

**FACILITY MANAGEMENT AND SUSTAINABILITY
IN NIGERIA**

BY

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(PGD/CIVIL/2009/2010/073)

**DEPARTMENT OF CIVIL ENGINEERING
SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY
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MINNA NIGER STATE, NIGERIA.**

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**THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL,
FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGERIA.**

**IN PARTIAL FULFILLMENT OF THE
REQUIREMENT FOR THE AWARD**

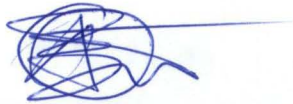
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**POSTGRADUATE DIPLOMA IN CIVIL ENGINEERING
SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY
FEDERAL UNIVERSITY OF TECHNOLOGY,
MINNA NIGER STATE, NIGERIA.**

DECEMBER, 2011

DECLARATION

I hereby declare that this thesis titled: facility management and sustainability in Nigeria is a collection of my original research work and it has not been presented for any other qualification anywhere. Information from other sources (Published or unpublished) has been duly acknowledged.



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12/2011
SIGNATURE & DATE

DEDICATION

This project is dedicated to God Almighty, my immediate family, the Bello's and well wishers.

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My deepest and profound gratitude goes to God Almighty, my helper and shield throughout the programme.

Sincere thanks and appreciation to my project supervisor; Engr. Dr. T.Y. Tsado who tutored and guided me all the way.

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ABSTRACT

Complex and dynamic activities in construction projects are broken down into stages and phases to suit supervision, efficiency and initiation of facility management concept, introduction of facility management at design phase to enhance access to equipment, room for maneuvering during repairs and upgrading of equipment. Investigatory survey research approach was used and eighty (80) questionnaire was distributed and 64.38% received. The ultimate aim is to access the level of compliance and found to be low in the construction sector (Nigeria). Construction progresses and in-house staff trained to sustain (operate and maintain) or facility managers employed after practical completion and commissioning for the management of facility. Facility management and sustainability is the operation and maintenance of facility to avoid rot/decay and a must adapt to eradicate waste and enhance performance.

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CHAPTER ONE

1.0 INTRODUCTION

Study has shown that huge sum invested in capital projects hardly equate the service/usage due to poor management, leading to increase in capital repairs, increase unscheduled shutdown and repairs, reduce equipment life, life-cycle cost saving unrealized and unsafe functional system and facilities that cannot meet the design intent. Hence the need for introduction of facilities Management in operation and maintenance and its sustainability.

Facility Management is the application of knowledge, skills, tools and techniques in facilities in order to meet or exceed stakeholders needs and expectation from a facility. It includes the processes concerned with identifying, analyzing and responding to facility needs in maximizing the result of positive event and thereby minimizing the consequence of adverse events.

Facility Management is a new concept in the Management discipline, widespread use of the term dates from the creation of the facility Management institute at Ann Arbor, Michigan in 1779 and the founding of the National (latter international) facility Management association in 1980.

Facility Management is defined by David G. Gotts as the practice of coordinating the physical workplace with the people and work of the organization, integrates the principle of Business Administration, Architecture, the Behavioural and Engineering Sciences.

Facility Management and sustainability is all embracing, efficient and effective functionality of a system which includes space planning of the environment, interior design, information system management environmental psychology management of human resources and maintenance.

1.1 PROBLEM STATEMENT

Loss of man-hour due to system collapse/breakdown, gross inefficiency in output/services, shut lived equipment/facility life, low returns/dividend on investment, shut lived facilities are all linked to ineffective maintenance, which has been identified as a very critical factor necessary for the enhancement and effective use of resources. Effective or adequate facility management has continued to be a giant problem to managers in developing countries. Well conceived and actualized project are often shut lived or abandoned largely as a result of poor maintenance.

In order to maximize limited resources for project/facility to perform or serve optimally, professional managers have been making frantic effort over the years at evolving practical concept and tools that would provide a basic scientific framework for systematically solving problems that arise from facility usage.

1.2 AIMS AND OBJECTIVES OF THE STUDY

1. To evaluate the effect of application of facility management in projects.
2. To examine effect of efficient management in equipment infrastructures and system.

3. To assess the effect of ensuring efficient facility management and maintenance on the life span and serviceability of infrastructure, equipment and systems.
4. Long-term effect of application facility management on the Nigerian economy and its cost efficiency.
5. To enhance performance and capacity utilization of equipment

1.3 JUSTIFICATION

This study is poised to investigate the impact and effects of facility management and sustainability concept on infrastructure, equipment and system. The challenges encountered in application assessed and general over view of impact of facility management detailed for use in practice.

The followings constitute the justification of the study;

1. Productive man-hour
2. Achievement of objectives
3. Reduction of capital cost
4. Less uncertainly
5. Creation of value
6. Shareholders reliability
7. Effective planning and forecasting.

1.4 SCOPE AND LIMITATION OF WORK

Facility management and sustainability is limited to construction project and infrastructure and service as it exist in developing nation like ours (Nigeria).

CHAPTER TWO

2.0 LITERATURE REVIEW

Facility Management (FM) has become an important subject for research and academic study in real estate and construction. To benefit most, organizations need to understand that their must be informed clients in managing their facilities and properties. Managing facility management effectively are extremely difficult owing to various environments, with the advent of internet, web based information management solutions enable information dissemination and information sharing among related participants. Generally, facility managers and staffs require access to the facility location to handle inspection and maintenance work at any facility locations. However, current desktops and notebooks are not suitable for using on facility locations because of problems in transportability. Facility managers and staffs generally handle various types of information, including specification, checklists and reports. Corrective repairs is grossly unproductive, as useful man-hour is lost during repairs.

