptions, which suggests that, interventions are often active and requires a greater degree of participation among the beneficiaries, and therefore, behavioral change is a pre-requisite for effectiveness measurement. The evaluation methods, employs both quantitative and qualitative data collection, and which are useful in estimating the aggregate benefits of the intervention. The methods of qualitative data collections are focus groups, indepth interview, participatory public appraisal (PPA), and field visits etc.

**2.3: ECONOMIC IMPACT ANALYSIS (EIA),** The EIA, examines the effect of an event on the economy in a specific area, and measures the changes in business revenue, profits, income and/or job opportunities. Economic impact analysis is commonly conducted, when there is public concern about the potential impacts of a project or policy, and it will typically measures or estimates the change in economic activity between two scenarios, eg, one assuming the economic event occurs, and the other assuming it does not occur (ie the counterfactual scene). Economic impact analyses, usually employ either of the following two methods for determining impacts.

**INPUT-OUTPUT MODELS (I/O MODEL).** A quantitative economic technique that represents the interdependencies between different branches of an economy, and it depicts inter-industry relationships within the economy, showing how input from one industrial sector may become input to another industrial sector.

**ECONOMIC SIMULATION MODELS;**These are more complex econometric and general equilibrium models, and it accounts for everything the I/O model can implement, and also can be used to forecast the impacts caused by future economic and demographic changes. Econometric, is the application of statistical methods to economic data, that aims to give empirical content to economic relations. It is the quantitative analysis of actual economic phenomena based on the concurrent development of theory and observations.

**3.0: ENGINEERING DESIGN, SPECIFICATIONS AND STANDARDS**

Engineering design, requires the application of scientific principle to ensure that structures and components are stable and in static equilibrium of rest (ie, ƩF = 0 ), at the position of loading. This therefore, deserves adequate knowledge of the structural system and principles, and also ensures they are implemented using the guides of engineering design codes and standards for structures and components, and bearing the basic objective in structural analysis and design, that is, to produce a structure capable of resisting all applied loads, without failure during its intended life of functional and service period.

Design specification, is a detailed document about the characteristics of a specific project, that determines/describes the criteria to be used during the implementation and construction. It is a document that is derived from the routine process of analysis, engineering design and experience, and its an important document used in construction of infrastructures

**3.1: ENGINEERING STANDARDS AND SPECIFICATION**; Technical standards are established requirements in regard to engineering systems, and are usually a formal document that provides uniform engineering or technical criteria, methods, processes procedures, and practices. A technical and engineering standard may be developed privately (as specifications for work through engineering design etc.) or by corporation, regulatory body, military etc. as criteria and tolerable limits, and which are determined through continuous investigation and observations of performances and characteristics of engineering materials, components and structures.

**4.0: PROCUREMENT PROCESS AND CONTRACT FORMALITIES**

The procurement process aim, is to assist in the selection of appropriate and competent contractors/consultants for an engineering projects, through the methods of tendering and competitive bidding, and which allows for adequate participation of experienced and qualified professionals in the field.

**4.1: PROJECT BIDDING;** The process of submitting proposal (or, tender) to undertake, or manage the undertaking of a project. The process commences, with understanding the concept of the project, cost estimates from the project’s detailed drawings and specifications, and construction materials and labour estimates.

BID-SOLICITATION; is the process of making public and advertise the construction data to interested parties, such as consultants, project/construction managers, contractors, and the general public. The process enable project owners to give project information to large group of competent practitioners to enable competitive opportunities, in an attempt to solicit/requests for expression of interest in a project

TENDERING; The process of making an offer, bid or proposal or expressing interest in response to an invitation or request to tender or bid for projects. The tender, is treated as an offer to do the proposed work for a certain amount of project cost (firm price), or a certain amount of profit (cost reimbursement, or cost plus). Tenders are generally, based on a “bill of quantities”, “bill of engineering measurement and evaluation, BEME”, or other specifications, which will enable the tenders to attain higher levels of accuracy and certainty as measured, and also must include the “statement of work” (SOW), which is a formal document that describes the work activities, deliverables and scheduled timelines for the execution of the project.

**4.2: CONTRACT FORMALITIES**These are essential requirements in basic engineering contracts according to the law of contract, obligations and trust. It emphasis that, agreements will be unenforceable unless they meet certain forms prescribed by statute, such as by put the transaction in writing (ie, to make formal/official), for it to be enforceable, since this could serve as a clear evidence of the agreement.

