

# **COST ENGINEERING PRACTICE IN 21<sup>ST</sup> CENTURY NIGERIA**

**BY**

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## ***ABSTRACT***

Sound cost engineering thinking, planning, design, estimating, scheduling, cost plan, control, negotiation, project management, administration and execution are the bases for the realization of good engineering projects and services, which are the cutting edge of twenty first (21<sup>st</sup>) century technology

The global economic meltdown and the fall in oil price have placed both Government and private enterprises in a predicament of declaiming financial resources. Total cost engineering management (TCEM) becomes more critical for full / optimized realization of projects from initial conception to final completion.

It maximizes the return on investment (ROI) during the entire life cycle of projects.

This paper defines a professional cost engineer and his methodical works and concludes that cost engineers will prove very useful for the Bureau of Public Procurement (BPP) – Public Procurement act (due process) procedures/implementations, customs destination inspections, engineering process / construction, privatization projects, oil and gas with the attendant benefit to the Nigerian economy.

## **WHAT IS ENGINEERING?**

Engineering is the discipline, art, science and profession of acquiring and applying technical, scientific and mathematical knowledge to design and implement materials, structures, machines devices, systems and processes that can safely realize a desired objective or invention for the benefits of mankind.

## **WHAT IS COST ENGINEERING?**

**Cost engineering** is an area of engineering practice concerned with the "application of scientific principles and techniques to problems of cost estimating, cost control, business planning and management science, profitability analysis, project management, and planning and scheduling.

The Cost engineer is a qualified professional dedicated to total cost management over the life cycle of a project, facility or manufacturing operation.

## **THE DISCIPLINE OF COST ENGINEERING**

The discipline of 'cost engineering' can be considered to encompass a wide range of cost related aspects of engineering and programme management, but in particular cost estimating, cost analysis/cost assessment, design-to-cost, schedule analysis/planning and risk assessment.

## **THE FUNDAMENTAL TASKS**

These are fundamental tasks which may be undertaken by different groups in different organizations, but the term cost engineering implies that they are undertaken throughout the project life-cycle by trained professionals utilizing appropriate techniques, cost models, tools and databases in a rigorous way, and applying expert judgment with due regard to the specific circumstances of the activity and the information available. In most instances, the output of a cost engineering exercise is not an end in itself but rather an input to a decision making process.

## **WHAT IS FINANCIAL MANAGEMENT?**

Financial Management can be defined as:

The management of the finances of a business / organization in order to achieve financial objectives

Simply put:

Financial management is the art and science of money management. Financial management is important at all levels of human existence because every entity needs to look after its finances.

## **WHY COST ENGINEERING IS IMPORTANT**

Engineering and Construction Industry may be classified in economic terms as a capital goods industry because the benefits of its products cut across all spheres of human endeavours.

No one who has responsibility for managing major, complex, high-tech programmes with a high development content will dispute the importance of the cost and financial aspects of the work, or the particular difficulty of assessing and controlling costs.

Cost remains a constant source of concern in virtually all engineering or construction projects as shown thus:

- When considering different technical options.
- In establishing budgets
- In conducting cost/technical trade-offs
- In the submission and evaluation of price proposals
- In preparing for contract negotiations and
- In assessing the cost impact of introducing changes to existing designs.

It is vital to understand that the huge investment on engineering and construction industry demand comfort, reliability economy and Total Cost Engineering Management (TCM) from initial conception to final completion. This is to ensure that as far as reasonably practicable that the project is realized with Quality, Time and Cost targets.

### **THE QUESTION(?)**

The question is:

- How to tackle these aspects to be best able to predict or assess cost?
- How to minimize the risk and impact of overspends against budgets? And
- How to ensure that there is an appropriate balance between technical aspects and the related costs?

With these goals in mind, cost engineering essentially attempts to capture practical experience in a systematic way, to analyze that experience in order to develop tools and models which, together with expert judgment, can be applied under different circumstances to make predictions of likely cost or assessments of whether a proposed cost is reasonable.

## **RISK ASSESSMENT**

An assessment of the likely cost and risk is made taking account of past experience with similar activities and the assessment of associated trends, and of any changes in working practices and productivity gains.

## **THE CHALLENGE**

Cost engineering extends beyond: Estimation and Assessment of cost.

This is due to the fact that these capabilities can also be applied to support the aim of achieving more cost-effective results. Awareness of the related cost is a key factor in the choice of approaches and design solutions, but traditionally the roles of establishing design solutions and of assessing the related costs have been separated both in time and responsibility. Typically, in the first instance the designer produces a design solution, which is then passed to other functions such as manufacturing and testing to add their inputs, and finally ends up with the estimator to calculate the cost of implementing this solution. Unfortunately, this is likely to be too late, as these exercises are often subject to time pressures that do not allow for a solution that is too expensive to be changed in a controlled way, which would normally require the design loop to be repeated.

