

## Appraisal of Equipment Maintenance Management in the Laboratory (A Case Study of Nigerian Institute of Leather and Science Technology, Zaria)

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### Abstract

With the global trend of modernization and sophistication of equipment, the requirements for often appraisal of various maintenance and management programs, cannot be over emphasized. Whereas the industrialized nation have taken up the challenges associated with maintenance and have continued to design and perfect various techniques and models we as nation has failed. This research is aimed at appraisal of equipment maintenance management in the laboratories under the directorate of science technology NILEST Zaria with a view of suggesting better maintenance management practice in line with international standard. Questionnaires were distributed to technical staffs for equipment assessment, oral interviews were undertaken, and overview of available equipment maintenance records was analyzed. The result shows that 70% of all personals who are involved in maintenance are not aware of the nature and content of available program prescribed by manufacturers and appeared by management. The skilled manpower's available for effective equipment maintenance were not sufficiently adequate with low level of expertise. These have affected the training mandate of the institute. It is recommended that adequate funds be provided, technical maintenance staff training be encouraged and finally there should be provision for design improvement of items/systems whose inherent reliability proves inadequate.

### Keywords:

Maintenance,  
Equipment, NILEST,  
Laboratories,  
Programs

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## Background to the Study

Equipment maintenance management is one of the most important aspects of quality assurance in the laboratory. With the global trend of modernization and sophistication of the aircraft, the requirements for often appraisal of various maintenance and management programs, cannot be over emphasized. Whereas the industrialized nations have taken up the challenges associated with maintenance and have continued to design and perfect various techniques and models. Thomas (2005) recognized that in most organisations, maintenance is not regarded as the same level with production, marketing, finance etc. without even regarding it as a key business area. Maintenance is also isolated with little integration with other departments. Of course, maintenance personnel have always had to rely on others to function. Much of the success of these interdepartmental needs have been achieved by long-term relationships based on mutual trust and respect. However, we can all recall examples of poor cooperation and even conflict, which has had adverse effects on overall progress. In many companies, the relationship between maintenance and operations is close to open warfare. According to him, maintenance management in reality can control up to 40% of a company's costs and often has a direct effect on production output. Thomas (2005) reiterated that for maintenance to be fully effective, it needs to be recognized as a full partner in the business process. Hillielet *al.*, (2005) defines equipment maintenance as the repair or replacement of worn or damaged parts in order to keep the equipment in a standard, corresponding to its original characteristics and functions. In this case, maintenance does not include work by higher demand or for change in the pattern or that could not have been foreseen at the time of initial designed.

The preparation of a maintenance policy and strategy is an excellent start. However, as it is established that maintenance has a direct effect on company sales, through costs reduction on production makes maintenance a business centre. In consequence, maintenance needs to forecast and develop a cost and income budget to form a maintenance business plan. This clearly demonstrates that maintenance, must take full responsibility for its internal management. Jabar (2003) has another perspective of looking at maintenance function as not only to maintain but also to enhance the process of plant operation system as a result of turnaround planning. Thus rather than restoring or trying to restore the equipment to its original performance, planning: a turnaround could better be aimed at enhancing the process and performance of a plant, equipment or any system. He further explained that maintenance to most people is any activity carried out on an asset in order to ensure that the asset continues to perform its Intended functions, or to repair any equipment that has failed, or to keep the equipment running, or to restore to its favourable operating condition. Over the years, many new strategies were implemented as maintenance strategies, which are intended to overcome the problems that are related to equipment breakdown. Jabar (2003) further explained the four common types of maintenance strategies as follows:

(I) Breakdown Maintenance According to Jabar (2003) this is one of the earliest maintenance programs being implemented in the industry. The approach to maintenance is totally reactive and only act when the equipment needs to be fixed. This strategy has no routine maintenance task and it is also described as non-scheduled maintenance strategy. To rectify

the problem, corrective maintenance is performed onto the equipment. Thus, this activity may consist of repairing, restoration or replacement of components. The strategy is to apply the corrective maintenance activity only which is required to correct a failure that has occurred or is in the process of occurring.

(ii) Preventive Maintenance Jabar (2003) describes preventive maintenance as time-based maintenance strategy where on a predetermined periodic basis equipment is taken off-line, opened up and inspected. Based on visual inspection, repairs are made and equipment is then put back on-line. Thus under this equipment maintenance strategy, replacing, overhauling or remanufacturing of an Item is done at a fixed intervals regardless of its condition at the time.

