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Assessing the Effectiveness of Tertiary Healthcare Facilities Maintenance in Nigeria: A Case Study of Abubakar Tafawa Balewa University Teaching Hospital, Bauchi.

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Abstract

This research paper evaluated the level of effectiveness of facilities maintenance in the Abubakar Tafawa Balewa University Teaching Hospital (ATBUTH) in Bauchi town; the paper tend assess the challenges with regard to the effectiveness of facilities maintenance within the various department/wards within the Hospital. The state of facilities maintenance in ATBUTH is presented in the result of this research. The paper critically analyses the inherent challenges of facilities maintenance in ATBUTH in Bauchi town Nigeria. The main challenges of managing the healthcare facilities in ATBUTH are the intricacy of the health facilities and inadequate professional man power among others. ATBUTH renders specialist services with sophisticated healthcare structures, equipment and machinery that can only be maintained by experts. The study adopted descriptive survey techniques, using the quantitative research approach (Amarantunga, Badru et al, 2002). Data was collected through the administration of questionnaires. Eighty (80) questionnaires were distributed to the facilities maintenance managers in ATBUTH. Fifty one (51) questionnaires were completed. The distributions of the respondent were 51 in-house maintenance officers and technicians. Five major indicators of effectiveness of facilities maintenace were assessed such as: Service performance, Capacity building, policies, and supervision. The data was then analyzed by weighing poor, fair, or good and the overall scores were taken to determine the degree of effectiveness of FM in ATBUTH.

Keywords / Abbreviations: Hospital Facilities, Facilities Management (FM), Facilities Maintenance Department (FMD), Medical Equipment Management, Abubakar Tafawa Balewa University Teaching Hospital (ATBUTH)

1.0 Introduction

Facility maintenance in hospitals is "maturing", which is indicative of the fact that planning and management is gaining grounds with all necessary requirements and compliances with regularities adhered to, but unfortunately many maintenance organizations in the hospitals still do not realize the prominence and paybacks of effective facilities maintenance. The primary focus of hospital maintenance is to ensure an exceptional environment of care along with the safety and security of both patients and staff. The growing urbanization has created the need for more complex hospital buildings. Nowadays, the urban hospitals need to provide a diverse set of health care service to vast number of patients and visitors in a more condensed, congested and concentrated space. This emphasized the importance of facility maintenance in healthcare sector (CHFM, 2016).

In this regard, maintenance is one most challenging and costly elements in hospitals (Chotipanich, 2004; Shohet, 2006). It supports functioning and continuity of care facilities and service of hospital as critical as emergency and lifesaving care facilities (Shohet et al, 2003). Maintenance may also affect many non-core activities of hospital such as food storage and supply, cleaning and security of building (CHFM, 2016). The healthcare facilities maintenance is different from other sectors, as they serve the clinical employees, the patients as well as the visitor of the hospital.

A number of studies have been reported in the literature (with mentioning of hospitals and healthcare facilities) on maintenance management issues (Garg and Deshmuh, 2006), facility management implication (Ventovuorient al, 2007), KPIs for facility performance measurement (Lavy et al, 2004a) reviewed published literature in healthcare FM domain.

2.0 Literature Review

Danniel Amos (2021): Facilities management (FM) play a vital role toward creating the hospitable environment that supports the core clinical business of rendering quality healthcare. To ensure optimal performance of FM, public hospital require a performance measurement (PM) framework that could guide and assist facilities managers in their operations, this paper aims to respond to this need by developing a performance measurement framework useful to improve FM performance within the context of developing countries hospital FM service delivery.

