

# ENGINEERING FUNDAMENTAL AND APPRAISAL ISSUES INVOLVED IN PLANT AND EQUIPMENT PROCUREMENT FOR CONSTRUCTION WORKS

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## ABSTRACT

Knowledge of engineering fundamental helps situate study of plant and equipment within the framework of task peculiarity and choice of suitable plants and equipment to achieve the task. Critical to choice of equipment is the financial implication, thus the need for in-depth appraisal of available alternative for cost effective alternative. This presentation attempt to present pivotal issue in engineering fundamental vis a vis appraisal techniques for selection of an optimum alternative with practical illustration.

**KEYWORDS:** Appraisal, Plant, Procurement Construction, Engineering, Equipment.

## 1.0 INTRODUCTION

## 2.0 TRINITY OF ENGINEERING TASK

Most engineering works revolves about three axes: a. Material b. Equipment and c. Job

**2.0 MATERIAL:** Diversity of forms and function, security, food and shelter after the fall of man were the main drive behind material evolution.

### 2.1 Material s' Evolutionary trend and Characteristics

I-Stone era: Fossil analysis *revealed* equipment used by early man to be stone based as well, this was dated back to 4 BC. Relics discovered around Mesopotamia east of Euphrates at Nile valley revealed equipment like hammer, hoe, cudgel to be stones. Writings and inscriptions were found in the form of Aeroliphigys on stone tablets, used in writing. Discovery of fire: Materials in use were purified with fire. Food implements were discovered likewise in this era.

ii- Wood era: Equipment used during early part of human creation were wood-based e.g. Club, cudgel, ploughs were attached to the back of yoked oxen and performs operation similar to the use of conventional tractor for ploughing .e.t.c

Men later advanced into living in wooden huts. This lead to the advent of wood era. Farm implements in this era are predominantly composite material (wood and stone) e. g soil digging equipment. Further exploration lead to the emergence of minerals like iron ore, copper, and their processing industry.

iii- Iron: Iron was discovered in Carthagian empire around 12<sup>th</sup> century and iron materials such as iron digger, plough, sword, cutlass replaced those that are of wood and stone. This era witnessed replacement of wooden and composite implements with iron stuff. Variation in environmental needs resulted in continuous change in tools and implement. Men started using animals in ploughing through on device mounting excavation device on their back and with pressure exerted on the wooden plough

while the animals are being driven along. This concept gave way to philosophy of tract-equipment and machines.

3.0 Equipment characteristic: Parameters for consideration in equipment selection are:  
Cost, Maintenance, Task, and Risk.

i. COST: There are various ways cost could be incurred in the use of construction plant and equipments .e.g. acquisition cost (hiring, outright purchase, lease) ; breakdown cost; replacement cost and running cost.

ii. MAINTENANCE: Running, Break down, Replacement , Planned- Preventive and Running maintenance: (encapsulated in routine checks on plants and equipment).

i. Planned -Preventive maintenance: Proactive maintenance approach or measure adopted to forestall breakdown.

ii. Breakdown maintenance: Maintenance operation when equipment is completely down.

iii. Replacement Maintenance: Shutdown of equipment and plant to effect replacement of part.

iii TASK: Task to be performed and associated risk.

The following items constitute potential risk factor worth considering in the choice of plants and equipment.

- i. Resalable value of the plant or equipment.
- ii. Equipment life span.
- iii. Maintenance cost.
- iv. Availability of spare parts

### 3.0 Job Characteristic.

- i. Work terrain      Work friendliness, Ruggedness.
- 2. Personnel .
- 3. Risk &uncertainty.
- 4. Man-machine compatibility issues.
- 5. Insurance issues.
- 6. Skills required.
- 7. Performance monitoring.
- 8. Job schedule ( Rancho Bon stress hold curve).

i.WORK TERRAIN: The nature of work terrain must often determines the types of plants and equipment that could be used. Terrain work may require leveling, for instance terrain that used to be cut and use in filling-up other aspect. This type of operation is referred to as cut and fills operation. Specialize machine and plants are often needed for such e.g. Grader, Dozers, pilfering machine (pilfer). Terrain could be work friendly or rugged.

