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Performance Measures of Maintenance of Public Facilities in Nigeria

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ABSTRACT

Public organisations in Nigeria are organisations which are controlled by the government. These organisations generally face different kinds of problems. Some of such problems are associated with poor maintenance of public facilities. This study presents performance measures of maintenance of public facilities in Nigeria. The study identifies financial scandal, improper facilities, poor maintenance culture, poor spare parts, incompetent management, lack of or inadequate training programmes, irregularity in power supply as major problems that hinder the performance measures of maintenance of public facilities. The study concluded that government, management and employees should play their respective roles to ensure effective maintenance of public facilities. It is also concluded that public organisations should adopt four key aspects of the Balanced Scorecard that focus on four separate but related perspectives of organisational performance and management such as financial performance, internal processes, customer satisfaction or customer value and workforce support.

Key words: Effective maintenance, effective utilisation, standard equipment, employee capability

INTRODUCTION

Public organizations e.g., River basin authorities, Nigerian Railway Corporation, to name a few were primarily and originally established by the Nigerian government as job providing ventures and rendering of social services rather than profit making enterprises. However, in recent times, the same government have been emphasising on privatising some of these organisations because of their operational inefficiency. This government policy in Nigeria, conform to what Shah, (2007) identified that The dysfunctionality of public sector governance is considered to be the root cause of corruption, inefficiency and waste in developing countries. In these organizations, one thing is paramount, which is the use of plants, equipment and vehicles in the day-to-day running of the organizations. Burbidge (1971) defined plants as all physical means of production available in a factory or company used in this way; includes the buildings, fixtures, machines tools, service machinery and workshop equipment. Failure may occur due to improper use of equipments. Even though plants/equipments might have been designed to be reliable, failure cannot be said to have been completely eliminated. Hence plants/equipment's maintenance should always be carried out if equipment reliability must be ensured.

Public facilities are facilities provided, owned, or being monitored by government either at the federal, state or local government level. Basically, they can be classified into two namely movable facilities which are facilities like earth moving equipment, vehicles, computers, typewriters, etc., that can change location from time to time and non-movable facilities like buildings, electricity lines,

pipe lines for water, etc., that cannot change their location. However, emphasis is focussed on movable public facilities, most especially on plant and equipment. All these facilities, irrespective of their group needs effective regular maintenance for proper functioning of the assets acquired. The performance of public facilities depends on the degree of effective maintenance. Unfortunately, however, maintenance is one of the major problems facing the public organizations with a resultant effect of having their premises littered with broken down plants/equipments which are allowed to rust away under rainy and sunny conditions and eventually are sold as scraps (Lawal and Adeyemo, 2004). This can be prevented. This study evaluates the performance of facility maintenance of public organization and suggested the extent to which effective maintenance are needed.

MAINTENANCE REQUIRED / NEEDED FOR THESE FACILITIES AND THE NEED FOR EFFECTIVE MAINTENANCE IN NIGERIA

These vary from breakdown (corrective) maintenance, in which the equipment run until it fails and is then repaired. Preventive maintenance is undertaken where an attempt is made to avoid breakdown by anticipating failure or wear and making a timely examination, replacement or adjustment. Preventive maintenance is usually considered more expensive than the corrective or breakdown maintenance. However, this additional expense incurred assists to minimize breakdown of plant.

Preventive maintenance: Some forms of the preventive maintenance are the regular lubrication and inspection, adjustment is normally practised on major items of equipment. It is intended to prevent future breakdown of facilities or equipment before it actual occurrence. It is defined as a planned maintenance actions that intends to prevent breakdowns and failures of facilities or equipment it is performed on an asset while the asset is still capable of functioning in a satisfactory manner for some time. It is difficult to determine the correct level of preventive maintenance to apply. Often, help can be obtained from the maintenance schedules proposed by equipment manufacturers, but a record of the frequency of unscheduled breakdown and their costs, is needed to institute and refine preventive maintenance programmes. Preventive maintenance should be considered when: the failure rate of the equipment starts to increase rapidly after a period during which it has been low; the cost of preventive maintenance attention should be less than the repair costs; equipment failure is likely to disrupt subsequent production operations or cause customer dissatisfaction and Injury could result from equipment breakdown. Preventive maintenance assists to preserve and enhance equipment reliability. Equipment is inspected to determine whether further maintenance attention is required. The common costs are supplies and replacement parts; labour and equipment downtime.