Managing the facility maintenance information play an important role in the view of facility management. Therefore, controlling and managing facilities effectively are extremely difficult owing to the environment of various facilities conditions, with the advent of the internet, web-based information management solutions enable information dissemination and information sharing among involved facility management participants. Furthermore, integrating promising information technologies such as Personal Digital Assistants (PDAs), Radio Frequency Identification (RFID) scanning and data entry mechanisms, can help improve the effectiveness and convenience of information flour in tracing fault. This study presents the usual methods of desktops, notebooks and research questionnaire readily available and practicable, since facility management

Consequently, consumerism became the in-thing as individual taste changes, triggering geometric growth in production, employment and wage increase. Large warehouse, expansion/extension of existing factories and opening of new ones needed to meet extra production equipment. Fast rate of growth of good and services leads to organization to accommodate workforce in production centers.

1. Demand for good and services became higher than supply
2. Cosmetic jobs became common i.e. No specification guidelines; most attempt by trial and error

The Catalysm of the increasing labour cost and demand, and the rising demand for goods triggered off the electronic revolution of robots, computers and automated machinery. Thus, technology originally designed for war and also for space programmes were adapted for peaceful purposes. The resulting vast modern complexes with hundreds of employees were a far cry from those they replaced.

The last half-century (1950 – 2000) has seen more changes and rapid technological advancement than any other period in history. As premises grew in height, size and occupancy, administrative personnel were put in place to handle all the complaints. The latter could be of any profession who might not be exceptional in handling such cases, more of a square peg in a round hole. In most cases, the problem is compounded because the personnel lack expertise and these scenario gave rise to progressive acquisition of experience by trial and error. Knowledge gained after sides of mistakes were made remains in the organization.

In 1980, a group of people responsible for various facilities in the united states of America got together to form the International Association of

facility management, not only for member use, but also enlighten others of the complexities of facility management and share bench marks.

2.2 FACILITY MANAGEMENT

Facility management involves the concept of cost effectiveness, productivity improvement, efficiency, maintenance and employee quality of life. Concepts are often conflicting in practice. In many cases, facility managers find themselves sinking in the quicksand of diminishing white-collar productivity, placed at the precipice of office air-quality problems, or embroiled in waste-management issues that predate their employment. Research in many of these areas is non-existent or inadequate and has produced conflicting results.

Employee expectations and concerns almost always come before clear-cut technical solutions often not available but managerial decisions. Every facility managers that know their own must be reactive, because is an ace in service delivery.

Unfortunately that assumption sink a deep hole in planning, which is the key to cost-effectiveness and proper reaction to multiple needs probably you will not swallow all our management philosophy hook, line and sinkers.

Consequently, a facility manager who is not verse with philosophy regarding his position, department and facility cannot provide the leadership needed by organization

2.3 NATURE OF FACILITY MANAGEMENT

Facility management is a recent concept in management discipline. Popular use of the term dates from the creation of the facility management institute at Ann Arbor, Michigan in 1979 and the founding of the National (later international) facility management association in 1980. However, facility management has long been in practice by the military, Government and North American Colleges and University Campus officials, usually under the name of post Engineering, Public works or plant administration before formation of management Association.

Facility management as defined by David Gotts is “the practice of coordinating the physical workplace with the people and work of the organization; integrates the principle of Business Administration, Architecture, the Bahavioural and Engineering Sciences”. Often simplified to mean tat facility manager integrate the people of an organization with its purpose (works) and place (facility).

2.4 FUNCTIONS OF THE FACILITY MANAGER

According to David Gotts; the common functions of the facility managers are:

2.41 Planning and Programming

Involves the collation and usage of relevant data from sources such as operation manuals, logbooks, maintenance schedules and past experience to formulate and implement policies and procedures for effective operations of the facility. In-built in this prioritization of the various activities in the programme to identify the critical action necessary as the fall due.

2.42 Organizing

It is important for the facility to be grouped and identified either by function or by nomenclature or the building in which the facility is located. The method of ordering maintenance is also crucial as it determines the point of initiation of action. This may be centralized in which case the maintenance department is expected to initiate action or user driven where the user initiates action or still in some case a mix of the two methods.

2.43 Staffing

The personnel engaged in the procurement of facility management must be deliberately recruited, trained and equipped to function effectively. Remuneration and other motivating factors must be adequately catered for to enable such employee devote quality time to their duties. The facility manager also has the responsibility of determining the right mix for the execution of various aspect of his responsibility.

Some organization may find it expedient to depend wholly or partly on staff within the employ of the organization. Other organization may utilize the services of consultants and still others may procure the services of facilities management contractors. Most usually a mix of all the above in various degrees depending on the complexity and function of the facility is adopted.

Suffice to state however, that the management of all the personnel involved in the procurement of facilities management, has direct impact on the quality of result obtained. Therefore, it is imperative that training and retaining be a cardinal principle of personnel management in this area.

2.44 **Directing**

For an effective management, the work involved must be properly scheduled. In the case of facilities, the various specified maintenance activities and duration must be properly scheduled and affected religiously. This requires a high level of coordination by the manager and his operative as well as users of the facilities involved. Maintenance work must be directed in such a way that it does not impact negatively on production. Thus, all activities involved must be co-ordinated to ensure a minimum down time. This may be an issue of policy for a large organization or may develop as a procedure for small organizations.

2.45 **Controlling**

Like in other areas of management, facility managers must necessarily control their work processes in order to achieve desired objectives. For view of the multiplicity of personnel involved in the maintenance of any given facility, a proper system of work reception is a necessity. Standard must be established and the process of scheduling works must be carefully programmed and executed.

The use of management information system is invaluable in the present age; therefore the basic knowledge of computer application is a necessity. Where facilities management is procured, the manager routinely carries out the contract administration and ensure that policy and procedures are not breached and that corporate objectives are met.