Justin Dodd, Jake Smithwick, Steven call and Dipin V. Kasane (2021): operational staffing is an ongoing concern for built environment industries. The proper staffing of maintenance personnels at hospital facilities to ensure optimal operations in the event of emergencies and disasters is an issue that has been the focus of continuing research. While a fair amount of scholarship has been dedicated to healthcare staffing in hospitals, such as nursing, there is a lack of research on identifying proper staffing for facilities management related professions in hospital facilities. Numerous utilization metrics, such as admissions, and facility metrics, such as admission, and facilities, and facility metrics, such as Gross Square feet (GSF), have been proposed as potential predictive measures for making staffing allocations. This study was con ducted to identify predictors of maintenance Full Time Equivalents (FTE) using published data by Washington State Department of Health. A linear regression was performed on maintenance FTEs at these healthcare facilities using the predictor variables, GSF,

and Equipment (PDE), R2 =.625, F(3,84) = 46.59, p =.000.

Vimal K.E.K et. Al, (2021): Today healthcare globally is growing at a rapid pace and despite the huge technological advancement, healthcare still face primitive challenge and hence results in the poor service and facility to needy. Layout planning act as one major reason which requires improvement for the effective and efficient working of healthcare facilities. This research aim at optimizing several quantitative criteria related to economic, technology and society which are take into consideration for the decision-making during the evaluation, analyzing and selection of best layout for an existing healthcare facility. Critical areas for the improvement were found out using statistical analysis based on the survey questionnaire and Apple's layouts for an efficient facility. The seven criteria namely inter-departmental satisfactory level, the average distance travelled and average time required for patient flow, the distance travelled and average time required for material flow were taken in to consdration.

IgalShohet and Sarel Lavvy (2017): contemporary trends in healthcare services provision tent toward the increased use of community-based healthcare centers . this study on the concept of healthcare provision hypothesizes that in the future, the main source of healthcare service will be a network of community-based clinic which will be a network of community clinic which will be responsible for the majority of primary and ambulatory care. This concept implies that a network of community clinic equipped with a wide geographical dispersion. The implications for healthcare facilities in terms of the resources and performance of the build environment are investigated by reference to the Israeli healthcare system. This paper reflects the results of research on healthcare facility management over the past 10 years. Comparisons of the performance and maintenance of hospital facilities and community clinics reveals that the maintenance and performance of clinic facilities have the potential to combine improved healthcare facility service with cost-effective facility management and maintenance.

3.0 Methodology

This study adopted descriptive survey techniques, using the quantitative research approach as considered appropriate (Amarantunga, Badru et al, 2002). Several maintenance technicians were interviewed to determine the scope, strategy, Roles and the effectiveness of the existing facilities maintenance management. Eighty (80) questionnaires were distributed to the facilities managers in ATBUTH. Fifty one (51) questionnaires were completed. The distributions of the respondent were 51 selected from the maintenance officers and technicians.

The questionnaire had three parts; Section 1, Section 2 and Section 3. In section 1, the questionnaire defines the scope, strategy, operations, roles and functions of the FM Department (FMD) and outlines ten (10) questions to be fully answered. In section 2, there were eight (8) questions in which the facilities maintenance officers were required to answer appropriately. While, in section 3 there were twenty six (26) questions to be completed as appropriate. The table below reveals the bench mark employed in the weighting of FM effectiveness indicators;

Table 1.0 showing bench mark used in identifying the effectiveness FM

S/No.	Condition	Level

1	Poor	< 20%
2	Fair	21-50%
3	Good	>51%

3.1 Site Description

The ATBU Teaching Hospital is located along Hospital road off Yandoka street in Bauchi metropolis. Its location lies at the North-west section of Bauchi metropolis at an altitude of 491metres above sea level. The coordinates are Latitude 10.32^0N and Longitude 9.83^0E. It is located within the bounds of Maiduguri Bye-Pass, Murtala Mohammed Way, and Yandoka Road. The ATBUTH core area covers a land area of 419,421.77 Square Meters (41.94Ha)

Figure 2: ATBUTH FACILITIES AND EQUIPMENT

The versions of infrastructure and medical equipment in the ATBUTH available to render health services are shown in the plates below