These costs will increase as the frequency of preventive maintenance increases. An increase in preventive maintenance cost will reduce the corrective maintenance cost. The benefits of preventive maintenance are that it prolongs the life of the plant, increase the terminal salvage value of an organization's asset, have a salutary effect on the quality of the goods and services produced and increases the safety of the operations involved (Iwarere, 2004).

Breakdown (Correctives) maintenance: There are advantages in having this work centrally organised to ensure better utilization and development of the workforce. Maintenance staff in charge of repair work should be trained in faultfinding. The staff should be supplied with

diagnostic equipment and maker's handbooks and circuit diagrams should equally be readily available. Repair times can be reduced if spare parts are readily available in stores rather than obtaining them from the equipment manufacturers whenever needed.

THE NEED FOR EFFECTIVE MAINTENANCE

Efficient and effective utilization of public facilities is a contributing factor to the promotion of industrial growth. The need for the effective maintenance can be realized by considering the adverse consequences of lack of effective maintenance system, some of which are:

- Excessive machine breakdown
- Disproportionate investment in spare parts and maintenance materials
- Poor utilization of staff
- Low quality of service
- Abnormal overtime cost
- Irregular operating time
- Shortened life span of facilities
- Loss in production output
- Frequent machine breakdown

All the above contribute to loss of profit, which hinder the realization of some organizational objectives. It is however necessary that maintenance productivity or effectiveness is continuously evaluated to ensure optimal machine availability and utilization (Iwarere *et al.*, 2005).

MAINTENANCE EFFECTIVENESS AND PERFORMANCE MEASUREMENT

Productivity is defined as the ratio of output to input. It measures the relationship that exists between the actual input and actual output. Productivity measurement can take either the form of per unit or the form of per monetary value. The per unit measurement is referred to as operational productivity which is the ratio of output in units to input in units while per dollar measurement is referred to as financial productivity. Productivity measures efficiency and effectiveness of a given system in achieving organization goals or objectives. Maintenance effectiveness therefore is the measure of efficiency of maintenance time, labour, material, energy and capital that have been used (Iwarere, 2009).

Performance measure: Performance measure for effective maintenance is used generally to evaluate maintenance effectiveness. This can be manually or with the use of computer. Certain selected factors (as applicable to any maintenance organization who want to measure its effectiveness) must be regularly plotted on a charts in order to dissolve the trend, on monthly, quarterly, or annually basis. It has been found possible to set up mathematical models to describe queuing situations specified by different forms of three basic elements (1) input process (2) queuing discipline and (3) service mechanism. These models can then be manipulated to show what the service system under investigation should be capable of achieving (Mindoch, 1978).

Situation-input to queuing-service mechanism

Maintenance department plant breaks down plant awaiting repair/plant repair: These measure can be used to decide for instance (usually on a cost basis) whether to speed up the

existing service rate of each channels working at the same rate as the present ones or whether to provide extra channels ones working at the same rate as the present once or whether even a reduction in service facility can be contemplated. To this end, there is the need to keep record of how these facilities are being maintained. Record keeping is a database for proper decision and actions as maintenance schedules recommend by manufactures are not often adequate because such schedules had not taken all factors of socio economic and political activities into consideration. Accurate record keeping will enhance making effective maintenance possible for varieties of these facilities. Every facility in question should have a record sheet where information obtained from the operators and users are recorded. The record sheet should include the following columns:

- Hours operated by the facilities
- Fuel consumed by the facilities
- What spare part had been repaired or changed for what cause?
- The age of the facilities
- Types of maintenance activities carried out on such facilities

Consequently with these records, it is not only possible but makes it easy to calculate the following:

- Calculate the running cost, the repair cost or the maintenance cost for unit time
- What are the trend of the efficiency and particulars of the facilities in question?
- Record when things start to go wrong
- And most importantly, forecast with high accuracy when certain spare part would be needed so that steps would be taken toward obtaining them before the predicted time and thus reduce idle time tremendously

Evaluation of maintenance activities: Priel (1974) identified that maintenance activities can be evaluated on the following criteria:

- Craft-hour utilization
- Work order progress
- Plant and equipment performance
- Cost of services provided
- Expense justification

Based on the above five criteria of work, the following maintenance performance measures are identified for public organisation (Lawal and Adeyemo, 2004):

- Craft-hours Utilisation (CU) = Total craft-hours worked/total craft-hours clocked
- Workdone Turnover (WT) = No. of jobs competed/total number of Jobs handled
- Downtime due to Maintenance = Total downtime for service/total shift hours worked
- Cost of spares and supplies = Total cost of supplies and spares/total maintenance expenditure
- Cost Reduction Effort = Routine service workload/cost of maintenance hours

The above ratios enable maintenance department of public organisations to assess performance, identify specific maintenance functions causing trouble and focus improvement efforts.