2.46 **Evaluating**

Management system must subject itself to periodic evaluation. This is necessary in order to assess the extent of successes or failures. For the event of success, the manager need to put in place structures not only to continue to achieve success but to also improve on the level of success. In the event of failure, however, a review of the causes of failure and

demand detailed records from the contractors into the client system so that he has a complete picture of all maintenance activities at any given time. The contractor must not be allowed to own client record within his own computerized coding system. These records belong to the client and it must be passed over as soon as they occur. The choice of vendor for the computerized coding system depends on the type of system required to underpin the efficient performance of the system.

In Nigeria, computerized coding system is still in its infancy as its use is limited to the multinationals and some few elected organizations. The future of efficient facilities management shall rest on an appropriate computerized coding system considering the speed with which the world is changing in the direction of information technology. A facility manager therefore, that desires to be relevant in the near future cannot ignore the advantages of computerized coding system considering the speed with which the world is changing in the direction of information technology. A facility manager therefore, that desires to be relevant in the near future cannot ignore the advantages of computerized coding system.

2.49 Facility Management in the Nigeria Public Sector

No facility manager handles as diverse a facility, with as consistently inadequate resources, as a Local, State or Federal Government employed officer.

The public sector has a culture overwhelmingly shaped by bureaucracy. This is a fact and it is universal, Nearly every action is governed by regulation. Also, except for capital construction, public sector programs are subject to the vagaries of short-term budgets. Change is difficult, particularly if it depends on another Ministry such as Ministry of Finance where budgetary allocations are released.

Two particularly difficult areas are procurement and personnel. Public-sector procurement policies are tedious and require time in order to comply with due process. Thus, the Facility Manager often is at the mercy of a finance officer, whose priorities are not necessarily coincident. Other seemingly inevitable conflicts involve sole sourcing and contract negotiation. Though directed (sole source) procurement are at the heart of standardization programs. They are generally opposed or made bureaucratically difficult by public-sector procurements, particularly extensions of existing contracts, are made more difficult because the finance department views negotiation as procurement with very limited applicability and to be avoided. Both of these situations arise because most public-sector finance departments

1. Are over-regulated by their finance regulations,
2. Are overworked and truly underfunded,
3. Have a low-bid mentality and
4. Are not professionally qualified to handle bidding process.

Competitive bidding has its place, but its effectiveness generally is overstated. Also, almost inevitably ratchets down the quality of service provided with each re-bid. These flexible procurement approaches greatly influence the climate in which the public sector Facility Manager must function.

There never seems to be enough money to accomplish the annual work plan in the public section. Almost all Nigerian public-sector facility managers face an ever-increasing back-log of work. When this backlog is presented to the appropriate government organ, the reaction has been to shoot the messenger by attacking the credibility of the Facility Manager past or present. Capital project, though, tend to have long planning cycles and to fare better in legislatures because they bring dividends of

democracy to the legislative constituencies. Thus, managing shortages of resources is a fact of life for the public-sector facility managers.

The public-sector facility manager must also be a particular good reactor, since he may have been forced to backlog proactive programs to eliminate crises. And he must be cost conscious, since funds in the public sector tend to come in specified pipelines, quarterly releases and in some cases monthly. It means knowing the system so that funds can be shifted from one account to another at the right time though legally. Also, it is a challenge to ensure that all funds are used on meaningful work items, even though some might not be top Ministry priorities. Finally, the facility manager must have do-able work that can soak up funds from other departments' excess money in the last thirty days of a fiscal year.

Public-sector facility management is framed in regulation. No one will remember who upgraded the electrical system, but everyone will remember who misallocated or veered funds, even if done unwittingly. A public-sector facility manager needs to be legally smart and conscious of the do's and don'ts of the Public Service Regulations (PSR).

Finally, the public-sector facility manager needs to maintain a special relationship with the permanent secretary, minister, or Governor and in the case of the Local Governments, the Chairman and Supervising Councilor for works. The facility department's budget is often the second largest administrative cost in the agency (only personnel is larger), so the chief executive needs to know that the facility manager is doing the best he can with limited resources.

For his part, the facility manager needs to know that he is on the administration's wavelength. If such a climate does not exist, it's time to do some active job searching, as it is definite that he is on his way out.

Regulations have so over-regulated the public sector that change is difficult. However, with adequate knowledge of the rules and personal disposition to the authorities, much can be achieved even in this seemingly difficult terrain. A public-sector facility department can be stable and dedicated, with a great sense of mission. On the plus side, public-sector facility managers often have better organized departments, more effective standards, excellent written procedures, and a more philosophical approach to their jobs than do private-sector facility managers.

A lot of mistakes are buried under the exigencies of speed in the private sector. On the other hand, the public sector may be slow but results obtained are robust and appreciable. It is however, debatable if late successful results can compensate for speedy mistakes, which at times prove costly. The answer depends on the types of facility and the use for which it is put to. Government has in the recent time made moves towards outsourcing facility management services in Nigeria. While this laudable direction is desirable, it is necessary to advise that strenuous efforts must be made to engage only companies with qualified practitioners. Facilities management is not an all comers affair and it cannot be made so if appreciable results are to be expected. With the imminent sale of Federal Government of Nigeria house to the public, a challenge of facilities management has been thrown to the practitioners. A new line of business has also been opened to entrepreneurs. The goal

however, must be to Manage Nigeria's huge infrastructure portfolio successfully.

2.5 CONCEPT OF FACILITY MANAGEMENT:- is an interdisciplinary field primarily devoted to the maintenance and care of commercial or institutional buildings, such as hospitals, hotels, office complexes, arenas, schools or convention centers. According to the International Facility Management Association (IFMA), it is "a profession that encompasses multiple discipline to ensure functionality of the built environment by integrating people, place, process and technology". The European facility Management association. Eurofm, uses the EN15221.

EN15221-1 provided by the European committee for standard is "integration of processes within an organization to maintain and develop the agreed services which support and improve the effectiveness of its primary activities".