Plate 1: Surgeons performing a CS procedure in the Surgery Unit

Plate 2: Laboratory Department Facilities

Plate 3: Department of Nursing Service Nepohrology Unit

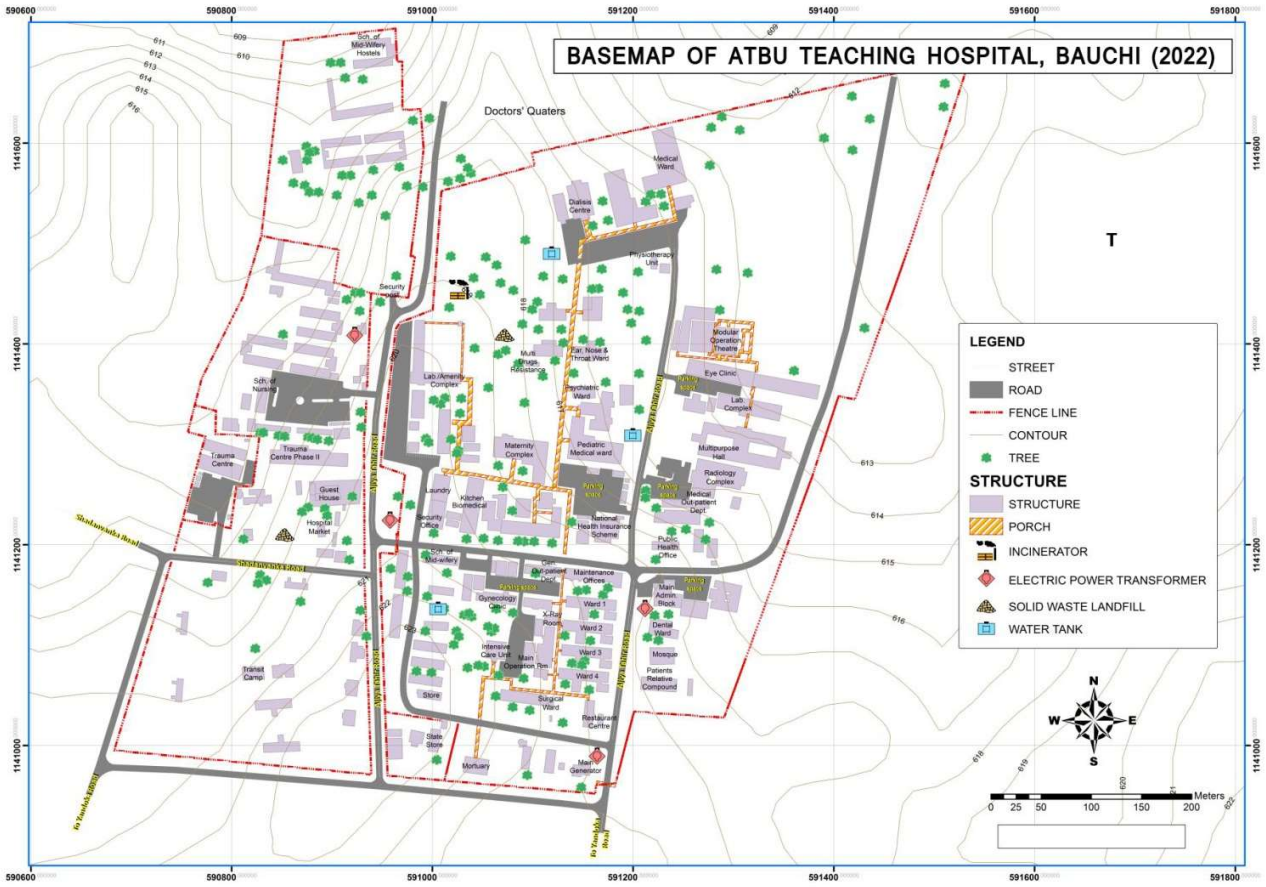
Plate 4: Solar Powered Street Light

Over Head Water Tank

Air Conditioners

Source: Field Survey, captured using TECNO Mobile (2022)

Figure 3: Basemap of ATBU Teaching Hospital, Bauchi



2.1 SCOPE OF FACILITIES MANAGEMENT IN THE ATBUTH

Shohet and Lavy, (2001) identified healthcare facilities maintenance as one of the basic essentials for successful delivery of healthcare services. The ATBUTH's facilities are among the most complex, costly and challenging to manage its facilities, Loose more and Hsin 2001.