ii. Personnel: Specialize job needs specialized equipment and specialists. There are jobs that require acquiring and special skill e.g. most engineering and technology related vocation requires special skill. Thus high level informed personnel are always required in carrying out specialized job. However, construction industry is multidisciplinary sector, whereby diverse knowledge skill and wisdom are needed in operating various plants and equipment. So also vocational centers and on-job skill acquisition centers are also available for skill upgrading and development

### 3.4 PLANT PROCUREMENT SYSTEM

Plant and equipment procurement issue is one of important factors that impacts project success. Some of the methods through which plant procurement could be achieved are as listed below: i ) Outright Purchase ii ) Hire Purchas iii ) Leasing iv) Hiring.

i ) Outright Purchase: The following conditions holds.:

The situation must exist whereby the person willing to sell a plant or equipment is ready to offer it for sale at a stipulated time frame and marked price. It involves articulating the term and

condition of sale and payment in an article of agreement. The ownership of the plant remains that of the buyer after purchase. Liability shift from the seller to buyer.

ii ) HIRE PURCHASE: This is a method of procuring plant and equipment with flexible mode of payment over a period of time rather than in lump sum. The ownership of the asset does not remain with the buyer until the capital involved has been defrayed. The buyer is often constrained to abide with term of agreement as specified by the seller. Buyer can withdraw the asset unconditional in case of hirer purchasers' payment default. The seller often posses insurance policy to recover asset anytime on occasion of breach of agreement.

iii ) EQUIPMENT LEASING: This is considered an alternative option to purchase. Capital intensiveness of the plant and equipment acquisition often necessitates leasing as an alternative. It makes an expensive plants and equipment available to contractors. It also involves documentation of term and agreement, interest rate, extent of concerned party's liability.

iv) HIRING: Ownership of the asset remains exclusively that of the hirer throughout the period of the equipment life cycle unless otherwise transfer. It entails specifying the hiring period and terms. Maintenance cost of the plant while in use is often borne by the hirer once the charge has been billed into the hiring cost. Most equipment requires manufacturers' attendance while such equipment is under hire.

### 3.5 APPRAISAL METHODS IN EQUIPMENT SELECTION

Two types of appraisal method exist in plant and equipment economics: a) Traditional Method.

b ) Discounted Cash flow Method.

a )Traditional Method: Traditional methods don't consider the time value for money. There are two types of traditional appraisal technique in plant and equipment economic.

i ) Payback period ii ) Accounting Rate of Return

i.) Payback Period: P.B.P method tells the time or period to recover in cash the amount outlaid on an asset or plant. If the plant or asset generates constant annual cash inflows, the payback period can be computed by dividing cash outlay by the annual cash inflows. The formula for calculating cash flow is as structured below:

$$\text{Payback Period (P.B.P)} = \frac{\text{Cash outlay (C.A)}}{\text{Annual Cash Inflow (A.C.I)}}$$

CASE I: Example: Consider plant A, with cash inflow detail as follow

Year	Cost N200,000	Life 6yrs	Annual Cash flow [N50,000]
	Cash flow	Cummu Cash flow	
0	[200,000 ]	[200,000]	
1	50,000	150,000	
2	50,000	100,000	
3	50,000	50,000	
4	50,000	0	
5	50,000	50,000	
6	50,000	100,000	

- Payback Period = Cash outlay

Annual Cash inflow

$$\text{PBP} = \underline{200,000}$$

50,000

$$\text{PBP} = 4\text{yrs.}$$

Therefore Payback period of the asset is 4yrs. This case represents the scenario of selection decision as relates to a single plant or equipment.

## ii. ACCOUNTING RATE OF RETURN

A capital investment project may be assessed by calculating the return on investment or accounting rate of return and comparing it with a predetermined target level. One of the equations is as stated below:

$$A.R.R = \frac{E.A.P}{E.A.I} \times 100$$

E.A.I

Where A.R.R = Accounting Rate of Return.

E.A.P = Estimated Average Profit.

E.A.I = Estimated Average Investment.

Consider the following example to illustrate application of accounting rate of return technique.

- Case 2

Cannan Projects is contemplating acquire a new machine with two available alternatives.

	MACHINE X	MACHINE Y
Cost	N10,000	N10,000
Estimated Residual Value	N2,000	N3,000
Estimated Future Profits	Yr 1 N5000	N2000
	Yr 2 N5000	N3000
	Yr 3 N3000	N5000
	Yr 4 N1000	N5000

Based on the Rate of Return on Investment Method, which of the two machines should be purchased?

