OKOH JOSHUA CHUKWUKA

COMPUTER ENGINEERING

17/ENG02/066

ENGINEERING LAW

A.B.U.A.D

OPEATION, MAINTENANCE AND MANAGEMENT OF ENGINEERING EQUIPMENTS FOR SUSTAINABLE DEVELOPMENT IN NIGERIA

TABLE OF CONTENT

ABSTRACT

It's not a new thing for engineers to make use of equipment to finish a task. All engineering categories makes use of equipment to function in their respective companies but sometimes some companies fail to manage and maintain these equipment which may be difficult for sustainability in our nation. OPEATION, MAINTENANCE AND MANAGEMENT OF ENGINEERING EQUIPMENTS is very important in every company because except from saving money from constantly buying new equipment every time, you also save the lives of workers in the company avoiding accidents caused by equipment due to lack of management and maintenance. Industrial maintenance has two essential objectives one is a high availability of production equipment and the other is low maintenance costs. The major hindrances in achieving these objectives are failures of equipment in plants. These failures can lead to costly stoppages of an organization's operation, which may result in low human, material, and equipment utilization. Failures must therefore be reduced or eliminated. An organization by having uninterrupted flow in operations can build its customers confidence in it and proper maintenance helps to avoid factors such as machine breakdowns that can bother effective productivity. The term 'maintenance' means to keep the equipment in operational condition and to have increased availability of production systems with increased safety and optimized cost. Maintenance management involves managing the functions of maintenance. Maintaining equipment in the field has been a challenging task as the engineering equipment becomes sophisticated and expensive to produce and maintain, maintenance management has to face even

more challenging situations to maintain effectively such equipment in industrial environment. Implementing a good maintenance

INTRODUCTION

Engineering is the use of scientific principles to design and build machines, structures, and other items, including bridges, tunnels, roads, vehicles, and buildings.[1] The discipline of engineering encompasses a broad range of more specialized fields of engineering, each with a more specific emphasis on particular areas of applied mathematics, applied science, and types of application Managing the operation and maintenance of equipment is fundamental to all owners and users of industrial assets. Process complexities and different methods of achieving the same outcomes have resulted in a large number of equipment types and models. Engineering is the application of economic, social, scientific, and practical principles to invent, build, design, maintain, and otherwise improve machines, devices, materials, systems, and processes. Engineering is an important field of work, especially in our company, so we can keep ahead of the design and machining curve.

OPERATION, MAINTENANCE AND MANAGEMENT OF ENGINEERING EQUIPMENTS FOR SUSTAINABLE DEVELOPMENT IN NIGERIA

We are going to be talking about the operation, maintenance and management of engineering equipment individually for a better understanding and knowledge of how it can sustain development in

Nigeria because without the knowledge of how such can sustain development in our nation one may not understanding the benefits.

1. OPERATION

Many companies or industries in Nigeria make use of machines/equipment and operation is being done on a daily basis. Computer Hardware Engineers research, design, develop, and test computer and computer-related equipment for commercial, industrial, military, or scientific use. They may supervise the manufacturing and installation of computer hardware. Computer hardware includes computer chips, circuit boards, computer systems, and related equipment, such as keyboards, hard drives, modems, and printers. Computer Hardware Engineers may design and test circuits and other electronic components as they relate to computers and computer-related equipment. The ongoing advances in computer technology are a result of the research, development, and design efforts of Computer Hardware Engineers. Some electrical and electronics engineers may also work with computers, designing and testing systems; however, they do not work exclusively with computers .Some Engineers may consider going into the following specialty:

Electrical Hardware Engineers design, develop, modify, and evaluate electronic parts, components, or integrated circuitry for electronic equipment. They analyze equipment to establish operating data, conduct experimental tests, and evaluate results. Engineers investigate and solve computer hardware problems that may arise. They select components and equipment based on analysis of specifications and reliability. Engineers spend time meeting with customers to discuss business objectives. They also conduct product documentation and training.