## **WHAT IS THE INTERNATIONAL COST ENGINEERING COUNCIL (ICEC)?**

The International Cost Engineering Council (ICEC) is a nonpolitical and nonprofit worldwide organization which was founded in 1976 with the object of promoting cooperation between national and multinational cost engineering, quantity surveying and project management organizations worldwide for their mutual wellbeing and that of their individual members.

ICEC member societies are located in more than 40 countries and have chapters or sections in many additional countries.

ICEC does not have individual members.

Participation in ICEC affairs is accomplished through membership in one of the ICEC affiliated societies. Persons interested in membership, should apply to one of the ICEC member associations which serve their nation of residence.

Member countries of ICEC include the Association for the Advancement of Cost Engineering (AACE International) of the United States of America founded in 1956 and the Association of Cost Engineers, United Kingdom founded in 1961 to mention but a few.

## **THE INSTITUTE OF APPRAISAL AND COST ENGINEERS (IA&CE) NIGERIA**

The Institute of Appraisers and Cost Engineers (IA&CE) a division of the Nigerian Society of Engineers is a member institute of the International Cost Engineering Council (ICEC). The IA&CE is dedicated to 21st Century Total Cost Engineering Management.

## **MAJOR OBJECTIVES OF ICEC**

To encourage promote and advance the sciences and arts of the cost engineering, quantity surveying and project management for the public good, worldwide.

## **INTERNATIONAL NETWORK**

ICEC is a worldwide confederation of cost engineering, quantity surveying and project management societies which acts to promote worldwide exchange of cost engineering and project management information and experiences.

## **OVERVIEW OF COST ENGINEERING**

The purpose of cost engineering is to determine standard cost for execution of works, quotations, cost control, cost assessment and cost management. Cost must be calculated based on the engineering facts by account. Allocation and distribution in most cases are not valid.

Sound mathematics and correct procedures are necessary for developing cost estimating systems, however it is more important for cost managers and users of cost information to understand how costs are developed.

The Key functions of Cost Engineering (CE) as defined by the International Cost Engineering Council (ICEC) are as shown thus:

To provide independent, objective, accurate and reliable capital and operating cost assessments usable for investment funding and project control; and

- To analyze investment and development for the guidance of owners, financiers and contractors.



- Estimates of capital or asset costs including development costs
- Estimates of operating and manufacturing costs through an asset's life cycle
- Risk assessment and analysis
- Trending of scope and cost changes
- Decision analysis
- Financial analysis (e.g net present value, rate of return etc)
- Project cost Control
- Appraisals of existing assets
- Project analyses, databases, and benchmarking
- Planning and Scheduling
- Siting studies etc.
- Productive and investment needs assessment
- Facility management needs assessment
- Project feasibility and budget assessment
- Cost management
- Procurement management
- Contract administration
- Whole-life appraisals;
- Quality audits
- Value management and
- Dispute resolution

***The Diverse Works of Cost Engineers include:***

- Cost Estimating
- Cost Control
- Cost Planning
- Conceptual Studies
- Value Engineering
- Constructability Studies
- Project Cash Flow Projection
- Independent Check Estimates
- Liquidated Damages Assessment
- Project Cost Variation
- Project Cost Fluctuation
- Negotiation Support
- Review of Contract time extension request
- Claims Management/Avoidance
- Construction Management
- Project Management
- Customs Destination Inspection
- Insurance Assessors/Loss Adjusters
- Project Scheduling
- Risk Analysis/Management
- Life Cycle Cost Analysis
- Value Analysis/Management
- Planning/Budget Estimates
- Profitability Analysis of Engineering Project and Process

***The CE provides Information by:***

- Estimating costs and analysis risk
- Trending and controlling costs and assessing design; and
- Documenting costs

***These are interdependent and feed back to each other. They include:***

- Analysing cost
- Assessing Design
- Assessing Risks
- Trending costs
- Advising clients
- Managing cash flows
- Preparing feasibility analyses and
- Assessing life-cycle costs

Key objectives of cost engineering are to arrive at accurate cost estimates and to avoid cost overruns. The broad array of cost engineering topics represent the intersection of the fields of project management, business management, and engineering. Most people have a limited view of what engineering encompasses. The most obvious perception is that engineering addresses technical issues such as the physical design of a structure or system. However, beyond the physical manifestation of a design of a structure or system (for example, a building), there are other dimensions to consider such as the money, time, and other resources that were invested in the creation of the building. Cost engineers refer to these investments collectively as "costs".