THE MAINTENANCE FRAME WORK

In order to improve effective maintenance of public organisation, it is impossible to isolate maintenance department/workshop from other departments in the organization. Thus, other departments that have direct influence on the management and organization of maintenance must be integrated and participated in the overall maintenance framework and consequently on its costs and efficiency. These departments must have common or unified objective with the maintenance department and participate together to achieve common objectives. These other departments are:

Projects and new work department (Mostly for building): This department is needed to co-ordinate for maintenance such as:

- Investment programs (forming and creating)
- Installation of projects
- Reliability and maintainability of projects
- Material standardization and technical documentation
- Choice of new works companies and reception of the equipment.

Purchasing department: This department is needed for

- Issuing and inspecting performance and technical quality specifications
- Helping and settling equipment guarantee problems
- Obtaining the technically dossier adapted to the needs of the company's maintenance policy, especially for maintenance and operational documents

Financial department: This department is needed for

- Economic link between depreciation and maintenance
- Economic revision of the equipment
- Replacement decisions, interpreting the economic viability of Plants/equipment and deciding when to be replaced

Human resources department: This department needs for

- Estimating personnel management, especially for qualification level, career evolution, post transfers, promotions, departures (retirement) hiring and training etc
- Work organization; determining the work structure or organogram

Security Department is needed for personnel and equipment security involving an efficient work organization, work post planning, integrated prevention etc.

Spare and supply management department: An essential part of a good maintenance strategy is to have good record keeping and effective supplies management policy. It's main function is to give basic information about the time purchase, condition and life cycle of all the plants/equipment etc. by way of proper decision and actions since maintenance schedules recommended by manufacturers are often inadequate for our public utilities into considering the socio-economical

factors. The availability of spare parts, either by contract or direct supply, is most essential aspect of the maintenance strategy. A good number of maintenance cannot succeed unless they are backed up with effective spare parts providing policies.

THE EFFECT OF SPARE PARTS AND THEIR PROCUREMENT

Spare part for maintenance of public facilities in Nigeria is got either by contract or direct supply. The availability of spare parts is the most essential aspect of maintenance strategy. A good number of maintenance activities in the Nigeria public sector cannot succeed unless they are being supported with effective spare parts provisioning policies. The level of success achieved is borne out of availability of spare parts needed to make necessary repairs, be it major or minor repairs.

Spare parts procurement: Although, there are problems of getting spare part in the country, however, experience has shown that the procurement of spare parts by direct purchase is more economical in term of cost, time saving and getting of genuine spare parts. The degree of spare parts procurement in public sectors depends on the following factors:

- The periodical demand for such spare parts
- Faults accumulation in the affected sector
- The financial capacity of the public sector management
- Government policies on maintenance works

The technical officer who is responsible for this duty should compile records of intending purchase with verification to avoid duplication. The following Rules of the game could be useful for spare part procurement:

- Honesty concerning the job and the price of the spare parts
- Avoid third party bargaining; buy directly correct and genuine spare parts
- Keep the habit of demanding for old and worn out part for visual inspection
- Maintain good statistical records and monthly checking of the spare parts
- Recruit honest and experienced personnel to take care of the store

Organisation should always give an important consideration to quality and cost. Thus, spare parts purchased must not be overpriced and should equally not fall below specification (Iwarere, 2010a).

Proper utilisation of spare parts will lead to inventory reduction. The spare part required should be determined through Economic Order Quantity (EOQ) model. This model of procuring inventory is very much valuable in Public Sector where security of stock of spare parts kept in store is guaranteed (Iwarere, 2005).

Problems Of Procuring Genuine Spare Parts. Even when funds are made available there still exist the problems of getting genuine spare parts. The contention is that government limited resources is not planned to be tie down on advance purchase of spare parts and when such parts are now urgently needed they are difficult to come by. Thus, a piece of capital equipment which cost over \$2, 000, 000 and capable of rendering the services of a facility could be kept idle because of \$1, 000 worth of spare parts. This problem is further compounded when fabrication of simple parts, which can be easily done in the workshops, are not possible because of lack equipment for such operation.