Tools and Technology

Tools used by Engineers include circuit testers, electronic measuring probes, frequency calibrators or simulators, integrated circuit testers, network analyzers, oscilloscopes, power meters, protocol analyzers, and signal generators. Technology used in this occupation includes the following types of software: analytical or scientific, computer-aided design (CAD), database user interface and query, object- or component-oriented development, office suite, operating system, project management, and word processing.

2. MAINTENANCE

Maintenance is the discipline and profession of applying engineering concepts for the optimization of equipment, procedures, and departmental budgets to achieve better maintainability, reliability, and availability of equipment.

Maintenance, and hence maintenance engineering, is increasing in importance due to rising amounts of equipment, systems, machineries and infrastructure. Since the Industrial Revolution, devices, equipment, machinery and structures have grown increasingly complex, requiring a host of personnel, vocations and related systems needed to maintain them.

An engineer should possess significant knowledge of statistics, probability and logistics, and additionally in the fundamentals of the operation of the equipment and machinery he or she is responsible for. A maintenance engineer should also possess high interpersonal, communication, and management skills, as well as the ability to make decisions quickly.

Typical responsibilities include:[2][3]

- Assure optimization of the Maintenance Organization structure
- Analysis of repetitive equipment failures
- Estimation of maintenance costs and evaluation of alternatives
- Forecasting of spare parts
- Assessing the needs for equipment replacements and establish replacement programs when due
- Application of scheduling and project management principles to replacement programs
- Assessing required maintenance tools and skills required for efficient maintenance of equipment
- Assessing required skills for maintenance personnel
- Reviewing personnel transfers to and from maintenance organizations
- Assessing and reporting safety hazards associated with maintenance of equipment.

Why is industrial maintenance so important?

Many industries can confirm how maintenance costs represent a high share of operating costs. Figures obviously vary from one company to another but they can still sometimes represent up to 50% of the global production costs, without even taking into account planned or unplanned downtime, stock and tools management, purchasing… These are as many unforeseen events which can lead to additional costs that a company often struggles to estimate but that are nonetheless closely linked to the maintenance teams' activity. It goes without saying that an organization's profitability and productivity partly depend on the maintenance processes that have been implemented; plants therefore should adopt a well-

thought and optimized strategy in order to make sure all equipment work in the most reliable way possible.

There are different types of maintenance in companies and they are as follows;

1. **Corrective maintenance**

Corrective maintenance is implemented right after a defect has been detected on a piece of equipment or a production line: its objective is to make the piece of equipment work normally again, so that it can perform its assigned function. Corrective maintenance can either be planned or unplanned depending on whether or not a maintenance plan has been created. Technicians apply unplanned corrective maintenance to react as soon as a failure couldn't be anticipated with preventive maintenance processes has been detected. Corrective maintenance gives technicians the possibility to perform their interventions without delay, even if they can choose whether they want to maintain the piece of equipment on the spot, right when a problem has been detected or later. Unplanned corrective maintenance can quickly become more costly than planned one because it can lead to costs which couldn't have been anticipated. Even if preventive maintenance doesn't always allow maintenance teams to anticipate each breakdown or failure as it remains very difficult to know exactly which components are about to fail, it still helps them reduce their scope of error.

2. Predetermined maintenance

Predetermined maintenance, probably the less known one of all the maintenance types presented in this article, doesn't rely on the actual equipment's state but rather on the programs delivered by manufacturers. They elaborate these programs based on their knowledge of failure mechanisms as well as on

MTTF (mean time to failure) statistics which they observed on a piece of equipment and its various components in the past.

Based on the assumption that this type of maintenance is only applied according to programs elaborated by manufacturers, failure risks are higher or lower whether the piece of equipment or part is new or old. Maintenance teams have no choice but to rely on these programs so they might not be able to anticipate failures (there's a risk for downtimes to occur and to have a direct consequence on productivity) and they also might proceed to completely useless parts replacement (which leads to additional costs that could have been avoided).