The objective of a facilities management department in teaching hospitals environment is to achieve zero defects in the hospital's corporal operation, especially in areas where small problems can have huge consequences and be a matter of life and death. The Head of Maintenance Department described the entire framework of facilities maintenance in ATBUTH described in figure 4. It was also enumerated the areas of coverage of the Department of Works and Maintenance in ATBUTH:

1) Maintenance of all plant, equipment, building, infrastructure and landscape through an incremental maintenance program.
2) Maintenance of all medical and laboratory equipment through strategic maintenance.
3) Cleaning of general areas as well as specialized areas including supply of toiletries and consumables.
4) Supply of clean new tailored linen, collection, transporting and laundering of soiled linen, repair of torn or damaged linen and provisions of curtains, cushion covers, and screens including consumables and facilities for bagging.

5) Supply of consumable items such as waste bins, sharp containers and coloured bags, collect and transport waste from the source of generation within the hospital to the incineration plant for disposal.
6) Repairs of all damaged equipment, structure, machinery and electrical facilities in the hospital.
7) Mobilization of Security service.

The facilities maintenance department (Works & Maintenance Services Department) of ATBUTH is divided into three (3) maintenance units responsible for certain categories of duties. This reduces the responsibility of the maintenance department but by no means reduces the complexity of its duty.

While In other hospitals setting, the situation differs from what Usman Abubakar (2022) presented. Oladejo (2021) in a study conducted on tertiary hospitals in South East Nigeria observed that healthcare facilities maintenance centered mainly on structure, equipment and machinery used by healthcare institutions while the cleaning of wards, offices and general areas as well as the supply of clean linen and disposal of waste bins were carried out by a facilities management unit.

3.0 ROLES AND RESPONSIBILITIES OF ATBUTH'S FACILITIES MANAGERS

The roles and responsibilities of the facilities maintainers in ATBUTH are as follows:

- Lease agreements
- Janitorial
- Safety & Security (Security guards, Surveillance and lighting system)
- Regular repairs (Buildings, infrastructure & medical equipment)
- Preventive maintenance (Safety plans development)
- Cost saving
- Insurance
- Ensure Compliance
- Procurement

3.1 FM STRATEGY USED IN ATBUTH

The facilities maintenance departments receive up to 20% of the total quarterly appropriation of the ATBUTH for the sole purpose of maintenance of the hospital's facilities/equipment and total environment. According to Salisu Y. J. and Abubakar U. (2022) there are two strategies adopted for facilities management in ATBUTH. They include:

1. **In-house;** The FM service, including the monitoring and control of performance is provided and conducted by the various FM units of the Department of Works and Maintenance Services in the ATBUTH.

2. **Outsourcing;** where a service is commissioned from an external supply organization usually under the terms of a formal contractual arrangement based upon terms and conditions derived from a service level agreement.

The Head of Facilities Maintenance Department, Engr. Abubakar U. (2022), identified the two main contractual relationships in the facilities management outsourcing. The managing agent is adopted when the hospital's FM department in an effort to keep its employees who do not have the required expertise or skill, brings in an external agent to manage the services more efficiently and effectively as though he/she

is a part of the Maintenance Department. The managing agent then oversees the individual service providers on behalf of the department of Works and Maintenance Services.

3.2 Level Of Effectiveness Of The FM Department in ATBUTH

1. Introduction

This section of the research paper critically analyses level of effectiveness of facilities management in the ATBUTH in Bauchi Town. The facilities managers from the FMD of the ATBUTH were given questionnaires and interviewed on medical equipment management, competence of the maintenance unit, professional qualification of the maintenance crew, environmental management and finally, the existence of staff training and development programme.