(iii) Predictive Maintenance According to Jabar (2003) Predictive maintenance is a more condition-based approach to maintenance. The approach is based on measuring the equipment condition in order to assess whether equipment will fail during some future period and then taking action to avoid the consequences of that failures. This is where predictive technologies (i.e. vibration analysis, infrared, thermographs, ultrasonic detection, etc.) are utilized to determine the condition of equipment, and to decide on any necessary repairs. Apart from the predictive technologies, statistical process control techniques, equipment performance monitoring or human senses are also adapted to monitor the equipment condition. This approach is more economically feasible strategy as labours, materials and' production schedules are used much more efficiently.

(iv) Proactive Maintenance Jabar (2003) unlike the three types of maintenance strategies, which has been discussed earlier, proactive maintenance, can be considered as another new approach to maintenance strategy. Unlike preventive maintenance that is based on time intervals or predictive maintenance that is based on condition monitoring, proactive maintenance concentrates on the monitoring and correction of root causes to equipment failures. The proactive maintenance strategy is also designed to extend the useful age of the equipment to reach the wear out stage by adaptation of a high mastery level of operating precision.

Recent development in science and technology has shown that equipment maintenance is becoming more sophisticated compared to few years back. For the equipment to remain at an acceptable level of efficiency the equipment must be subjected through detailed maintenance. Its ideal time must be kept to the minimum. Equipment are also costly items. Daily routine procedures in maintenance can help to increase the lifespan of life circle of the equipment, thereby preventing unnecessary burdens on finances resources. Faulty equipment can also be unsafe for the users. Use of guideline could help in overcoming most of the problems encountered in equipment maintenance in all the laboratories.

Maintenance is define as the combination of all technical and administrative actions including supervising action, intended to retain an item in or restore it to a state, a state where it can perform a required function.

Maintenance is required for two principle reasons.

1. Operational: To keep the equipment in a serviceable reliable condition so as to generate revenue.
2. Value Retention: To maintain the current future value of the equipment by minimizing the physical decoration of the equipment throughout its life.

Thus maintenance is carried out for the following reasons.

1. To obtained the best performance at minimum cost.
2. To operate in an efficient and safety manner.
3. To increase the lifespan of the equipment.
4. To forestall unnecessary breakdown.

### **Statement of the Problem**

It is obvious that the NILEST attitude to laboratory equipment maintenance management programs is inadequate. This is the evident with dilapidated and inefficient state of her equipment which are neglected and abandoned for what timely and minor repairs could have forestalled. This has seriously affected NILEST training efficiency. Also the safety of the staff, student under training and the instructor coupled with the lives of the people around that environment must be ensured by the technicians in charge.

### **Research Questions**

1. What is the nature and content of the NILEST equipment maintenance management program?
2. What are the provisions of the programs with regard to equipment acquisition, replacement, maintenance funding, and availability of maintenance workshop?
3. What is the current equipment maintenance and management program practice in the laboratories? The problem of this research therefore is the assessment of equipment maintenance program in the laboratories.

### **Objectives of Study**

The aim of this research is in the assessment of equipment maintenance management program in Nigerian Institute of Leather and Science Technology Zaria.

The specific objectives of this research are:

1. To examine the nature of equipment maintenance in the laboratory.
2. To assess the impact of the practice of equipment in the laboratories.
3. To access maintenance program for design improvement of item/system whose inherent reliability proves inadequate.
4. To make recommendation towards the effective equipment maintenance management program in the laboratories.

### **Materials and Methodology**

These outline how to find answers to the research questions, from the research problem.

### Method of Data Collection

The method of data collection used in obtaining data analysis of results and conclusion includes;

1. Review of written document.
2. Questionnaires administrations.
3. Observation of maintenance activities.
4. Structured oral interviews.

A total of 25 questionnaires were distributed to all laboratory under science laboratory department based on trade, rank, qualification and years of experience. Discussion were held with technicians and technologies to know about maintenance activities and procedures in line with international standard. The researchers went through laboratories to observe maintenance activities.