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Cost engineering then can be considered an adjunct of traditional engineering. It recognizes and focuses on the relationships between the physical and cost dimensions of whatever is being "engineered". Cost engineering is most often taught at universities as part of construction engineering, engineering management, and related curricula because it is most often practiced on engineering and construction capital projects. Engineering economics is a core skill and knowledge area of cost engineering.

### **Cost-Estimating Methods**

There are many different approaches and methods for estimating or assessing costs, all of which have advantages and disadvantages under particular circumstances. Factors determining the most appropriate methods includes but not Limited to:

- The nature of the activity to be costed or assessed
- The degree of familiarity of the organization with the item or activity to be costed
- The extent to which reference can be made to previous exercises
- The availability of reliable design information
- The time available to prepare the estimate.

#### ***Other key aspects are:***

- The stage in the overall cycle at which the estimate is being made
- The specific customer requirements in terms of presentation of cost details

- The degree of accuracy required.  
Usually several methods will be applied as a “sanity check” on means to verify that the results are valid. The most common approaches to estimating/cost assessments includes but not limited to:
  - ❑ ***"Rule of thumb" approach***
  - ❑ ***Detailed "grass-root" or "bottom-up" approach***
  - ❑ ***Analogy***
  - ❑ ***Competitive supplier proposals***
  - ❑ ***Parametric approach***

## **CRITERIA FOR COST EFFECTIVENESS**

Stakeholder want their project to be cost effective. Every client and every project will have different criteria for cost- effectiveness. These criteria engender a relationship between the underlisted factors:

- Design
- Material
- Quality
- Expenditure
- Time
- Special Requirements of the project

## **LIFE CYCLE COSTING**

The 21st century engineering design concept is now based on the economic life cycle cost, in preference to the cheapest possible constructional design, hence Cost Engineers must give careful consideration to the underlisted three “Rs”

- ❑ Running Cost
  - ❑ Repairs Cost
  - ❑ Replacement Cost

These should be considered alongside the cost of initial construction work. Annual cost associated with utilities, operations and owners budget. It should also be remembered that the savings which arise are not just from the running cost but also from the maintenance, and renewal costs.

In terms of life cycle costing, for a building to function effectively and efficiently over time, careful consideration must be given at the design stage for the need to maintain and replace installations.

## **COST ENGINEERING PRACTICE IN NIGERIA**

Cost Engineering practice in Nigeria is semi-hijacked by non engineers as defined by the institute of Appraisers and Cost Engineers and /or non “Accredited Cost Engineers” (AI&CE) a division of the Nigerian Society of Engineers hence the controversy over which field of the profession should attend to works pertaining to costing/cost management of engineering and processes.

I can say with all sense of responsibility that the hijacking of cost engineering practice by non engineers was occasioned by exigency, but it must be emphasized that it is time we stopped using the element of exigency to continue with flawed professional process.

The depth of cost engineers professional training and knowledge as afore-discussed and the awareness/ understanding of complex and latest 21st Century engineering design and systems puts the “Accredited Cost Engineer in the right perspective for full realization of Cost Engineering Practice.

## **RECOMMENDATIONS FOR THE IMPROVEMENT OF COST ENGINEERING PRACTICE IN NIGERIA.**

- Federal Government Technical ministries, departments, parastatals, Agencies, MDA's, the armed forces, Police, paramilitary agencies, the universities, oil and Gas companies and private sectors are encouraged to utilize the professional services of "Accredited Cost Engineers" for Engineering Economy / full realization of their engineering/process projects.
- Be certain that projects cost estimates are adequate and flexible to cope with potential changes in the market.
- Costs should be calculated based on facts and transactions rather by allocations and distributions.
- Cost Engineers in will prove very useful for the Bureau of Public Procurement (BPP) – Public Procurement act (due process) procedures/implementations
- The Cost Engineers training and professional experience will prove very useful for Federal Government – Customs Destination Inspections and the on going Privatization exercise in the country with the attendant benefits to the Nigeria economy.
- Cost Engineers will also prove very useful for the Insurance Industry as the engineering Assessors / Loss Adjusters.
- Monitoring of Cost Engineering curriculum in tertiary institutions in line with 21st Century technology.



Professional training for the certification of “Accredited Cost Engineers” (ACostE) and continued professional Development (CPD) must be intensified by the institute of Appraisers and Cost Engineers (IA & CE) (a division of the Nigerian Society of Engineers for the advancement of the science, art and practice of cost engineering in Nigeria.

Let me finalize by wishing you a COST quality time in all your projects.

**Thank you and God bless you all**

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