

Overview of Cost Engineering Principles: Creating the Awareness for Effective Project Administration

By

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Abstract

The transformation agenda of the government of the Federal Republic of Nigeria seeks to define new and better ways of doing business with a view of reducing cost of projects and governance. However, it has been observed that the eventual cost of most engineering projects has always been on the increase. This is more with government owned projects. It was discovered that the reason for this is that most engineers do not apply the principles of cost because they do not fully understand these principles and have to depend on the judgement of a quantity surveyor. Quantity surveyors unfortunately do not understand engineering principles and so their judgement is often in error, thereby creating a high variation between the estimated and actual cost of a project. A cost engineer however understands and applies sound engineering and cost principles to bring out a project estimate that varies very little from the actual project cost. However, not many engineers are aware of the available services of a cost engineer in regards to project planning and control. This paper therefore seeks to create an awareness of the field of engineering study, "cost engineering" with the hope that engineers would seek to acquire the knowledge of cost engineering, or employ the services of one.

1. Introduction

The Application of the physical sciences to solving human problems requires the expenditure of huge resources which include material, finance, and human. Often time, these resources are not readily available and therefore require adequate planning and management. Engineers, as the utilisers of these resources, need to have a good understanding of the handling of the scarcely available resources for profitability and safety. Many abandoned projects can be attributed to lack of proper estimates, monitor, control or a combination of these. Project failures and collapse of structures could also be attributed to lack of proper planning. Poor returns from an agricultural project is also an indication of poor estimate of necessary inputs.

2. Cost Engineering

Cost is the monetary value of all inputs made to run a business or execute a project, be

it construction, manufacturing, agricultural or other related services. For every project, it is required that the possible cost be determined prior to commencement of execution. This is usually referred to as the estimated cost of the project. Ensuring that the variance between project estimated cost and actual cost is kept at the barest minimum requires a high level of professionalism and experience. The services of a professional cost engineer becomes invaluable at this point.

The International Cost Engineering Council (ICEC) defines cost engineering as the field of engineering that deals with the problem of cost estimation, cost control, business planning and management.

A refinement of this definition by the Association for the Advancement of the Cost Engineering (AACE International) shows that cost engineering is the area of engineering practice where engineering judgement and experience are used in 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.

A look at these definitions show that it is not enough to make estimate of cost of projects. It is equally important that such an estimate be timely, accurate and insightful. Even when these are achieved, there must be effective control of the scarcely available resources. The role of the cost engineer cuts across every stage of the project, spanning the entire life cycle of a project.

3. Functions of a Cost Engineer

The functions of a cost engineer cuts across every area of engineering and business. Cost engineering can be applied to:

- Machining
- Metal fabrication
- Electrical assembly
- PCB fabrication
- Crop production
- Crop processing and storage
- Construction

- Transportation
- Software design, development and deployment
- Manufacturing

This list can go on. In all areas of engineering, the cost engineer will be involved in:

- Estimating the cost of a project.
- Reconciling project costs on daily basis by tracking estimated cost against actual cost.
- Integrating project schedule data with accounting data, giving a clear picture of the performance of the project .
- Giving advice on the feasibility of a project or a part of it
- Giving guidance on contract management
- Building cost rules to calculate indirect costs such as escalations and other overheads
- Arbitrating / mediating in claim disputes

Again this list is not exhaustive. The cost engineer will be involved in anything to do with cost (including time) and control of cost in any project or business of any nature.

4. Skills and Knowledge Required for Cost Engineering

Like every area in engineering, the practice of Cost Engineering (CE.) requires a high level of professionalism. Many of skills and knowledge required to practice CE are gained from the classroom while others are from experience. In your study and practice of your area of engineering, you probably have “brushed” through some or all of these skills. A more detailed study of them is however required to be a Cost Engineer. The AACE International grouped these skills and knowledge into six sections.

SECTION 1:- SUPPORTING SKILLS AND KNOWLEDGE

This section describes skills that are not part of core CE but are required in its practice.