The categories of indicators that were used for assessing the facilities maintenance of ATBUTH are: Financial indicators, physical indicators and functional indicators. The FM performance indicators are:

2. Indicators of FM Effectiveness in ATBUTH

i. Competence of the FM Department in Handling Emergencies
ii. Professional Qualification and Competence of the Maintenance Staff
iii. Existence of Staff Training and Development Programme
iv. Facilities Maintenance Staff Strength

Service Quality Indicators for FM Operations

i. Competence of the FM Department in Handling Equipment Emergencies During Emagency

The competence of the maintenance crew in the ATBUTH is questionable especially during emergencies. The responses from the answered questionnaires reveals that the department of Works & Maintenance Services are poorly staffed. Only very few qualified staff are recruited, which the most are technicians. See Table 1

Table 1 Competence of the Management Department in Handling Equipment during Emergencies.

Competence in Handling Equipment	Frequency	Percent (%)
YES	31	60.8
NO	20	39.2
Total	**51**	**100**

Source: Analysis of the data acquired from the administered Questionnaires

Table 1, reveals that 31 respondents representing 60.8% are of the opinion that the maintenance unit is competent to handle emergencies involving equipment failures while 20 respondents representing 39.2% feel the maintenance unit is not competent in handling emergencies involving equipment failure.

ii. Professional Qualification and Competence of the Maintenance Staff

The professional qualification of the maintenance staff is another very critical aspect that needs to be thoroughly examined because it greatly affects competence of the maintenance units. See below table 2.

Table 2 Professional Qualification and Competence of the maintenance staff

Professional Qualification and Competence	Frequency	Percent (%)
YES	39	76
NO	12	24
Total	**51**	**100**

Source: Analysis of the data acquired from the administered Questionnaires

The result in table 2 shows that 39 respondents representing 76% feel they are professionally qualified and competent to handle maintenance while 12 respondents representing 24% said that maintenance staff are not professional qualified and competent.

The economic situation in Nigeria has made employers to recruit staff with less qualification that they can pay less and still expect to have the best results. The members of staff in the maintenance units of the Department of Works & Maintenance Services in ATBUTH are of the opinion that they are professionally competent and qualified to handle all aspects of maintenance but current study shows that the maintenance department lack adequate personnel for maintenance of some sophisticated medical equipment.

iii. **Existence of Staff Training and Development Programme**

The available qualified professionals in the facilities maintenance management in ATBUTH ought to be engaged in constant staff training and development programmes to be abreast with the current sophistication and complexity of medical technology. See table 3

Table 3 Existence of Staff Training and Development Programme

Staff Training and Development Programme	Frequency	Percent (%)
YES	0	0
NO	51	100
Total	51	100

Source: Analysis of the data acquired from the administered Questionnaires.

Table 3 shows the responses on the presence of staff training and development programmes. The result reveal that 51 respondents representing 100% are of the opinion that staff training and development programmes are not in existence for the maintenance department. The responses show that staff in the maintenance units do not undergo staff training and development even in the face of highly sophisticated medical equipment and technology.

In August 2011, the Federal Government of Nigeria imported and distributed sophisticated medical equipment to tertiary healthcare institutions in Nigeria including the ATBU Teaching Hospital. The argument question is how will these equipment be put to good use and be maintained without adequate training of the maintenance staff? Lack of maintenance will make these equipment to breakdown and be abandoned without getting to the life cycle estimates of the manufacturers. Medical equipment are in constant use twenty four (24) hours in a day, every seven (7) days of the week all year round because tertiary hospitals such as the ATBUTH do not run out of patients. The precursor for adequate and more efficient facilities management system in ATBUTH, is the present need for staff training and development programme.

iv. **Facilities Maintenance Staff Strength**

Data from the completed questionnaires indicate that the maintenance staff comprises 78 technicians, 1 head of equipment & facilities, and 1 head of works. There is no director of physical planning.