### Results

**Table 1**

Years of experience	Ph.D.	M.Sc.	B.TECH/B.Sc.	HND	ND	(%)
1-5years	0	-	2	0	5	27.9
5-10years	0	6	0	0	5	32.6
10years and above	0	0	0	0	2	39.5

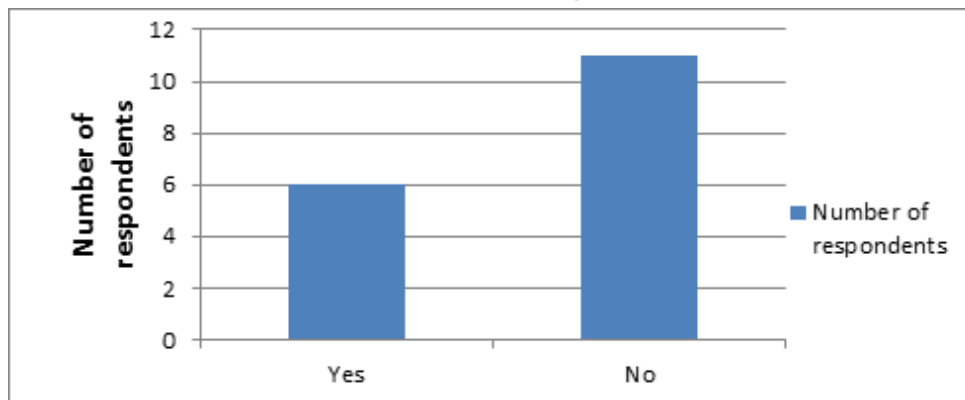
**Table 2**

Trade	Number	Percentage
1) Equipment maintenance	2	8.3%
2) Laboratory management.	2	8.3%
3) Safety and health supervisors.	0	0%
4) General Laboratory techniques.	20	83%
<b>Total</b>	<b>24</b>	<b>100%</b>

**Table 3**

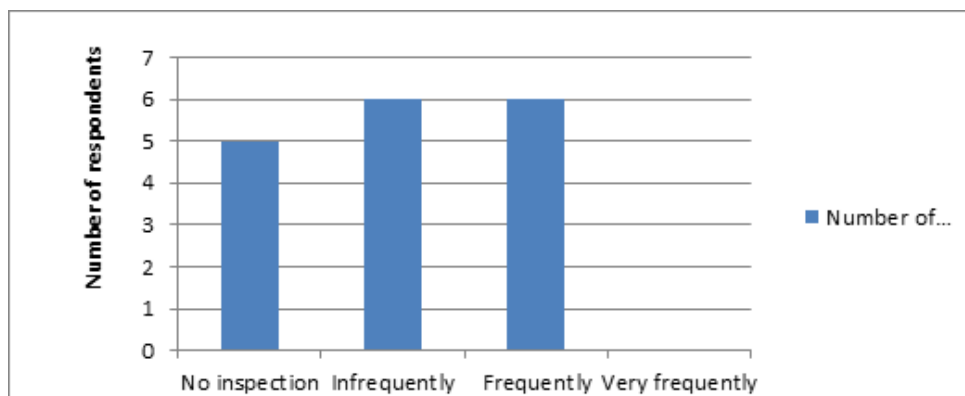
Objectives	Frequency (yes)	%	Frequency (no)	%
1) To ensure the realization of the inherent safety and reliability level of equipment	5	22.7%	17	77%
2) To ensure the reliability to their inherent levels when deterioration has occurred	4	18%	18	82%
3) To obtain the information necessary for design improvement of items whose inherent reliability proves inadequate	8	36.36%	14	63.64%

**Figure 1:** Awareness of equipment maintenance program in the laboratories



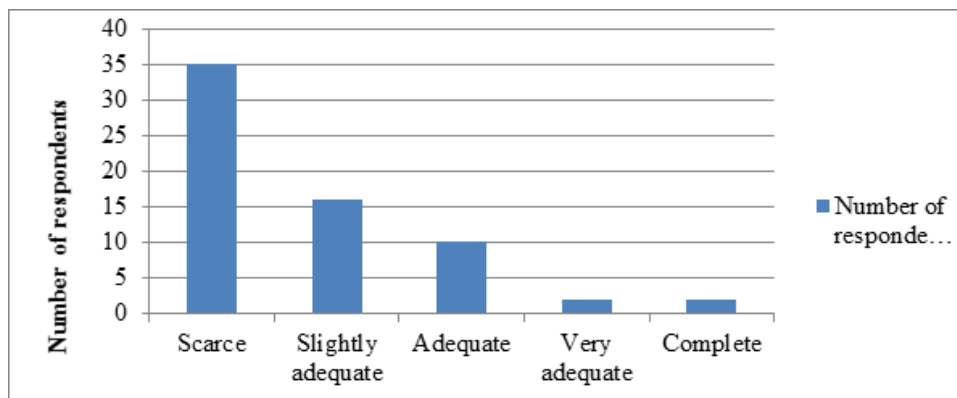
In the above result, it implies that technical staffs are not adequately inform of equipment maintenance program in the laboratories. The effect of this result is that the mandate of training cannot be fully achieved. BIS report (2011), shows that high quality and efficient equipment plays a vital role in supporting and providing good quality, reliable and sustainable services on which all maintenance works depends on.