According to European standard the scope of FM is 'space and infrastructure' (planning, design, workplace, construction, lease, occupancy, maintenance, furniture, cleaning e.t.c) and 'people and organization' (catering, ICT, HRM, HS & S, accounting, marketing, hospitality etc).

According to BS 8536 : 2010; facility management is performed during the operational phase of a facility or building's life-cycle, which normally extends over many decades. It represents a continuous process of a service provision to support the owner's core business and one where improvement is sought on a continuous basis. The support of administrative facility management through technology is identified as computer aided facility management (CAFM).

2.6 KEY AREA OF FACILITY MANAGER

The discipline of facility management and the role of facility managers in particular are evolving to the extent that many managers have to operate at two levels: strategic-tactical and operational. In the former case, owners need to be informed about the potential impact of their decisions on the provision of space and services. In the latter, it is the role of a facility manager to ensure proper operation of all aspects of a building to create an optional, safe and cost effective environment for the occupants to function. This is accomplished by managing some of the following activities.

2.61 Health and Safety

- i. Occupational safety and health, including compliance with local state, national laws and agencies.
- ii. Industrial hygiene, including indoor air quality
- iii. Display screen Regulations
- iv. Safety Rules for contractors
- v. Risk Assessment
- vi. Control of substances Hazardous to Health

2.62 Fire Safety:-

- i. Fire protection and safety
- ii. Smoke/heat detectors
- iii. Fire alarm systems
- iv. Sprinkler systems
- v. Fire extinguishers
- vi. Dry risers
- vii. Fire stopping
- viii. Fire Risk Assessment.

2.63 Security:-

- i. Security
- ii. Access Control
- iii. Security guarding
- iv. Intruder Alert
- v. CCTV

2.64 Maintenance Systems

- i. Heating, ventilating, air conditioning and refrigeration
- ii. Preventive and predictive maintenance
- iii. Corrective maintenance / Reactive repairs
- iv. Building automation systems
- v. Building fabric and decorative
- vi. Ground maintenance and horticulture
- vii. Computerized maintenance management system

2.65 Periodic Statutory Testing and Inspections:-

- i. Lifting equipment
- ii. Work equipment
- iii. Pressure system
- iv. Asbestos
- v. Mansafe systems (window cleaning roof access, manholes e.t.c.)
- vi. Electrical portable appliance and fixed wiring
- vii. Lighting conductors
- viii. Emergency lighting
- ix. Fire protection systems.

2.66 Operational

- i. Disabled Access
- ii. Cleaning
- iii. Waste management
- iv. Environmental issues

- v. Reception
- vi. Meeting room management
- vii. Mail Room
- viii. Photocopying
- ix. Vending
- x. Office space planning, layout, and furniture placement
- xi. Car parking
- xii. Specifying, tendering and contracts negotiation
- xiii. Pest control
- xiv. Daily inspection of escape routes and fire exits

2.67 Commercial Property Management:- Lease negotiations

2.68 Business Continuity Planning

- i. Business continuity planning
- ii. Disaster recovery
- iii. Emergency procedures

2.69 Computer Aided facility Management:-

- ii. Building information modeling
- iii. Computerized maintenance management system
- iv. Personal Digital Association (PDA)
- v. Radio Frequency Identification (RFID)
- vi. Mobile RF10-based facility management (M-RFIDEM)

2.7 FACILITIES OPERATION AND MAINTENANCE

Facilities operations and maintenance encompasses all that broad spectrum of services required to assure the built environment will perform the functions for which a facility was designed and constructed operations and maintenance typically include the day-to-day activities necessary for the building and its system equipment to perform their intended functions. Operations and maintenance are combined into the

common term O & M because a facility cannot operate at peak efficiency without any maintained, therefore the two are discussed as one.

Facilities O & M section offers guidance in the following areas:

- i. **Real Property Inventory (RPI):-** Provides an overview on the type of system needed to maintain an inventory of an organization's assets and manage those assets.
- ii. **Computerized Maintenance Management System (CMMS):-** Contains description of practices used to track the maintenance of an organization's assets and associated costs.
- iii. **O & M Manuals:-** It is now widely recognized that O & M represents the greatest expense in owning and operating a facility over its life cycle. The accuracy, relevancy, and timeliness of well developed, user friendly O & M manual cannot be overstated. Hence, it is becoming more common or detailed, facility-specific O & M manuals to be required as a part of the total commissioning process.
- iv. **Janitorial Cleaning:-** As the building is opened the keys are turned over to the janitorial, custodial or housekeeping staff for interior "Cleaning" and maintenance. Using environmentally friendly cleaning products and incorporating safer methods to clean the building provides for better property asset management and a healthier workplace also important to an effective overall facility maintenance and cleaning program.
- v. **Historic Buildings Operation & Maintenance:-** This is a unique and complex issue: balancing keeping old equipment running while contemplating the impact of installing new more efficient equipment. Further, cleaning of delicate surfaces and artwork require the use of products that are likely to damage the surfaces, while providing a healthy environment for the building occupants maintaining strict temperature and humidity control to protect artwork and antiquities is

an additional challenge for the O & M staff. Extensive research has been done by the Smithsonian institution regarding the effect of temperature and humidity on artifacts.