This type of maintenance, just like others, is imperfect. It doesn't guarantee that a piece of equipment won't break down since all programs are based on failure statistics but they don't take the equipment's actual state into account. Each piece of equipment can have several maintenance programs multiplied by the number of existing pieces of equipment.

3. Condition-based maintenance

Among all types of maintenance cited above, the condition-based maintenance is the most complicated to implement. It aims to prevent failures and requires regular check-ups of the state, the efficiency as well as other indicators of the system. All this data can be gathered automatically on the field or remotely thanks to a direct network connection to the equipment, in order to make sure that it is constantly controlled. Maintenance teams can decide whether they want to operate constant or regular interval control: they read counters, check parts' wear, control motors' temperatures… These are all actions the teams can undertake to

ensure that no piece will cause a breakdown that would damage the whole production line.

Even if condition-based maintenance can seem difficult to implement, it is particularly economical. Since maintenance technicians proceed to very regular check ups of their parts and equipment, they will only take in charge the ones that need to be repaired or replaced. As a consequence, the purchasing department won't have to manage dozens of parts orders that will be stored and won't really be useful to ensure the proper functioning of the production line. In a nutshell, this type of maintenance allows companies to save money.

4. Preventive maintenance

Preventive maintenance is applied by technicians teams and managers before any breakdown or failure occurs. Its aim is to reduce the probability of breakdown or degradation of a piece of equipment, component or spare part. In order to implement such maintenance, teams have to take the part's history into consideration and keep track of the past failures. They are therefore able to identify the time ranges during which a piece of equipment might break down.

This type of maintenance is described as planned because it's based on well-established maintenance programs and hard facts. It is possible to apply preventive maintenance thanks to a computerized maintenance management system (CMMS), an essential tool for any company wishing to organize its maintenance department and therefore to ensure long-lasting productivity. A CMMS is a truly useful tool for maintenance teams as they enter every detail of their interventions and exchange with colleagues in order to keep track of all the operations, maintenance plans, etc. Technicians, thanks to their work and the information they give in, progressively build a whole history of past breakdowns and failures.

5. Towards predictive maintenance

A next-gen CMMS like Mobility Work, a solution that offers a performing analytics tool able to gather all the data entered by maintenance teams themselves, aims to progressively help plants evolve towards predictive maintenance. It allows technicians to anticipate breakdowns: they generate reports directly in their maintenance management software, they know when a piece of equipment might break down and therefore proceed to industrial maintenance operations. Once again, the most important thing is anticipation because any failure could slow down the production and become extremely costly. Predictive maintenance can be implemented thanks to an intuitive and easy to use CMMS, which will ease industrial maintenance technicians' lives and generate tables and graphs for them thanks to all the data entered by all their colleagues.

To conclude, types of maintenance that is to be implemented depends on the company's strategy. No matter what decision it makes, it has to provide the maintenance teams with a maintenance management software in order to ensure proper interventions monitoring as well as smooth communication between technicians and other professionals. This is exactly what innovative solutions such as user-friendly next-gen CMMS Mobility Work. Thanks to its analytics tool, this asset management software helps technicians visualize all their breakdowns, failures, operations and interventions and analyzes data in order to help plants figure out what type of maintenance to deploy.

MANAGEMENT

Management is a career that brings together the technological problem-solving ability of engineering and the organizational, administrative, and planning abilities of management in order to oversee the operational performance of complex engineering driven enterprises. A Master of Engineering Management (MEM) is sometimes compared to a Master of Business Administration (MBA) for professionals seeking a graduate degree as a qualifying credential for a career in engineering management.

Management is a broad field and can cover a wide range of technical and managerial topics. An important resource is the Engineering Management Body of Knowledge (EMBoK). The topics below are representative of typical topics in the field.

Leadership and Organization Management

Leadership and organization management are concerned with the skills involving positive direction of technical organizations and motivation of employees.