The characteristic components of Contract Formalities includes,

. CAPACITY TO CONTRACT; For a contract to be valid, the parties involved must have the required capacity, which will enhance and could encourage the understanding and consent to basic terms of the contract. Capacity in an engineering contract, is a measure of the strength (eg, corporation, personnel etc.), responding to an offer (ie, construction work). Essential measure of strength includes, Skills, Exposure, Experience, Age, Goodwill, Competency (Professional capacity), Finance, and Collaterals, etc.

. MUTUAL CONSENT OF CONTRACTING PARTIES, This is determined through the processes of offer and acceptance. The mutual consent in an agreementrequires,that the service expected can be delivered with utmost good faith.( in Latin “uberrimae fidei.") and according to an expected quality and work standard. The acceptance of an offer, is an indication that the contractor is competent to execute the engineering task, hence the “trust and confident”, of the client is developed to commence the project.

. PERFORMANCE/OBLIGATORY; An obligation is an action that someone is required to take, whether legal or moral, which can incur a penalty for non-fulfillment.. And also in labor relation theory, obligation is a moral or legal duty to perform certain work according to an expectation.

. LEGAL FORMALITIES FOR AGREEMENTS BETWEEN CONTRACTING PARTIES; These are the bureaucratic processes, which are necessary to formalized agreements, and also are necessary, requirements for legal compliance and law enforcement in case of defaults and contract breach.

**4.3: COUNTERFACTUAL AND RISK/BENEFIT ANALYSIS;** Risk analysis is a technique used to identify and assess factors that may jeopardize the success of a project or from achieving its goal. The technique may also help to define preventive measures to reduced the probability of these factors from occurring and identifying counter measures to successfully deal with these constrains, when they develop to avert possible negative effects on the competitiveness of the project/program.

A counterfactual (CF), is a conditional containing an if-clause, which is contrary to fact. The basic idea of counterfactual theories of causation is that, the meaning of causal claims, can be explained in terms of counterfactual conditionals of the form, “if A had not occurred, C would not have occurred”. Thus, it is a significant aspect in impact evaluation, which assesses the changes that can be attributed to a particular intervention, such as a project, program and/or policy.

CONGNITIVE BIAS; This is a systematic pattern of deviation from the norm or rationality in judgment, whereby inferences about people and situations may be drawn in an illogical method. Individuals create their own “subjective social reality”, from the perception of the input, which if not the objective input, may dictate their actions and behavior.

**5.0: CONCLUSION – ECONOMIC APPRAISAL EA**

**5.1; The economy,** is defined as a social domain that emphasizes the practice, discources, and material expressions associated with the production, use and management of resources (ie, land, labour, capital and entrepreneurship). Therefore, an economic indicator/performance index, is an essential tools in evaluating economic activities, especially the aggregate effects on global economy/National budgets. An economic indicator, is a statistical data about an economic activity (eg, budgets and expenditure), and which describes the economic performance and also enables the prediction of future performances. The economic indicators, includes measurable index, earning reports, and economic summary.

**5.2; Economic appraisal,** is a decision methods used in project evaluation, program orpolicy, that takes into account a wide range of costs and benefits, denominated in monetary terms or for which a monetary equivalent can be estimated. It is a systemic process for examining alternative uses of resources, which focus on assessment of needs, objectives, options, costs, benefits, risks, funding, affordability and other factors.

EA, is a key tool for achieving value for money and satisfying requirements for decision making, financial management and accountability. The following techniques are useful in the processes,

. Cost-Benefit Analysis; ie, assigning monetary value to the measure of effects and events.CBA; is defined as a measurable and desirable outcome, or the result from an action, investment, project, and resources etc. It is therefore an indication of convenient and comfortable spending on a project.

. Cost Effectiveness Analysis; also known as Sensitivity analysis, is a method of predicting the outcome of a decision given a certain variables (eg, limited resources). It compares the relative costs and outcomes (effects) of different courses of possible actions.

. Scoring and Assigning weight to Preferences; Preference is the ordering of alternatives based, on their relative utility, which usually encourages optimal choice.

**5.3; THE ENGINEERING COST**: The aggregate sum of all incurred expenses, which also is the actual cost of executing a project. Comparatively, in economics’ theory, the opportunity cost, which also is known as alternative cost, is the value of a best alternative, while making a decision, during choice analysis amongst several mutually exclusive alternatives, and considering the project taken as the best choice. This means that, the project executed is a “preference”, relative to others within the global and/or competitive economy and budget supply. Also, since the project’s procurement is a preferential choice, the expenditure therefore must be accurately justified, through adequate financial management, audits, and the engineering methods of ensuring quality and reliable products and services.