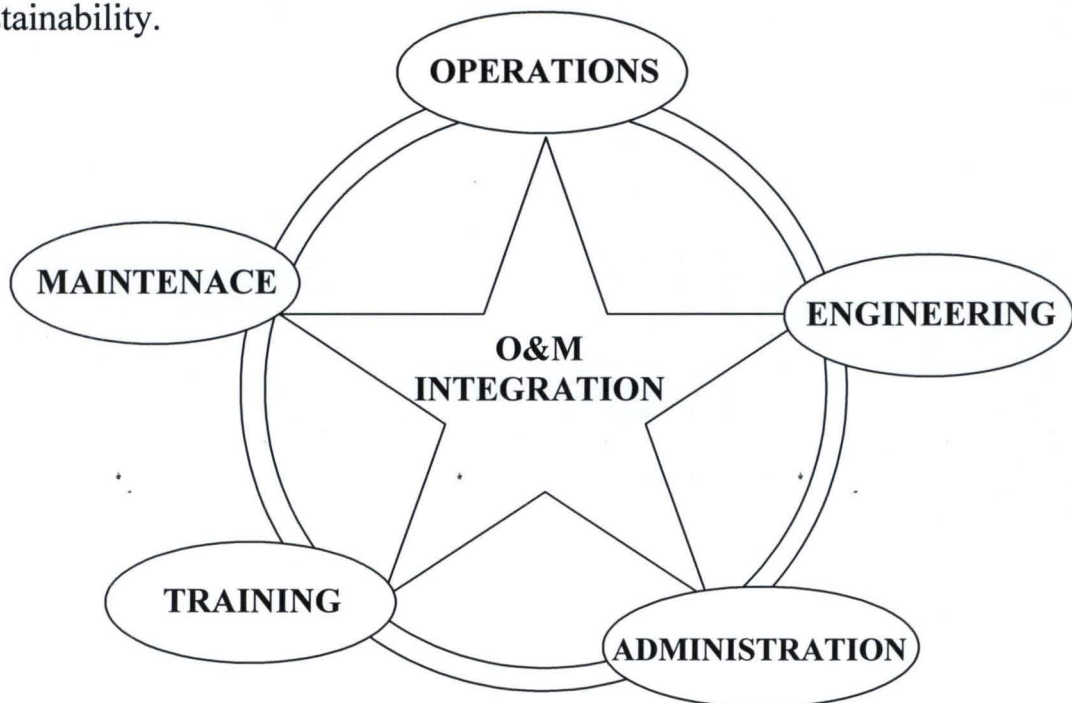
The scope of O & M includes the activities required to keep the entire build environment as contained in the organization's Real Property Inventory of facilities and their supporting infrastructure, including utility systems, parking lots, roads, drainage structures and ground's in a condition to be used to meet their intended function during their life cycle. These activities include preventive and predictive (planned) maintenance and corrective (repair) maintenance. Preventive Maintenance (PM) consist of a series of time-based maintenance requirement that provide a basis for planning, scheduling, and executing scheduled (planned versus corrective) maintenance. PM includes adjusting, lubricating, cleaning, and replacing components. Time intensive PM, such as bearing/seal replacement, would typically be scheduled for regular (plant or "line") shutdown periods. Corrective maintenance is a repair necessary to return the equipment to property functioning condition or service and may be both planned or unplanned. Some equipment, at the end of its service life, may warrant overhaul. Overhaul is the restoration of an item to a completely serviceable condition as prescribed by maintenance serviceability standards.

Requirements will vary from a single facility, to a campus to groups of campuses. As the number variety and complexity of facilities increase, the organization performing the O&M should adapt in size and complexity to ensure that mission performance is sustained.

- ii. Reduce capital repairs
- iii. Reduce unscheduled shutdown and repairs
- iv. Extend equipment life, thereby extending facility life
- v. Realize life-cycle cost saving, and
- vi. Provide safe, functional system and facilities that meet the design intent.

2.8 SUSTAINABILITY IN O&M

Sustainability is an important aspect of the O&M process. A well run O&M program should conserve energy and be water resource efficient, while meeting the comfort, health and safety requirement of the building occupants. For high performance and sustainable Buildings; Key information/department/units are integrated for high performance and sustainability.



A critical component of an overall facilities O&M is its proper management, the management function should bind the distinct parts of the program into a cohesive entity. The overall program should contain five district functions: operations, maintenance, Engineering, Technology, and Administration (OMETA). Beyond establishing and facilitating the OMETAs links, O&M managers have the responsibility of interfacing with other department managers and making their case for ever shrinking budgets.

2.9 SUSTAINABILITY (OPERATION AND MAINTENANCE)

Can be fully operation and effect optional when resources needed at each stages are integrated into the system for full utilization of service for cost. Major resources/key areas are highlighted below:

- 2.91 Planning and Design Phase:-** O&M activities start with the planning and design of a facility and continue through its life cycle. During the planning and design phases, O&M personnel should be involved and should identify maintenance requirements for inclusion in the design, such as equipment access built-in condition monitoring, sensor connections, and other O&M requirement that will aid them when the built facility is turned over to the owner/riser organization. The O&M team should be represented on the project development team so they know ahead of time the types of controls, equipment and system they will have to maintain once the facility is turned over to them. The construction operation Building Information Exchange (COBIE) initiative should also be a consideration. For a larger complexes. O&M staff should consider system-wide integration and compatibility of proposed products with existing systems, including tools, equipment and cleaning supplies.
- 2.92 Construction Phase:-** Near the end of the construction phase and prior to turnover of the facility, vendor/manufacture O&M manuals are

organized and provided to the owner/operator. Typically, personnel are trained in specified areas to support operations. Assurance that the manuals and training are provided is a part of the Building Commissioning Process. In addition, typically part of the construction contract, warranties/activation dates and spare parts information should be organized and tracked.

2.93 **O&M Approach:-** The O&M organization is typically responsible for operating and for maintaining the built environment. To accomplish this, the O&M organization must operate the systems and equipment responsibly and maintain them properly. The utility systems may be simple supply lines/systems or may be complete production and supply systems. The maintenance work may include preventive/predictive / (planned) and maintenance, corrective (repair) maintenance, trouble calls, (e.g. a room is too cold), replacement of obsolete items, predictive testing and inspection, overhaul, and ground care. O&M organizations may utilize a Reliability-Centered Maintenance (RCM) program that includes “the optimum mix of reactive, time or interval based, condition-based, and proactive maintenance (predictive/planned) practices. These primary maintenance strategies, rather than being applied independently, are integrated to take advantage of their respective strengths in order to maximize facility/equipment reliability, while minimizing life-cycle cost”. Particularly for Heating, Ventilating, and Air Conditioning (HVAC) systems, retro-commissioning is an option to improve operating efficiencies. The O&M organization is also normally responsible for maintaining records on Deferred Maintenance (DM); i.e. maintenance work that has not been accomplished because of some reason-typically lack of funds.