The section is further sub-divided into nine sub-sections.

- i. Engineering Economics
- ii. Terminology
- iii. Computer
- iv. Statistics and Probability
- v. Optimisation
- vi. Productivity Management
- vii. Human Relation/Behavioral Science

- viii. Organisational Structures
- ix. Measurement

SECTION II :- COST ESTIMATING

This section is sub-divided into three sub-sections.

- i. Estimating Basics.
- ii. Contractors Costs
- iii. Owners Costs

SECTION III:- COST CONTROL

This section has three sub-sections.

- i. Work Breakdown Structure and Code Accounts.
- ii. Earned Value (Also called Achieved and Accomplished Value).
- iii. Key Cost Control Techniques.

SECTION IV:- PLANNING AND SCHEDULING

This section has three sub-sections.

- i. Planning Basics.
- ii. Scheduling Basics.
- iii. Schedule Control.

SECTION V:- CONTRACT MANAGEMENT

This section has two sub-sections.

- i. Contract Arrangement.
- ii. Contract Administration.

SECTION VI:- ECONOMIC ANALYSIS AND BUSINESS PLANNING.

This section has two sub-sections.

- i. Budgeting and Cash Flow
- ii. Value Engineering

Details of each of these sub-sections can be obtained from the official website of the AACE International (www.aacei.org).

5. Tools for Cost Engineering Practice:

The Cost Engineer relies heavily on his experience and the collective experiences of other engineers for his practice. Several databases, software, reference manuals,

models and handbooks exist on the internet to aid the Cost Engineer in his practice. A few of the sites are listed below:

www.hg.usace.army

www.lanl.gov

www.jsc.nasa.gov

www.saffin.hq.af.mil

www.contracts.hq.navsea.navy.mil

www.es.epa.gov

www.c3i.osd.mil

www.mijuno.larc.nasa.gov

All of these sites were developed and maintained by foreign bodies and so have reflections of their environments. Though relevant to the general practice of CE, there is a need for indigenous development of these materials with more local content to reflect our local environment.

6 Cost Engineering Certification

To practice CE at an international level, the Cost Engineer needs to be certified by a certification body. A few of the bodies accredited by the ICEC are:

- AACE International (United States/Canada) Certified Cost Engineer (CCE) Program
- AACE International (United States/Canada) Certified Cost Consultant (CCC) Program
- Association Francophone de Management de Projet (France) Certification en Matrise de Projet (CMP) Program
- Association of Cost Engineers (United Kingdom) Certified Cost Engineer (CCE) Program
- Associazione Italiana d'Ingegneria Economica (Italy) Practicante in Ingegneria Economica (PIE) Program
- Dutch Association of Cost Engineers Certified Cost Engineer (CCE) Diploma Program
- Sociedad Mexicana de Ingenieria Economica, Financiera y de Costos (Mexico) Ingeniero en Costos (ICC) Program
- AACE International (United States/Canada) Interim Cost Consultant (ICC) Program
- Associazione Italiana d'Ingegneria Economica (Italy) Esperto in Ingegneria Economica (EIE) Program.

The various levels of certification by the bodies are:

- i. Certified Cost Consultant (CCC)

- ii. Certified Cost Engineer (CCE)
- iii. Earned Value Professional (EVP)
- iv. Planning & Scheduling Professional (PSP)
- v. Interim Cost Consultant (ICC).

7. Cost Engineering versus Quantity Surveying

From the white paper issued by ICEC in 1996 and revised in 2002, the function of Cost Engineers and QS include:

- 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 (eg, 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
- Dispute resolution

Whereas QS relates these functions to building design and constructions only, CE relates them more to engineering projects and processes and other areas of business.

8. Conclusion:

A brief overview of cost engineering has been made in this paper. Its relevance in areas of engineering can never be overemphasised. It is hoped that all engineers will imbibe the principles of cost engineering, which hitherto, was done only in the construction industry. It is hoped also that only qualified and probably certified cost engineers would be engaged in all engineering projects.

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