MACHINES MAINTENANCE MANAGEMENT PRACTICES IN SAWMILL INDUSTRIES IN NIGER STATE, NIGERIA

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Abstract

The frequent breakdown of machine which usually affect the production and the abandoning of machines that have not exhausted their life span become serious consigned. Hence, the study was carried out to identified machines maintenance management practices in sawmill industries in Niger State, Nigeria. A descriptive survey research design was employed for the study. The total of 88 respondents comprising of 22 managers, 44 machine operators and 22 saw doctors of sawmill industries of Niger State were used as population of the study. A structure questionnaire was developed by the researcher and used for data collection. The instrument was face validated by two lecturers from the Department of Industrial and Technology Education, Federal University of Technology Minna and one sawmill manager. The instrument was tried-out on 17 sawmill workers of Jebba South Kwara State. The reliability coefficient of the instrument was 0.86. Mean and standard deviation were used as the statistical tools to analyze the data, while Analysis of Variance (ANOVA) was employed to test hypotheses of the study at 0.05 level of significant. Based on the data collected and analyzed, the following findings were made. The machines maintenance coordinating and evaluating are moderately practiced in sawmill industries in Niger State. Based on the findings, the following recommendations were made: Government and sawmill owners should organized seminars and training for their workers to improve on management of maintenances activities in sawmill industries.

Keywords: *Machines, Maintenance, Management, Sawmill, Practices*

Introduction

Wood is a natural product of trees which consists of three main parts, the roots, trunk (stem) and the crown that contain the branches and the leaves. Wood is one of the most environmentally friendly building materials derived from forest as it contributes significantly to National economic growth and development (Marfo, 2010). Workers in wood processing industries (sawmill), are generally associated with occupation hazards with consequent health risk (Addai, 2002). All sawmill industries ought to be equipped for optimal performance.

A sawmill could be described as a facility which process raw timber to dimensional lumber for eventual use. Sawmill is an essential wood processing industry which continue to make significant contribution to the economic development of Nigeria communities, and the world in general (Paqueo & Silfverberg, 2015). Sawmill component for sustainable wood processing operation depend on source of timber supply, technology used in milling process, human resources and the use of sawmill byproduct (Berberet *et al*., 2010).

Sawmill industries can be located either at rural, semi urban and urban areas being the major classifications of settlement. Rural sawmill industries are located in the outskirts of cities mostly small with little commercial activities, these may include villages or hamlets where there are multiple and vast natural vegetation and open space (Akpan, 2014). Semi urban sawmill industries are categorized between urban and rural facilities, here the area is semi developed, the population and the equipment isn't as low as rural areas but less than the urban areas. While urban sawmill industries are demographically large, relatively densely populated and equipped with all modern facilities compare to rural and semi urban sawmill industries (Bloch *et al.,* 2015)

Adequate maintenance of sawmill machines reduces the rate of failure and ensure adequate machine operation. Maintenance is defined as all the technical and administrative actions, which include supervision aiming to restore an equipment or device to a state of well been in order to perform a required work (Telang & Telang, 2010). In this study maintenance of sawmill industry equipment and machine could be constant checking of the parts, lubrication of the parts, repairing and replacement of the worn out parts to be capable of performing the operations the user want it to performed. For effective maintenance and proper functioning of sawmill machines in order to achieve good products, there is need for management.
Maintenance management is the activities of planning, organizing, implementing, monitoring and controlling in order to sustain a certain level of availability, value and reliability of system and its component and the ability to operate to a certain standard level of quality (Al-Turki, 2011). As used in this study, maintenance management could be described as a process of planning, organizing, coordinating, and evaluating maintenance activities to accomplish the goal of the wood processing industries.

Coordination is the duty of management to achieve harmony on individual efforts to the achievement of group goals (Yasin, 2010). Coordination of sawmill industry activities involves the services of management. These services could consist of planning, organizing and coordinating society needs based on adequate use of available resources in woodwork industry. To ensure plan maintenances is effectively carry out there is need for proper evaluation of maintenance.

Evaluation is the determination to judge the condition of someone or something in a careful and a thoughtful manner. An evaluation in an organization provides evidence that supports the decision-making process about the continuation of operation performance (Wick *et al.,* 2010). This means that planning, organizing, coordinating and evaluating maintenances activities in sawmill industries are very important to it success. Therefore it is against this backdrop the study is undertaken to find out the machines maintenance management practices in sawmill industries in Niger state, Nigeria.