Spare parts stocking: It is necessary to keep the statistical data of spare parts movement and demand, which must be clearly, indicated and assisted in selection of the essential parts to stock. Most of public facilities are made with a variety of spare parts such as we have in plants and vehicles and their demand for routine servicing and repair vary from one to another. However, these spare parts should be kept with maximum security in the store. From experience the spare parts must be given strict consideration for storing at all times. For durability, the spare parts must be well preserved and well stocked, for example bearings must be sealed in a grease paper and rubber parts should be preserved with talcum powder. A very discipline and methodological location procedure are required for a hundred of rack to stock wide range of spare parts. Above all, all spare parts should be identified and managed through control or stock cards.

Standardization of equipment: The public facilities such as vehicles found in the country are not exempted from the difficulties encountered in the area of spare parts procurement, which are aggravated by the fact that Nigeria buys from anywhere and everywhere. Thus, it is difficult for a maintenance officer to secure spare parts to the series of brands of equipment to which he is saddled with for maintenance. Even in large engineering installation. Many of our public facilities are made up in this way. Hence, it is cumbersome for maintenance. The important thing to consider is that organisation should take it as a policy to always procure standard equipment.

Cost estimate: Good costing of materials (spare part) is necessary for maintenance programs of public facilities. A proper estimates preparation will reduce work and hence save cost of maintenance. The entire estimated cost of repair of each facility should be kept in history sheet. This history sheet must be checked periodically to determine when repair of such facilities is no longer of economic importance. This will assist to properly determine the life cycle of future facilities to acquire and in turn help in increasing the maintenance effectiveness of the present facilities as well as those facilities to acquire in future. The major roles of cost estimates are to:

- Ascertain the appropriate cost target
- Monitor the actual cost incurred
- Ensure that actual cost are controlled throughout the project life
- Be able to trace the cost overruns to particular units and ascertain reasons for the negative deviation

LIFE CYCLE COSTING WITH AN EMPHASIS ON COST SAVINGS

Public organisation nowadays should consider life cycle of the facility to procure before approving fund allocated for the procurement. This is because the most prominent hindrance facing organizations now a day is the fact that life cycle of many new products are fast declining simply because of fast technological innovations and the nature of competition affecting a particular facility. In view of this development, it is essentially important to first apply life cycle costing to determine the possibility of recovering the entire costs incurred in acquiring an asset such as equipment or facility through effective utilisation in realising income over the life span of the facility. Avoiding the application of life cycle costing to an asset to acquire or to a new product to manufacture is likely to lead to a disaster in view of the global keen competition and other related factors (Iwarere, 2009).

Life cycle costing is defined in the Chartered Institute of Management Accountants, CIMA, Official Terminology as The maintenance of physical asset cost records over the entire asset lives, so that decisions concerning the acquisition, use or disposal of the assets can be made in a way that achieves the optimum asset usage at the lowest possible cost to the entity. This term may be applied to the profiling of cost over a product's life, including the pre-production stage (tero- technology) and to both company and industry life cycle.

The overall cost determine for life cycle of facility in a service industry, such as public organisations include all costs associated with the procurement and all the running and maintenance costs. Part of the maintenance costs include spare part to procure.

The arguments put forward in support of life cycle costing to the proposed investment opportunities are:

- To avoid product or service failure
- To determine the correct product or service cost by considering factors such as investment cost, number of years to maturity, anticipated demand and imitations

Thus, public organisation engaging on road transport should be familiar with road transport costing. Three of the objectives of road transport costing as identified by Iwarere (2004) are:

- To ascertain operating cost per kilometre
- To control running cost of the vehicle
- To determine when to replace the vehicle

PROBLEMS THAT MILITATE AGAINST EFFECTIVE MAINTENANCE OF PUBLIC FACILITIES NIGERIA

The following are some of the problems that hinder maintenance effectiveness in public organisations: Financial problems; Unable to determine facility life cycle; Poor spare parts management; Under utilisation and non utilisation of available resources; Incompetent maintenance staff; Irregularity in power supply; Insufficient basic repair and maintenance equipment; Ineffective work methods; Poor organisation; Poor monitoring and control; No effective incentive scheme; Unavailability of spare parts; Poor job card/form; Inadequate storage facilities and Poor attitude of workers.