Table 4: Staff Strength in the Facilities Maintenance Units

Years of experience of the FM Staff	Frequency	Percent (%)
< 9 years	33	64.5
10 – 20 years	14	27.8
20 – 30 years	3	5.8
> 30 years	1	1.9
Total	**51**	**100**

Source: Analysis of the data acquired from the administered Questionnaires.

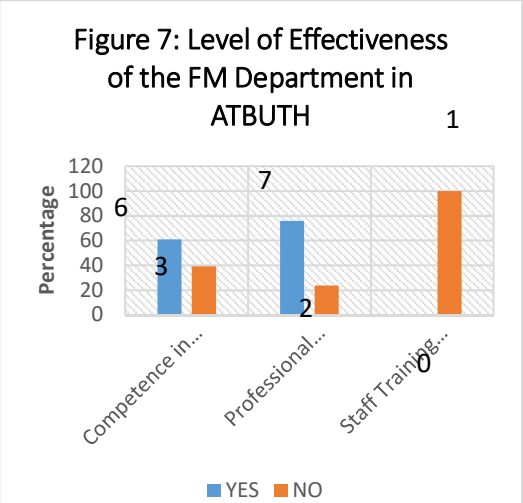
In terms of experience, table 4 also shows that 14 participants had working experience of the range between 10 to 20 years, 3 had 20 to 30 years of experience in FM industry, while 33 each had less than 9 years and 1 had more than 30 years of working experience. What this implies is that there is a fair if not poor spread among the staff in terms of professional pedigree and commensurate years of working experience in the Facilities Maintenance services which reveals a barely fair measure of reliability able to produce true and reasonable maintenance service.

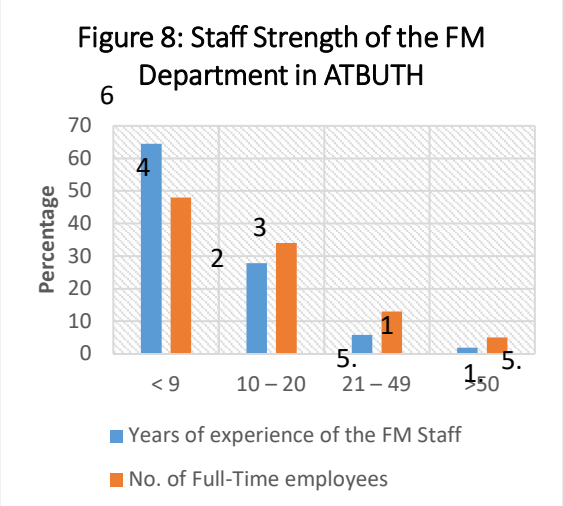
Table 5: Full-Time employees in the Maintenance Units in ATBUTH

No of Full-Time employees	Frequency	Percent (%)
< 9	24	48
10 – 20	17	34
21 – 49	7	13
>50	3	5
Total	**51**	**100**

Source: Analysis of the data acquired from the administered Questionnaires

Table 5 indicates that the Department of Works & Maintenance Services in ATBUTH has a number of full-time employees in each functional unit between 1 and 9 which represents 48% and then 34% of them having 10 to 20 employees in their maintenance units of the Works & Maintenance Services Department. This is contrary to an established fact in Nigeria where there should be at least a minimum of 25 maintenance staff in maintenance units, including their crew-members (Iyagba, 2005). This is an indication of the fact that the ATBUTH maintenance unit's staff strength is generally inadequate.





v. Service Quality Indicators for FM Operations

In order to be able to measure service quality, the four (4) basic features of service quality indicators were assessed. These

indicators are: tangibility, reliability, responsiveness, collaboration, and personnel reliability.