2.94 **Life Cycle O&M:-** According to the International Facilities Management Association (IFMA), the operating life cycle cost of a facility typically

are comprised of 2% for design and construction. 6% for O&M and 92% for occupants salaries. O&M of the elements included in building structures and supporting facilities is complex and requires a knowledgeable, well-organized management team and a skilled, well-trained workforce whether the functions are performed in-house or contracted. The objective of the O&M organization should be to operate, maintain and improve the facilities to provide reliable, safe, healthful, energy efficient and effective performance of the facilities to meet their designated purpose throughout their life cycle. To accomplish these objectives. O&M management must manage, direct, and evaluate day-to-day O&M activities and budget funds to support the organization's requirements.

- 2.95 **Computerized Maintenance System:-** O&M organizations may utilize Computerized Maintenance Management Systems (CMMS) to manage their day-to-day operations and to track the status of maintenance work and monitor the associated cost of that work. These system are vital tool to not only manage the day-to-day activities, but also to provide valuable information for preparing facilities Key Performance Indicators (KPIs)/metrics to use in evaluating the effectiveness of the current operations and to support organizational and personnel decisions. These systems are starting to be integrated more and more with Geographic Information System (GIS), Building Information Modeling (BIM) technologies and Construction Operations Building Information Exchange (COBIE) to increase/improve a facility's operational functionality.
- 2.96 **Coordinating Staff Capabilities and Training:-** Operation and Maintenance (O&M) organizations must address the skill level of their staff in light of the O&M systems and components within their facilities. This extends beyond the in-house staff to any to any contracted services

as well. If the skills required to support installed systems and equipment are scarce, either training must be provided or less sophisticated equipment systems utilized to provide an economical working arrangement. Regardless of their equipment sophistication levels, every organization should develop training programs and track staff qualification to ensure they are adequate for existing planned building systems. This will allow organizations to make improvements to training as need on an ongoing basis. A recurring training program should consider both the type of skills required and the available labour pool skills in the geographic area. Topic areas to consider are:

- i. Safety/OSHA regulations and guidelines
- ii. Equipment operational start-up and shutdown procedures
- iii. Normal operating parameters
- iv. Emergency procedures
- v. Equipment Preventive Maintenance (PM) plans
- vi. The use of proper tools and materials, to include Personal Protective Equipment (PPE).

2.97 Non O&M Work:- Most O&M organizations typically also perform work that is beyond the definition of O&M, but is often required and performed by them, that the work often becomes a part of their baseline. This work is facility-related work that is new in nature, and as such, should not be funded with O&M funds but funded by the requesting organization. E.g. from installing and outlet to support a new copier machine, providing a compressed air outlet to a new test bench, day porter services for a special event set-ups and moves, or other minor facilities work of like nature to a complete room rehab and/or new, small construction projects. Methods available to document the built environment's condition and its maintenance/repair needs include the periodic Facility Condition Assessment (FCA).

CHAPTER THREE

3.0 MATERIALS AND METHODS

The methodology adopted in this project is investigatory survey research approach.

- Study of literature related to facilities management, operation and maintenance.
- Preparation of questionnaire
- Visit to existing facilities
- Questionnaire survey and personal interview of managers and collection of data from site.
- Analyzing the questionnaire
- Qualitative analysis of data obtained.
- Remedial measures to be suggested and data made retrievable for future reference.
- Conclusions, recommendations and suggestion for future study and update.

3.1 METHOD OF SURVEYING

The general methodology of this study relies largely on investigatory survey research approach, survey questionnaire given to construction manager/staff of existing facilities and facilities under construction, were collected and adopted the more general and basic method and sources of data collection.

3.2 RESEARCH DESIGN

According to Tull and Hawkins (1984) "Research Design is the specification of the procedures for collecting and analyzing the data necessary to help identify a problem or to help solve the problem in discuss, such that the difference between the cost of obtaining various levels of accuracy and the expected value of the information associated

with each level of accuracy is maximized". In line with the research topic, exploratory and casual research design adopted.

Exploratory Research:- Design is concerned with the acquisition of that fundamental information that would uncover the nature of the problem under investigation for the study. The researcher made use of both primary and secondary types of exploratory research method.

Casual Research:- Deals mainly with establishing the effect which one variable has over the other. Both engaged in the course of this research work.

3.3 METHODS AND SOURCES OF DATA

As earlier indicated, two basic sources of data collection were used in the course of this research work. Primary (field) and secondary (desk) research sources.

3.3.1 **Primary Data:-** This involves gathering fresh information that will help in solving the problem at hand. Collection of primary data for the purpose of this study was done through observations, personal interviews and the use of questionnaires made up of structured (closed) and unstructured (open) questions were administered to the sample size which composed of managers, maintenance staff, labour (skilled/unskilled). Colleagues and the general public.

3.3.2 **Secondary Data:-** This consist of existing information's which are useful for the purpose of the study at hand. The research made use of bulletins, annual reports, journals, textbooks, magazines, newspapers and unpublished works, including online information.

3.3.3 **Questionnaire Design:-** The questionnaire, quintessential nature consist of different types of questions, structured to examine the literacy level and understanding of the respondent to raised questions and second part narrowed to general understanding and overview of the said topic

“facilities management and sustainability”. Its awareness, level of practical compliance and adaptation (primary data).