- Solution:

A) Determine Average profit for the machine X and Y( first step).

[I] Machine X

Total profit ----- N14,000

Profit before depreciation----- N 8000

6000

N8000 = Cost- Residual value i.e N(10000-2000) = N8000

- Average Profit = Net Profit

- Period

= N 6000

- 4

A.P = N1500

B. Determine average investment

Investment at Yr 0 ( beginning) \_\_\_\_ N10,000

Investment at Yr 4 (end) \_\_\_\_\_ N2000

\_\_\_\_\_ N 12,000

- Average Investment = Investment at Beginning + End

- 2

= N12,000/2

Therefore the Average investment for Machine X =N6,000 while Average profit = N1,500

## [II] . MACHINE Y

### A. Determine the Average Profit

Total Profit ----- N15,000

Profit b4 depreciation ---- N7,000

N8,000

Estimated Average Profit = N 8000 i.e. Profit

4                      Period (Time)

Average Profit = N8 000

4

Average Profit = N2000

### B. DETERMINE AVERAGE INVESTMENT :

Investment at Yr 0 ( beginning) = N10,000

Investment at Yr 4 ( end) = N3,000

N 13,000

Average investment = Net Investment

Period

= 13,000

2

Estimated Average investment = N6500 for plant or project Y

- Therefore, A.R.R ( Accounting Rate of Return) is given by

$$A.R.R. = \frac{E.A.P}{E.A.I} \times 100$$

$$E.A.I$$

A.R.R = 2000 X 100

6500

A.R.R = 30.80 %

A.R.R OF Machine Y = 30.80 %, while A.R.R of Machine X = 25.00 %.

Using A.R.R as a criterion for project or asset selection, machine Y should be purchased, since it's the one with highest return in investment.

#### 4.0 LEASE DECISION CONTRACTS INVOLVED IN PLANT AND EQUIPMENT PROCUREMENT

4.1 LEASE? \_\_\_\_\_ a lease is a system of agreement where the owner of the property or asset (lessor) conveys to another (lessee) the right to use an asset for an agreed period, in return for rent payable at the outset or instalmentally subject to agreement between the two parties to the contract.

##### 4.2 TYPES OF LEASE CONTRACT

There are two types of lease contract: a) Financial Lease. b) Operating Lease.

4.2.1 FINANCIAL LEASE: Note the following facts here. Responsibility of maintaining and upkeep of the equipment is substantially that of the lessee. Financial lease therefore is a lease that transfers substantially all risks and rewards associated with ownership of an asset. Title may or may not be eventually transferred. A financial lessee uses the asset for most of its useful life, which often makes it expedient for the lessor to offer it for sale to the lessee afterward.

##### 4.2.2 OPERATING LEASE :

All risks and rewards incidental to ownership often remain with the lessor. Equipment is used during the economic life of the asset by many leases. Equipment may not be offered to the lessee for purchase in case the lessor desire to offer it for sale during the economic life of such asset.

4.2.3 DISADVANTAGES OF LEASE OPTION: Some of the advantages of leasing include, expensiveness ---It could be expensive, Creation of contractual commitment (It tends to create contractual commitment).

Also there must be steady rental payment (rental payments must be irrespective of the fact that profit is made or not), and reduction in company's asset backing (Since it is an off-business liability, the assets backing of the assets backing of the company is reduced).

**4.2.4 ADVANTAGES OF LEASING:** In the section above, some of disadvantages of leasing are outlined. However it is important to consider disadvantages of this procurement option.

Leasing reduces capital requirement to run the asset/business, relatively easy and quick to arrange, the equipment may be a better alternative, It reduces cash budgeting, the charges are allowable for tax purposes and premium may be paid out of other income generated by the assets of the company is reduced.

**4.3 CONCLUSION:** This work has presented essential things that are necessary in situational selection of equipment and tools for work, with merits of different approaches. Also the procurement issues involve in financial appraisal of plants and equipment for optimum selection of the best and cost effective alternative. The realism of applicability of a suitable financial appraisal technique is demonstrated. It is believed that adopting right approach would eliminate financial waste and would enable right-in-time job delivery.