Statement of the Problem

The frequent breakdown of machines which usually affect the production and the abandoning of machines that have not exhausted their life span, this disallowed the managers and the machine operators to perform optimally when converting wood. In recent years, sawmills in Nigeria are passing through a difficult period as a result of multiplicity of the factors such as improper maintenance planning and organizing of industries and most of sawmill in Nigeria are depreciated which Niger State is part of it. (Ogunwusi, 2012).
Hence, the need for this study is to identify machines maintenance management practices in sawmill industries in Niger State, Nigeria.

Purpose of the study

The purpose of the study is to find out the machines maintenance management practices in sawmill industry in Niger State. Specifically, the study tends to check:
1. Machines maintenance coordinating practices in sawmill industries in Niger state
2. Machines maintenance evaluating practices in sawmill industries in Niger state.

Research Questions

The following research questions were raised to guide the study:
1. What are the machines maintenances coordinating practices in sawmill industries in Niger state?

2. What are the machines maintenances evaluating practices in sawmill industries in Niger state?

Hypotheses

The following null hypotheses were formulated to guide the study and were tested at 0.05 level of significance:

$H0_1$ There is no significant difference in the mean responses of managers, machine operators and saw doctors on the ways sawmill machine maintenance practices are coordinated in sawmill industries.

$H0_2$ There is no significant difference in the mean responses of managers, machine operators and saw doctors on the ways sawmill machine maintenance practices are evaluated in sawmill industry.

LITERATURE REVIEW

Olaoye (2013) carried out a research on management of occupational hazards in wood processing industries in South-West Nigeria. The general purpose of the study was to investigate the management of occupational hazards in wood processing industries in South-West Nigeria. Specifically; Identify measures for planning of wood processing activities in industries to eliminate hazards, determine the measures for organization of wood processing industries to eliminate hazards and identify the measures for co-ordination of the processing activities to eliminate hazards during the finishing of wood products amidst others. A survey research design was adopted for the study. A structured questionnaire was used for data

collection. The trial test for determining the coefficient of internal consistency of the instrument was carried out using Cronbach Alpha. The reliability coefficient of the instrument was 0.94. Five research questions were posed in line with the purpose of the study and five hypotheses were tested at 0.05 level of significance. Stratified sampling technique was used to determine a sample of 711 workers in wood processing industries in South-West Nigeria that constituted the population of 7,110 workers. Mean and standard deviation were used to interpret the five research questions while ANOVA statistics test was used to test the hypotheses. The study revealed that twenty identified factors among which are principles of hazards planning on production innovation and development in all wood processing activities and addressing of hazards by planning team to enhance product development were measures for planning of wood processing activities in industries to eliminate hazards. The study also revealed that eighteen measures like adoption of the use of waste strategy approach for all waste materials in industries and removal of saw dust, shavings and waste materials daily were identified as the measures for organization of wood processing industries to eliminate hazards. It was also discovered that fourteen measures like proper handling of products during finishing operations and appointment of competent foremen as unit heads in wood processing industries were the measures for co-ordination of the processing activities to eliminate hazards during the finishing of wood products. It was also shown that twenty seven major constraints like employees and employers in industries do not always show interest on safety and lack of conducive working environment such as space were found to hinder the management of occupational hazards in wood processing industries. The study revealed that there was no significant difference ($p>.05$) in the mean ratings of engineers, foremen and designers on the measures for planning of wood processing activities in industries to eliminate hazards. The study also revealed that there was no significant difference ($p>.05$) between the mean ratings of designers and engineers on the measures for organization of wood processing industries to eliminate hazards. There was no significant difference ($p>.05$) between the mean ratings of managers and foremen on the measures for co-ordination of the processing activities to eliminate hazards during the finishing of wood products. The study revealed that there was no significant difference ($p>.05$) between the mean ratings of timber sellers and machine operators on the major constraints hindering the management of occupational hazards in wood processing industries. It was also discovered that there was no significant difference ($p>.05$) in the mean ratings of engineers, foremen and designers on the measures for improving the management of occupational hazards in wood processing industries. It was recommended that efforts should be made by the managers, foremen and engineers to identify high risk areas that require immediate attention in wood based industries. It was also recommended that an attempt should be made by the government to reduce tariff on wood products