Chisnal. (1984) defines questionnaire as “method of obtaining specific information about a defined problem. So that the data after analysis and interpretation, result in a better appreciation of the problem”. In this study, questionnaires are essential instruments in the sense that they assist in collecting information from the respondent. The questions were phased in simple language which are easily understood and interpreted by the respondent.

3.4 **POPULATION AND SAMPLE OF STUDY**

According to Chisnall (1981), population refers to any group of people or objects which are similar in one or more ways and forms the subject of study in a particular survey. This population could be finite-where the total number of item or people constituting the population cannot be counted. The population of this study is from the staff of Ajaokuta Steel Company Limited, construction companies (within Ajaokuta) and the general public.

- 3.4.1 **Determination of Sample Size:-** A sample is the true representation of any population. The information supplied by this sample unit is considered as applying to the population. The information supplied by the sample not be a true view of the population, that inference can be drawn. The larger the sample size, the greater the precision or reliability, but constraint are that of time and cost. A mathematical formular was employed to determine the sample size that is a true representation of the population selection by simple random sampling.

$$n = \frac{N}{1 + N(e)^2}$$

Where: n = Sample size

N = Population

E = margin of error say 0.05 (95%)

Choosing a margin of 5% and population size of 100, we therefore calculate items;

$$n = \frac{100}{1 + 100 (0.05)^2} = 80$$

$$n = 80$$

Therefore, sample size 80 (eighty) will be used.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

4.1 RESULTS

Facilities Management Evaluation (Data from Questionnaire)

SECTION 'A'

Table 1: Population sampling according to department response

DEPARTMENT	NO OF QUESTIONNAIRE	PERCENTAGE %
Admin	11	13.75
Maintenance	32	40
Account	9	11.25
Engineering	28	35
TOTAL	80	100

Source: Data Obtained from survey (questionnaire)

Table2 Year of service in the organization

DEPARTMENT	NO OF QUESTIONNAIRE	PERCENTAGE %
1 – 3	14	17.50
4 – 7	19	23.75
8 – 11	32	40
14 and above	15	18.75
TOTAL	80	100

Source: Data obtained from survey

Table 3 Educational Qualification of Respondent

DEPARTMENT	NO OF QUESTIONNAIRE	PERCENTAGE %
WAEC	15	18.75
ND/NCE	27	33.75
B.SCH/HND	29	36.25
M.SC and above	7	8.75
TOTAL	80	100

Table 4 Position/Rank of Respondent

POSITION/RANK	NO OF QUESTIONNAIRE	PERCENTAGE %
Junior Staff	19	23.75
Senior Staff	29	36.25
Management Staff	23	28.75
Directors	9	11.25
TOTAL	80	100

RESPONSE TO SECTION 'B' MAINTENANCE**Table 5: DEPARTMENT**

DEPARTMENT	NO OF QUESTIONNAIRE	PERCENTAGE %
Admin	7	8.75
Maintenance	32	40
Account	6	7.5
Engineering	28	35
TOTAL	73	91.25

Table 6: Year of Service

YEAR OF SERVICE	NO OF QUESTIONNAIRE	PERCENTAGE %
1 – 3	9	11.25
4 – 7	11	13.75
8 – 11	30	37.50
14 and Above	8	10
TOTAL	58	72.5

Table 7: Educational Qualification

EDUCATIONAL QUALIFICATION	NO OF QUESTIONNAIRE	PERCENTAGE %
WAEC	13	16.25
ND/NCE	25	31.25
B.SC/HND	28	35
M.SC/HND	7	8.75
TOTAL	73	91.25

Table 8 Position/Rank

POSITION/RANK	NO OF QUESTIONNAIRE	PERCENTAGE %
Junior Staff	11	13.75
Senior Staff	28	35
Management Staff	23	28.75
Directors	7	8.75
TOTAL	69	86.25

SECTION 'C' HEALTH AND SAFETY**Table 9: Department**

DEPARTMENT	NO OF QUESTIONNAIRE	PERCENTAGE %
Admin	5	6.25
Maintenance	22	27.5
Account	6	7.5
Engineering	24	30
TOTAL	57	71.25

Table 10: Year of Service

YEAR OF SERVICE	NO OF QUESTIONNAIRE	PERCENTAGE %
1 – 3	9	11.25
4 – 7	17	21.25
8 – 11	30	37.5
14 and above	15	18.75
TOTAL	71	88.75

Table 11: Education Qualification

EDUCATION QUALIFICATION	NO OF QUESTIONNAIRE	PERCENTAGE %
WAEC	7	8.75
ND/NCE	22	27.5
B.SC/HND	26	32.5
M.SC & ABOVE	5	6.25
TOTAL	60	75

Table 12: Position/Rank

POSITION/RANK	NO OF QUESTIONNAIRE	PERCENTAGE %
Junior Staff	10	12.5
Senior Staff	24	30.0
Management Staff	21	26.25
Directors	6	7.5
TOTAL	61	76.25

SECTION 'D' FACILITIES MANAGEMENT**Table 13: Year of Service**

YEAR OF SERVICE	NO OF QUESTIONNAIRE	PERCENTAGE %
1 – 3	7	8.75
4 – 7	12	15.0
8 – 11	24	30.0
14 and above	10	12.5
TOTAL	53	66.25

Table 14: Education Qualification

EDUCATION QUALIFICATION	NO OF QUESTIONNAIRE	PERCENTAGE %
WAEC	4	5
ND/NCE	16	20
B.SC/HND	25	31.25
M.SC/ABOVE	6	7.5
TOTAL	51	63.75

Table 15: Position/Rank

POSITION/RANK	NO OF QUESTIONNAIRE	PERCENTAGE %
Junior Staff	7	8.75
Senior Staff	20	25.0
Management Staff	17	21.25
Director	6	7.5
TOTAL	50	62.5

Table 16: Department

DEPARTMENT	NO OF QUESTIONNAIRE	PERCENTAGE %
Admin	5	6.25
Maintenance	24	30
Account	3	3.75
Engineering	20	25
TOTAL	52	65

Note: All data obtained from survey (questionnaire).