Operations, operations research, and supply chain

Operations management is concerned with designing and controlling the process of production and redesigning business operations in the production of goods or services. Operations research deals with quantitative models of complex operations and uses these models to support decision-making in any sector of industry or public services. Supply chain management is the process of planning, implementing and managing the flow of goods, services and related information from the point of origin to the point of consumption.

Management of technology

The Management of Technology (MOT) theme builds on the foundation of management topics
in accounting, finance, economics, organizational behaviour and organizational design. Courses in this theme deal with operational

and organizational issues related to managing innovation and technological change.

New product development and product engineering

New product development (NPD) is the complete process of bringing a new product to market. Product engineering refers to the process of designing and developing a device, assembly, or system such that it be produced as an item for sale through some production manufacturing process. Product engineering usually entails activity dealing with issues of cost, productibility, quality, performance, reliability, serviceability, intended lifespan and user features. Project Management techniques are used to manage the design and development progress using the phase-gate model in the product development process. Design for manufacturability (also sometimes known as design for manufacturing or DFM) is the general engineering art of designing products in such a way that they are easy to manufacture.

Systems engineering

Systems engineering is an interdisciplinary field of engineering and engineering management that focuses on how to design and manage complex systems over their life cycles.

Industrial engineering

Industrial engineering is a branch of engineering which deals with the optimization of complex processes, systems or organizations. Industrial engineers work to eliminate waste of time, money, materials, man-hours, machine time, energy and other resources that do not generate value.

Management science

Management science uses various scientific research-based principles, strategies, and analytical methods
including mathematical modelling, statistics and numerical algorithms to improve an organization's ability to enact rational and

meaningful management decisions by arriving at optimal or near optimal solutions to complex decision problems.

Engineering design management

Engineering design management represents the adaptation and application of customary management practices, with the intention of achieving a productive engineering design process. Engineering design management is primarily applied in the context of engineering design teams, whereby the activities, outputs and influences of design teams are planned, guided, monitored and controlled.

Large and small engineering driven firms often require the expertise of external management consultants that specialize in companies where engineering practice and product development are key drivers of value. Most engineering management consultants will have as a minimum a professional engineering qualification. But usually they will also have graduate degrees in engineering and or business or a management consulting designation. It involves providing management consulting service that is specific to professional engineering practice or to the engineering industry sector. Engineering management consultancies, are typically boutique firms and have a more specialized focus than the traditional mainstream consulting firms, A T Kearney, Boston Consulting Group, KPMG, PWC, and McKinsey. Applied science and engineering practice requires a holistic approach involving a combination of management art, science, and engineering practice. There are many professional service companies delivering services in a consultancy type relationship to the engineering industry, including law, accounting, human resources, marketing, politics, economics, finance, public affairs, and communication. Commonly, engineering management consultants are used when firms require a combination of special technical knowledge, and management know how, to

enhance knowledge or transform organizational performance and also keep any intellectual property developed confidential.

Engineering management consulting is concerned with the development, improvement, implementation and evaluation of integrated systems of organizations, people, money, knowledge, information, equipment, energy, materials and/or processes. Management Engineering Consultants strive to improve upon existing organizations, processes, products or systems. Engineering management consulting draws upon the principles and methods of engineering analysis and synthesis, as well as the mathematical, physical and social sciences together with the principles and methods of engineering design to specify, predict, and evaluate the results to be obtained from such systems or processes. Engineering management consulting can focus on the social impact of the product, process or system that is being analyzed. There is also an overlap between engineering management consulting and management science in services that require the adoption of more analytical approaches to problem solving.

Examples of where engineering management consulting might be used include developing and leading a companywide business transformation initiative, or designing and implementing a new product development process, designing and implementing a manufacturing engineering process, including an automated assembly workstation. Management engineers may specialize in the acquisition and implementation of Computer aided design (CAD), Computer-aided manufacturing (CAM) and Computer-aided engineering (CAE) applications. Services may include strategizing for various operational logistics, new product introductions, or consulting as an efficiency expert. It may include using management science techniques to develop a new financial algorithm or loan system for a bank, streamlining operation and emergency room location or usage in a hospital, planning complex distribution schemes for materials or products (referred to

as Supply Chain Management), and shortening lines (or queues) at a bank, hospital, or a theme park. Management engineering consultants typically use computer simulation (especially discrete event simulation), along with extensive mathematical tools and modeling and computational methods for system analysis, evaluation, and optimization.