Maheshwaran *et al.* (2015) carried out a study on Planning of maintenance activities – A current state mapping in industries. The study aims at mapping the current state of the work procedures for maintenance engineers and planners in the industry and analyzes the gap from current practices to the strategic planning which could increase productivity. The study specifically focuses on how industries work today with finding critical resource, performing criticality analysis, and planning maintenance. A mixed method research design involving the use of quantitative and qualitative method of data collection was stipulated, with the intent of increasing knowledge about how criticality and bottleneck detection is used from a maintenance perspective in industry. Quantitative data was collected using a web-based

questionnaire survey while the qualitative data was collected using a structured interview guild. The study was carried out in two of Sweden's largest discrete manufacturing companies. The targeted population of the study was 82 maintenance or production experts. 62 out of the 82 subjects was sampled using non – probabilistic judgement sample. The method of data collection involves the use of a web-based questionnaire and also an interview guild. Data collected was analyzed using SPSS and presented with descriptive statistics in terms of frequency of responses. The findings of this study show that majority of the companies work with bottleneck detection to high degree. Companies do not work with criticality classification to a high degree, however the one's using it updates it. All companies from interview data worked with criticality classification and bottleneck detection. During interviews the term "critical resource" resulted in random answers, and not everyone was sure what are critical and bottleneck resources. It was also shown that the vast majority prioritizes maintenance work orders, and all interviewed companies does it. From the interviews, prioritization of reactive maintenance is largely situation-dependent, criticality classification is not always used to prioritize maintenance, and bottlenecks are not extensively used in maintenance work.

METHODOLOGY

The study adopted descriptive survey research design as the study collected and analyzed data from few people considered to be representative of the entire group. The study was carried out in Niger State that was created out of the defunct North western state. The state comprises of 25 local government areas grouped into seven educational zones. The population for the study consists of 88 subjects. Twenty-two (22) managers, 44 machine operators and 22 saw doctors in sawmill industries in Niger State. The total population for the study being 88 is manageable hence there was no need for sampling. Hence the total population was used.

The instrument for data collection for this study was structured questionnaire. It consisted of 48 items developed by the researcher from literature. All section of the questionnaire is structured so that respondents will give their opinion based on a five point rating scale. The scales used are as follow. Research Questions: Very highly practiced (VHP) = 5, Highly practiced (HP) = 4, Moderately practiced (MP) = 3, Slightly practiced (SP) = 2, Not practiced (NP) = 1.

The draft instrument was subjected to face validation by three experts, two from the Department of Industrial and Technology Education, Federal University of Technology Minna and one sawmill manager.
Cronbach alpha reliability formula was used to determine the internal consistency of the instrument for data collection. Seventeen copies of the instrument was administered, 5 for managers, 10 for machine operators and 2 for saw doctor in Jebba South of Kwara State The reliability coefficient of the study was analyzed to be 0.86.
The instrument was administered to the respondents by the researcher with the aid of six research assistants to facilitate the administration. The research assistant was briefed on the objectives of the study and how to locate the subjects. They were also briefed on how to collect the questionnaire from the respondents. The questionnaire returned rate was 100%.

Descriptive statistics was used for the analysis of the data collected. Mean and standard deviation were used to answer research questions while, analysis of variance ANOVA was

used to test hypotheses 1, 2, 3 and 4. Decision on the research questions was based on the result of mean scores, interpreted relative to the concept of real lower and upper limit of numbers as shown in Table 3.1. Decision on the hypotheses was based on comparing the significant value with ($P < 0.05$) level of significance. If the significance value is equal or greater than ($P < 0.05$) level of significant, the hypothesis is upheld otherwise not upheld.