SUGGESTIONS FOR ENHANCING EFFECTIVE MAINTENANCE OF PUBLIC FACILITIES IN NIGERIA

- Appropriate maintenance planning and plant/equipment history cards should be established. Proper maintenance should be carried out on plant, machinery and vehicle in order to operate properly and to prolong its life, so reducing capital expenditure. Training and retraining of the maintenance personnel should be intensified at all levels
- Adequate funds should be allocated and made readily available to the maintenance workshop to help reduce the cost of downtime and also to improve maintenance effectiveness. Supervision and execution level of preventive maintenance should be improved in order to reduce frequent breakdown of motor vehicles

- Adequate attention should be given to workshops needs. Maintenance personnel should be rewarded for good ideas contributed to overall efficiency. Drivers should be place under the direct control of workshop manager rather than personnel manager for effective management
- Government and management should develop policies, which would project the importance of maintenance function
- Remuneration paid to staff should be adequate in order to improve labour productivity

CONCLUSIONS

The existence of market competition is a catalyst for improving performance. The Commercialisation and privatisation of some of the public organisation carried out by the governments in Nigeria is evidence that social benefits alone should no longer the only ultimate goal; rather, public organisations need to reduce costs, improve quality of services and improve performance.

Effective maintenance management prolongs the life of the plants and also increases productivity of any organization. This study has deal with effective maintenance of facilities in Nigerian public organizations. It also highlighted the role of spare parts as well as roles of various departments directly or indirectly associated with maintenance and how they can play effective role in evolving an effective maintenance of public facilities in Nigeria. The government, management and employees should play their respective roles to ensure effective maintenance of public facilities.

The historical evidence showed public road transport businesses managed by corporations in Nigeria have always been finding it difficult to recover the investment costs in spite of the increased number of passengers favouring this mode of transportation business. Operations performed by other public organisations such as River Basin Authorities, Nigerian Railway Corporation, Nigerian Telecommunications Limited (NITEL) are facing the same hindrance mentioned in the foregoing. For instance, NITEL paid heavily for its cost of operational inefficiency when MTN, a multinational foreign communication firm swept communication market with the introduction of mobile phone and the firm was able to recover its investment cost within a shortest period apart from the huge profit earned. Even though the objective of public sector organization in the past was not to make profit, yet, they were still expected to provide services in an efficient manner in the right place and to be timely. The increasing withdrawing of government support to the public corporation is clear indication that public organisations that are yet to be privatised should improve operational efficiency. Because of these vital reasons, privatisation of public organisations has of recent become popular in Nigeria. At present, most public corporations are expected not only to break even, but also to stand-alone by making sufficient surpluses.

The unfortunate aspect is the fact that the high remuneration payable to the workers in the government commercialized industries such as the Nigeria National Petroleum Corporation, (NNPC); The National Electric Power Authority, (NEPA) and The Nigeria Telecommunication Limited, (NITEL) fail to improve productivity (Iwarere, 2003).

Public sector organisations must properly utilise their facilities in order to be judged efficient. Even though low capacity utilisation has been one of the major global problems affecting many public sectors, yet, the basic fact is that, some public sector organisations performed better than others in their facility utilisation. Those organisations that possess better managerial and technical skills were able to perform better than those organisations that possess incompetent staff. More so, a corrupt practice of top management team in many public sectors in Nigeria is a major obstacle for achieving poor performance (Iwarere, 2010b).

Since Public organisations in Nigeria operate at the cost of inefficiency, it is suggested that they should adopt four key perspectives of Balance Scorecard that focus on four separate but related perspectives of organisational performance and management such as financial performance, internal processes, customer satisfaction or customer value and workforce support. Some of the performance areas of focus are i.e., there is an emphasis on measuring results relating to employee and Training is analyzed to determine such as:

- Cost effectiveness
- The extent of improving internal processes to decreasing costs.
- Effective utilisation of facilities
- Effects of how financial benefits are derived from improvements in employee safety and turnover
- Employee capabilities
- Employee satisfaction
- Employee motivation
- Developing of new opportunities;
- Outcome of customer satisfaction and customer retention.
- Operations and maintenance performance
- Performance for energy and utilities
- Reduction of paperwork and increase in automation of work

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