**Figure 2:** Inspection of the Laboratories equipment's



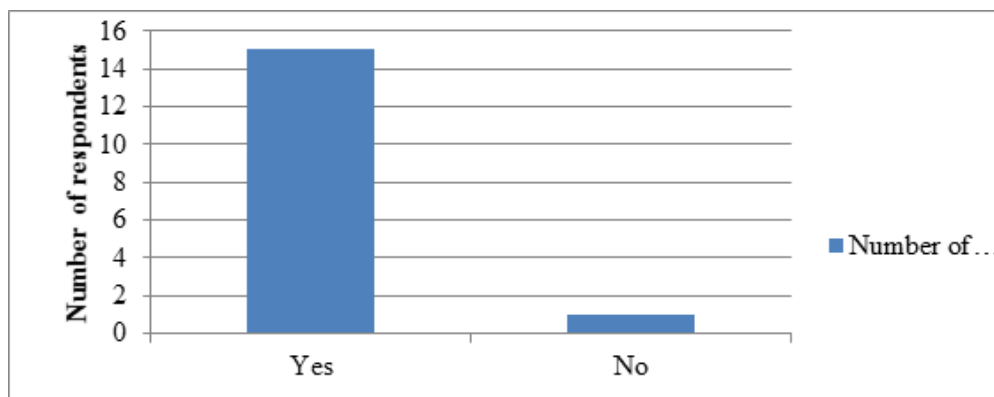
The above illustration shows that the equipment are inspected infrequently. According to virgillo (2011), he says that there must be a workshop organization and equipment maintenance procedures, in order to adequately have spare parts available and be able to able an emergency.

**Figure 3:** Adequacy of equipment's provision in the laboratory



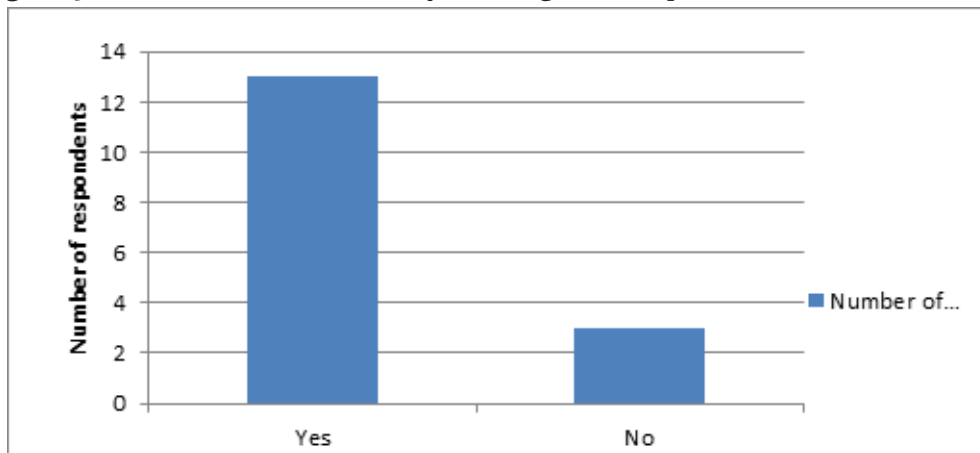
The result above indicates that adequacy of equipment provision is scarce. The implication of this result is that the training mandate of the institute will be affected.

