

# **COST ENGINEERING APPLICATIONS IN CONSTRUCTION PRODUCTIVITY IN NIGERIA**

**A PAPER PRESENTED BY**

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# WHAT IS COST ENGINEERING?

- Cost engineering has been defined as that area of engineering practice where engineering judgement and experience are utilized in the application of scientific principles and techniques to problems of cost estimation; cost control; business planning and management science; profitability analysis; and project management, planning and scheduling.

# APPLICATION OF COST ENGINEERING TO CONSTRUCTION PROJECTS

- From the definition, it will be appreciated that cost engineering principles are vital to the successful planning, execution and management of construction projects. Such applications include:
  - Design optimization;
  - Construction optimization;
  - Feasibility study and economic analysis
  - Construction management options;
  - Equipment selection analysis;

- Equipment job allocation;
- Profitability analysis;
- Maintenance management.
- Bidding procedures;
- Construction Cost Estimating;
- Conceptual and preliminary estimates;
- detailed cost estimate;
- Project Monitoring and Costs Controlling;
- Construction Accounting Systems;
- Earned Value, Performance Indices;
- Cash Flow Management;
- Cost reduction.

- Application of cost engineering in productivity enhancement through cost reduction
- The importance of reducing costs has become increasingly significant due to inflation. Many organizations have attempted to counter rising labour and material costs with savings in other areas.

# FIGURING COSTS

- Before a person can reduce costs he or she must know how to figure costs. Costs can be thought of as everything expended to provide the product or service. Generally these costs, as related to construction, can be broken down into the following categories.

**1. Direct labour costs.** These are expenditures for labour that are directly involved in the creation of the product or service. (The more product or service provided, the more direct labour that is used.) Examples include machine operators, claims processors, bank tellers, artisans, and site operatives.

**2. Raw material costs.** These are expenditures for raw materials that are directly involved in the creation of the product or service. (The more product or service provided, the more raw material that is used.). examples include cement, sand, crushed stone, reinforcing steel, etc.



**3. Indirect labour costs.** These are expenditures for labour which are not directly applied to the product or service. Examples include personnel specialists, quality-control personnel, supervisory personnel, Plant manager, general Manager, and public-relations specialists.

**4. Operating supplies costs.** These are expenditures for necessary items that do not become a part of the product or service (items in addition to the product/service raw materials). Examples include brochures explaining a service, cleaning compounds, safety clothing, and office supplies.

**5. Maintenance costs.** These include labour and material costs incurred to repair and maintain satisfactory performance of equipment and facilities. Examples include replacement parts, maintenance personnel, and repair bills.

**6. Waste or scrap cost.** This includes products, parts, or services which cannot be reworked or reused and which do not meet quality standards. Examples include items damaged during manufacture and unused services.

**7. Energy costs.** These include charges for electricity, gas, water, steam, and any other source of power.

**8. Overhead costs.** These include expenditures for physical space, staff services, research, advertising, and legal services.

- Generally overhead costs are shared by several departments. Ordinarily an attempt is made to allocate these costs to each department on some equitable basis using cost engineering principles.

# COST BUDGETS

- A budget is a statement of expected results or requirements expressed in financial or numerical terms. The preparation of a budget is part of the planning function. The actual administration of a budget is part. of the control function.

# COST-REDUCTION GUIDELINES

- Several guidelines should be followed when implementing a cost-reduction program. These are not presented as hard-and-fast rules, but rather as general guidelines to be followed.



# COST-REDUCTION STRATEGIES

- Where should cost-reduction efforts be focused? Logically cost reduction should begin in those areas where the greatest savings can be realized. These areas are not always obvious. Locating them may require considerable effort, but such efforts usually payoff. At the same time, small cost reductions are also important.

This is especially true if the small reductions can be repeated frequently thus adding up to a sizeable reduction. With this in mind, several general strategies may be followed to cut costs. While all of the following strategies can be effective, the supervisor generally has more control over the first five than the last three.

**1. Increase output.** The idea here is to increase output utilizing the same or fewer resources. This reduces the cost per item of product or service. The supervisor should always try to operate at the level of output that results in the greatest efficiency.

## **2. Make better use of time.**

The focus here is on eliminating any unnecessary activities. This may involve the establishment of work standards and the improvement of work methods

**3. Regulate or level the work flow.** A regular, steady flow with no bottlenecks and no equipment breakdowns is desirable. Irregular flows with many peaks and valleys are usually inefficient and often require the use of costly overtime.

**4. Minimize waste.** The creation of unnecessary services and the scrapping of partially processed or unused materials can be very expensive. Any effort to reduce these wastes can pay big dividends. Other types of waste include idle personnel, work expended on projects of little value, and equipment not being used at full capacity.

**5. Analyze all control points.** Adequate control is not only desirable but necessary. However, excessive control can interfere with the work and run up costs. For instance, quality checks should be properly spaced to insure the desired quality but should not be overdone to the point of interfering with the accomplishment of the work

## **6. Ensure adequate storage space.**

Inadequate storage can be quite costly. This situation can cause unnecessary materials-handling and production delays. In a construction-oriented organization storage space would include adequate space for storing supplies.



## **7. Install modem equipment.**


Obsolete and wornout equipment should be replaced. This not only increases the machine efficiency, but it usually has a positive effect on the operator. For example, one has only to look at the improvements that have been made in the typewriter field (a manual typewriter versus a modem word processor).