Table 6: Service Quality Indicators for FM Operations

Determinants	(Acceptance) Frequency
Tangibles: Appearance of physical facilities	
1. Up-to-date appearing equipment	34
2. Visual appealing physical facilities	56
3. Well dressed and neat-appearing staff	61
Reliability: Ability to perform service dependably and accurately	
4. Performing duties at certain times promised	42
5. Showing sincere interest in solving problems	52
6. Performing the service right at the first time	26
7. Insisting on error-free records	38
8. Giving personal attention to maintenance	42
9. Always come in on time	34
10. Meeting deadlines for projects and assignments	46
11. Proactive FM personnel	55
12. Having the hospital's best interest at heart	68
13. Being available at all time to assist	57
Responsiveness: Willingness to help and provide prompt service	
14. Individual promptness/consistency in giving service	69
15. Never too busy to respond to requests	31
Collaboration	
16. Close collaboration of the maintenance department with the hospital's management.	46
17. Assurance that a problem will be handled effectively and efficiently	37

Source: Analysis of the data acquired from the administered Questionnaires

Based on the four (4) dimensions of service quality (table 6), services are claimed to be tangible because people can feel the impacts of such services as maintenance repairs and cleaning services.

4.0 GENERAL FINDINGS

The findings submitted that the ATBUTH's FM unit had not effectively achieved their roles towards effective execution of facilities maintenance functions.

- ATBUTH's FM is not effective. Maintenance is reactive instead of proactive. The reactive approach to maintenance is still subject to the availability of funds.
- Although maintenance schedules exist in the ATBU Teaching Hospital studied, they are not out to use.
- The inefficiency of the FMD in ATBUTH is shown by their very poor response rate to facilities breakdown.
- Resources allocated for FM in ATBU Teaching Hospital are inadequate. The FMD attributes reasons for their inefficiency to inadequacy of funds.
- The FMD of ATBUTH has very few professionally qualified staff. A greater number of their staff are technicians who do not have the professional training and full

experience to handle maintenance of sophisticated medical equipment.

The results showed that a majority of the ATBUTH's FM staff do not have more than ten (10) years of working experience related to facilities management. There is an existing formal maintenance policy on environmental concerns as claimed by the respondents that is guiding the maintenance work execution in ATBUTH. About fifty four percent (54%) of the respondents claimed that the FM unit has an existing log-book.

4.1 RECOMMENDATIONS

The following are only but a few general recommendations for establishing an effective facilities management for ATBUTH.

1) The FM unit should be part of the design and construction.
2) Emphasis should be placed on capacity building of the FM staff to keep up with advancement in technology.
3) A proactive approach to maintenance should be adopted, the reactive approach is not suitable especially as human lives are involved.
4) Well qualified and experienced maintenance managers and staff should be appointed to achieve effective maintenance.
5) A functional maintenance schedule should be put in place and strictly adhered to, to prevent crucial equipment failures
6) Adequate resources should be provided for facilities maintenance by critically analyzing the cost expended on maintenance over the years and making necessary projections to arrive at a more adequate estimate to cover the cost of maintenance in the future.

Below are more specific recommendations from analysis of FM in the ATBU Teaching Hospital: The facilities management units should engage in periodic Audit assessments of facilities maintenance.

a. The hospital's facilities management staffs should make use of maintenance checklist.
b. Emergency generator testing programmes are very necessary and should be established for the ATBU teaching hospital.
c. An advanced state of the art computerized Information technology and Geographic Information System may be employed for monitoring affected facilities in real time, and surveillance around and within the hospitals environment.
d. Separate shifts of the facility management staffs so as to improve the management staff performance.
e. The ATBUTH can have the technology of Surveillance Camera (CCTV) which can better assist in predictive maintenance model.
f. Critical operations should be outsourcing with reference to the Lighthous's approach to facilities management.
g. Another recommendation is to conserve energy such as replace lights throughout the hospital building, with exception of the operating rooms, with energy-efficient fluorescent lighting fixtures.

4.2 CONCLUSION

Having analyzed the issues raised and the responses in this study, it has been concluded that effective and efficient maintenance in the ATBU Teaching Hospital can only be achieved if specialized professionals who can handle sophisticated medical equipment, fixture and fittings are

engaged to render services on full time basis.

The study recommends that management should ensure that the head of maintenance department has the required maintenance managers' attitude success factors before appointing them rather than being political in their selection. Management should ensure that all the staff are given adequate training for effective use of the building and the services.

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