**Figure 4:** The main objective of the level of equipment in the laboratory



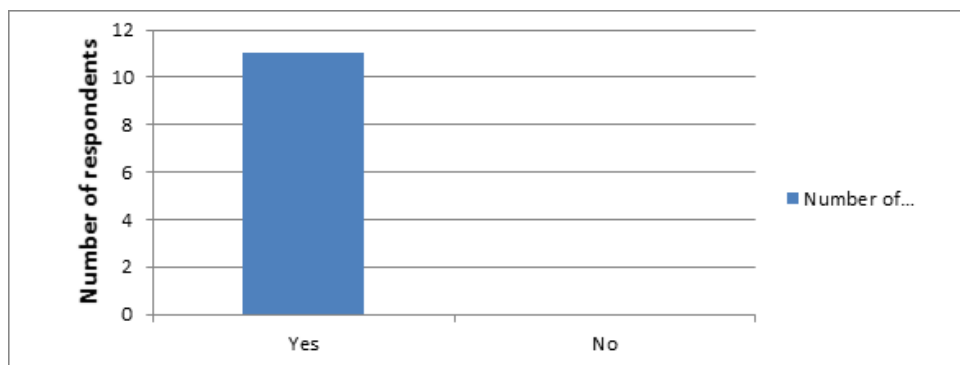
Research which is a structure enquiry that utilizes acceptable scientific methodology to solve problems and create new knowledge that is generally applicable, scientific methods consist of systematic observation, classification and interpretation of data for appropriate development. Thus the figure above shows that the main objective for of equipment provision is for training and research purpose. This is in correspondence to the training mandate of the institute.

**Figure 5:** The information necessary for design and improvement of items



The result shows that information necessary for improvement of equipment to meet its manufacturer operational level. However reports of maintenance record and verbal reports have not fully studied and analyzed for improvement and re-modification of system. According to Aminu (2006), good and effective maintenance that ensures restoration of system product quality and improvement of all equipment production is as a result of adhering sufficiently to manufacturers program.

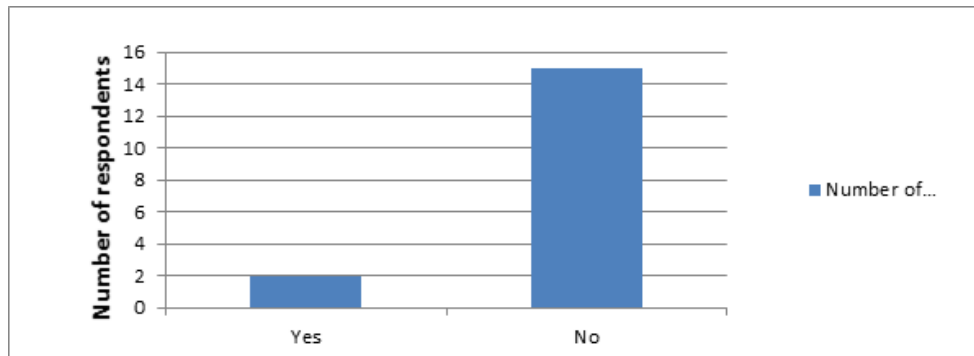
**Figure6:** Consideration of the laboratory maintenance program



The above result indicates that all the technical staffs strongly believe that the institute should adopt a maintenance program for maximum efficiency. This is in agreement with the research of Thomas (2005) who reiterated that maintenance to be fully effective, it needs to be recognized as a fully partner in the business process. He further suggested that the manner, scope of examination and inspections must relate to the severity of use of installations and maintenance of laboratory equipment by skilled and sufficient man power.



**Figure7:** Adequate fund of equipment in the laboratory



The above result fails to meet a research conducted by Zurich (2001) who developed a maintenance management program identified that adequate budget must be made available to provide the parts and service as contain in the program work.

### **Conclusion**

Base on the results obtained and analysed, the following conclusion are drawn:

1. There is not enough fund provision for the adequate implementation of maintenance program in other to achieve the goals and objectives as prescribe by the manufacturer.
2. There is no provision of research and development for system improvement, modification and redesign.
3. There is no effective system for accountability of fund available in the laboratories.
4. There is no sufficient equipment for diagnosis and repair of systems whose inherent reliability proves inadequate.

### **Recommendations**

1. The government should adequately fund equipment maintenance program to sustain its lifecycle especially now when the nation is passing through economic downpour.
2. An inspection team should be put in place to monitor equipment maintenance program.
3. There should be training and re-training of staffs specifically on maintenance services.
4. There should be a program for development of system improvement, modification and redesign whose items fails the manufacturers operations.