## **8. Invest in employee training.**

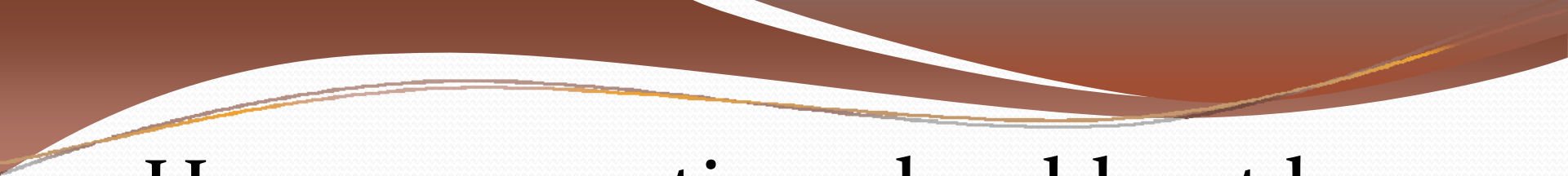
Employees who properly understand their jobs are more efficient than those that don't. Unusually any front-end investments in training are made-up through increased job efficiency.

# Overtime

- Overtime is a curious phenomenon. Some employees refuse to work overtime while others look on it as a gift from heaven. The attraction of overtime to employees is that overtime pay is usually higher than the normal pay rate. The law states that all hours over 40 worked in one week must be paid at least at the rate of time and one-half.



Some organizations pay double or even triple time for certain overtime. Besides the obvious cost of higher wages, overtime often has some additional hidden costs. These include decreased employee efficiency, higher reject rates, and more absenteeism (all due to employee fatigue). In spite of these costs there is a great temptation to resort to overtime whenever things get behind schedule. Certainly there are times when the use of overtime is justified.



However, overtime should not be resorted to at the drop of the hat. When used excessively, overtime often indicates poor supervision. The old saying, "something is wrong if you can't do your job in eight hours a day," has some validity.

- Furthermore, overtime can create other problems. Deciding who should work overtime can be difficult. Also, if overtime becomes habitual, there is a tendency to expect it as a part of regular wages. If and when the overtime is discontinued, some employees become unhappy because they are "making less pay." Yet another possibility is for employees to learn how to pace themselves in anticipation of creating overtime.

- If overtime becomes necessary, there are certain things that a supervisor should do:
  - **Consider the alternatives.** What is the cause of the overtime? Is it poor planning, inappropriate organization, faulty equipment, or what? Is there anything that can be done to avoid or minimize the use of overtime?

- **Explain why overtime is necessary.** All the facts should be made available as soon as possible. Tell the employees why and how they were selected for overtime and how long it will last.
- **Have adequate raw material and supplies on hand.** Overtime is certain to be wasted if adequate materials and supplies are not on hand.




- **Include work breaks.** Remember the employees have already worked a full day. Adequate breaks are essential.
- **Be alert as a supervisor.** Because of the increased costs associated with overtime make sure that it is used wisely. Be available to answer employee questions and provide needed guidance.

# CAUSES OF HIGH OPERATIONAL COST IN CONSTRUCTION PROJECTS

## Absenteeism

- The costs associated with absenteeism can be large. Machines may be idle, schedules may slip, and temporary help may have to be hired. Unfortunately absenteeism cannot be completely avoided. Employees get sick, relatives die, accidents occur, and certain personal business must be tended to during normal work hours.

- However, there is an avoidable type of absenteeism-the employee who could come to work but lays out instead. Research has shown that employees tend to have low absenteeism when they (1) are satisfied with their job and (2) have loyalty to the organization.

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- Under the first category, an employee may lay out because the job is boring. The job may be repetitive, it may not use the individual's skills, or it may have little responsibility.

- The second category, having loyalty to the employer, can be just as important as having satisfied employees. Loyalty occurs naturally if an employee feels good about the organization. Of course, the reverse is also true. Employees who harbour ill feelings about the organization and/or supervisor are rarely loyal. The general style of supervision employed by a supervisor naturally affects an employee's feelings about the organization. If employees feel that the supervisor is fair, open-minded, and concerned, then they usually develop good feelings and loyalty for the organization.

# Tardiness


- An employee who reports late can run up costs in many of the same ways as the absentee. Job satisfaction and employee loyalty have also been found to be related to tardiness. In most situations, a small group of chronic offenders account for the vast majority of tardiness. As with absenteeism, some tardiness is controllable and some is not.

- Accidental tardiness occurs because of, flat tires, severe weather, or personal emergencies. Controllable tardiness relates to the habitual offender. This is the employee who is late on a regular basis. This type of tardiness should not be ignored but should be dealt with directly.

# Materials handling

- Materials handling involves the movement of materials. This includes raw materials, supplies, in-process materials, finished goods, and equipment. The average cost of materials handling has been estimated to be as high as 35 to 40 percent in a manufacturing setting.



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- Idle employees and machines waiting for materials, supplies, or customers can be extremely costly. The questions listed below suggest specific ways that materials-handling problems might be reduced.

# Questions to help reduce materials handling problems

1. Is the travel distance the absolute minimum?
2. Are storage areas convenient and of adequate size?
3. What alternate arrangement might be better?
4. Are components and partial assemblies often damaged in transit?
5. Are materials moved manually from one area to another?
6. Is materials handling performed by any of your skilled employees?
7. Are there any loading and unloading operations that take considerable time?
8. Are materials moved several times within the department before actually being worked on?

# Conclusion

- This paper has highlighted the application of cost engineering to construction industry in a nutshell. The paper was based on one aspect of such applications, that is, cost reduction to enhance productivity. There is no doubt that the intervention of cost engineering will lead to high productivity and profitability in the construction industry.



- Questions and Answers

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- Thanks for listening.