HOW OPERATION, MAINTENANCE AND MANAGEMENT OF ENGINEERING EQUIPMENTS SUSTAINS DEVELOPMENT IN NIGERIA

This paper examined the policy framework for macoeconomy and observing the coordination of monetary in Nigeria by looking at the purpose of the broad macroeconomics objectives as well as the measures used in economic stability and management in Nigeria economy. These measures or policies are used in the economy to control instability in the country's economy. The paper finds out that there is a positive relationship between money supply and GDP which is important instrument promoting stability in the economy. It is also the opinion of this paper that there should be a commitment to approach in deals which serves as a measure to control price and help in maintaining growth and development the country's economy.

Importation and exportation is a very common factor in our today's economy of Nigeria and the world at large. Many companies if not all deal with daily transactions of goods. When machines/equipment are managed and maintained cost of getting those goods constantly would reduce therefore saving money and benefiting the economy

of Nigeria. Management and maintenance goes a very long way in our nation so keeping records of the equipment is also very important to avoid damage and so on. These are the benefits of equipment maintenance record in a company which also benefits the sustainability development in Nigeria;

1. ***Prevent expensive repair works from happening***

With constant use, your equipment is prone to wear and tear. Performing routine inspections allow you to see and repair small damages before they become a big problem. Documenting these inspections and small repairs help you keep track of all the maintenance work that your equipment has undertaken, ensuring that each machine is in tip-top shape before putting them to work.

2. ***Helps you create specialised maintenance programs***

Each equipment go under different working conditions and they have different limitations as well. With the help of routine check-ups, you will be able to determine and record the differences of each individual equipment with regards to maintenance works. In turn, this information will help you in creating maintenance programs specifically catering to each individual equipment on your fleet.

3. ***Prevent problems regarding warranty claims***

Documenting every repair or maintenance work done on your equipment will help you process warranty claims much easier. Keep a record of the type of maintenance work done to your equipment as well as the exact time and date repairs were done as this information will help determine your rights for the warranty claims.

4. *It increases the safety of operators*

If a piece of plant or equipment is well maintained, the risk of accidents occurring due to malfunctioning machinery is reduced. When incidents involving faulty machinery occur, there's a big chance that the operator is the first one to be affected. Having an equipment's maintenance history documented will help you keep track of your machinery's health. This enables you to schedule an inspection when needed, at the same time it ensures that your equipment are safe to work with.

5. *Helps you track who is accountable for a piece of equipment*

One machine might have multiple operators. Performing a routine inspection and documenting the findings after every project will help you track down who is accountable for any damage inflicted on your machinery. Keeping these types of records will also encourage operators to take better care of the equipment.

6. *It increases the resale value of the equipment*

Keeping a detailed record of all the maintenance and repairs that a piece of equipment went through will help increase its resale value. Buyers thoroughly assess a piece of equipment before purchasing it, most especially if the machines have already been used. Presenting potential buyers a documentation of your equipment's maintenance history lets them know that the equipment they are planning to buy have been well taken care of.

CONCLUSION

Maintenance is a combination of all technical, administrative, and managerial actions during the life cycle of an item to perform the required function. Previously, maintenance has been supposed as an expense account with performance measures developed to track direct costs or surrogates such as the headcount of tradesmen and the total duration of forced outages during a specified period. Fortunately, this perception is changing. Nowadays, maintenance is acknowledged as a major contributor to the performance and profitability of business organizations. Maintenance managers therefore explore every opportunity to improve on profitability and performance as well as achieve cost savings for the organization.

REFERENCES

https://www.mobility-work.com/

https://www.edd.ca.gov/

http://www.eajournals.org/

http://www.plantminer.com.au/