4.2 DISCUSSIONS

Overall, the field test result indicate that the questionnaires are effective tools for facility maintenance assessment and management. Questionnaires used as data source yield a good result/data base for the assessment and level of compliance in the construction industry. The numbers of questionnaires given out was Eighty (80), the questionnaire was given out base on department, qualification, year of service and Position/Rank. Responses are grouped and classified into sub-head according to the above classification.

Generally, response was high except lacking in depth in core area of study. 100% response observed in the categories of department, year of service, educational qualification and position/Rank (General).

Response on maintenance is relatively lower, especially in key areas; 91.25% in department, 72.5% in year of service, 91.25% in Educational Qualification and 86.25% in Position/Rank. Health and safety response is lower compared to maintenance; 71.25% in department, 88.75% in year of service, 75% in Educational Qualification and 76.25% in Position/Rank.

Response to questionnaire in facilities management has the lowest and off point response; 65.0% in department, 63.75% in Educational Qualification, 62.5% in Position/Rank and year of service is 66.25%

Cumulative percentage response shown by result seems encouraging, but a through assessment of the field data report (questionnaire) shows that much is guess work in key areas and much work has to be done to enhance facility management.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATION

5.1 CONCLUSIONS

Facilities management and sustainability is a new concept that has not been fully embraced and embedded into the construction industry of Nigeria. Answers to question (questionnaire) by respondent shows a low level of compliance and awareness. A good government policy that will cover both private and public sector and include training, induction and monitoring will enhance the practice of facility management and sustainability. Adequate budget for would be managers (facility) and monitoring ill make facilities serve optimum long after practical completion and commissioning.

This study takes a holistic approach to analyse facilities management as practiced and level of adherence. Facility management has to be adopted in all stages of construction. At design stage where space in managed for equipment and utility use right through to commissioning where managers (facility) are employed for sustainability (operation and maintenance) of the project. Budget made available for operation and maintenance is a small percentage of the cost sum compare to the decay and rot that sets in if not well managed

5.2 RECOMMENDATIONS

- i Facilities management should be employed in all stages of construction.
- ii. Introduction of Government Policy that introduce a clause in the contract that enforce the contractor to adopt facility management all through.
- iii Subsequent training of in – house staff by contractor or employment of facility managers by the client.

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QUESTIONNAIRE

SECTION 'A' – GENERAL

Please tick the appropriate box, your choice of answer or comment as the case may be

1. Department: Admin ☐ Maintenance ☐ Account ☐ Engineering ☐
2. Year of service in the organization: 1 – 3 ☐ 4 – 7 ☐ 8 – 11 ☐ 14 and above ☐
3. Educational Qualification: WAEC ☐ ND/NCE ☐ B.SC/HND ☐ M.SC ☐
Others (please specify) ☐
4. Present position/Rank: Junior staff ☐ Senior Staff ☐ Management staff ☐
Accountant ☐ Manger ☐ Consultant ☐ Director ☐
6. How often do machines in organization breakdown Common ☐ Uncommon ☐
7. Reaction time to repairs Immediate ☐ Delayed ☐
8. Are your equipment automated? Yes ☐ No ☐
9. Does your equipment alarm/warn when faulty Yes ☐ No ☐
10. Can operator also carry out maintenance? Yes ☐ No ☐
11. How often is inspection done? Daily ☐ Weekly, Monthly ☐ every other month ☐ Every other day ☐

SECTION 'B' (MAINTENANCE)

12. What method of maintenance adopted?
Preventive maintenance ☐ Predictive maintenance ☐ Corrective maintenance
Reactive repairs ☐ Facility Management ☐
13. What system of maintenance adopted?
Manually updated paper-based record ☐ Personal Digital Assistance ☐
Radio Frequency Identification ☐ Mobile Radio Frequency Identification System ☐
14. Do you employ statutory testing and Inspection? ☐ No ☐

15. How often and when

Daily and before operation ☐ Weekly before and after operation ☐

Every other day; before, during and after operation ☐

Monthly before and after operation ☐

16. Difficulties encountered in maintenance activities? Lack of tools ☐ Manpower ☐

Poor management ☐

17. Have you heard about facility management as a tool of maintenance Management?

Yes ☐ No ☐

SECTION 'C' (HEALTH AND SAFETY)

18. Have you heard of operational health and safety? Yes ☐ No ☐

19. Do you take occupational safety and health into consideration? Yes ☐ No ☐

20. Health safety induction; is it a must? Yes ☐ No ☐

21. Tool box observed daily? Yes ☐ No ☐

22. Health and safety implemented by safety officer or all? Yes ☐ No ☐

23. Level of personal protective equipment compliance? Average ☐ Satisfactory ☐

Below average ☐ Good ☐ Excellent ☐

24. Is site safety walk/meeting a routine? Yes ☐ No ☐ Please comment

25. How often is house keeping observed? Daily ☐ Weekly ☐ Monthly ☐

On demand ☐

26. Has adequate safety measure enhance production and reduce cost of production in your organization? Yes ☐ No ☐ Please comment...

SECTION 'D' (FACILITY MANAGEMENT)

27. Do you know the work of facility managers? Yes ☐ No ☐

28. Do your establishment engage facility managers? Yes ☐ No ☐

29. Is facility Management part of the organization operation mode? Yes ☐ No ☐

30. If facility management is been practiced, at what level and when do you hope to start if know. Please comment....

31. Do you see the need to engage facility management at design stage Yes ☐ No ☐

32. Do your establishment consider institutionalizing facility management and sustainability?

Yes ☐ No ☐