S/N	ITEMS	$\bar{x}_{Avg}$	S.D	RK
1.	Delegate workers to execute specific operation in sawmill	4.33	0.59	HP
2.	Adequate supervision of workers in sawmill industry	3.33	0.59	MP
3.	Periodic inventory and inspection of machine in sawmill	3.41	0.98	MP
4.	Motivation of workers through the provision of adequate working materials, training and development	3.27	0.92	MP
5.	The activities (sawing, cleaning and lubricating) are brought together, harmonize and unified for effectiveness of sawmill instruction	2.16	1.00	SP
6.	Proper handling of tools and machines during and after operation	1.89	0.73	SP
7.	Develop programs that will assist sawmill workers to improve technologically	1.44	1.53	NP
8.	Using performance appraisal by the manager as a yard stick of promotion and training	1.36	1.06	NP
9.	Improving the safety arrangement in sawmill industry by providing different safety devices	2.39	1.13	SP
10.	Ensuring maintenance of different machines and equipment in woodwork industry	3.25	0.79	MP
11.	Ensuring cordial relationship between sawmill manager and other workers for realization of maintenance culture	2.95	0.84	MP
	GRAND MEAN	**2.70**	**0.92**	**MP**

RESULTS

Research Question one

What are Machines Maintenance Coordinating Practices in Sawmill Industries in Niger State?

Table 1

Mean Responses of Respondents on Machines Maintenance Coordinating Practices in Sawmill industries in Niger State

Key: $\bar{x}_{Avg}$= Average mean of tree group of respondents
SD = Standard Deviation, **RK** = Remark, **SP** = Slightly practiced, **HP** = Highly practiced, **MP** = Moderately practiced, **NP** = Not practiced

Table 1 Showed that the respondents rated 1 out of 11 items presented as maintenance coordinating practices as 'highly practiced' with means ranged 4.29, five practices rated moderately practiced' ranging from 3.25 to 3.41, three were 'slightly practiced' ranging from 1.89 to 239 and two rated not practiced ranging from 1.36 to 1.44. The 11 items had their standard deviation ranging from 0.06 to 1.53 which is less than 1.96, showing that the respondents were not too far from the responses and were close to one another in their responses. The closeness of the responses adds value to the reliability of the responses. The grand mean indicated the mean of 2.70, which signified that the machines maintenance planning was moderately practiced.

Research Question Two: What are machines maintenance evaluating practices in sawmill industries in Niger State?

Table 2: Mean Responses of Respondents on Machines Maintenance Evaluation Practices of in Sawmill industries in Niger State

S/N	ITEMS	$\bar{x}_{Avg}$	S.D	RK
	Check the achievement of objective and failure after each operation in sawmill industry	2.43	0.79	SP
	Check the maintenance practices in sawmill industries	3.30	0.77	MP
	Ensuring higher productivity in sawmill industries	3.25	0.57	MP
	Good human relation among manager and other workers	4.44	0.74	HP
	Check the workers welfare	3.39	0.82	MP
	Check performances of safety devices	2.42	0.95	SP
	Ensure safety compliance	3.24	0.83	MP
	Check work excellence among sawmill industry machine operators	2.31	0.69	SP
	Check the effective management of material resources	2.22	0.87	SP
	GRAND MEAN	**3.00**	**0.78**	**MP**

Key: $\bar{x}_{Avg}$ = Average mean of three groups of respondents
SD = Standard Deviation **RK** = Remarks
SP = Slightly practiced, **HP** = Highly practiced, **MP** = Moderately practiced

Table 2: The analyses of data presented revealed that the respondents rated 1 out of 9 items presented as 'maintenance evaluating practices of sawmill machines' as highly practiced'' with

means ranged 4.44, four rated moderately practiced ranging from 3.24 to 3.39 and four rated slightly practiced ranging from 2.22 to 2.43. The 9 items had their standard deviation less than 1.96 showing that the respondents were not too far from the responses and were close to one another in their responses. The closeness of the responses adds value to the reliability of the responses. The grand mean indicated the mean of 3.00, which signified that the machines maintenance planning was moderately practiced

Hypothesis 1 There was no significant difference in the mean responses of managers, machine operators and saw doctors on the ways machines maintenance practices are coordinated in sawmill industries.

Table 3 Analysis of Variance (ANOVA) of respondents on the ways machine maintenance practices are coordinated in sawmill industry.

Source	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1.112	2	0.556	2.274	0.109
Within Groups	20.532	84	0.244		
Total	21.644	86			

Table 3 presented result of the ANOVA on maintenance coordinating practices of machines in sawmill industries in Niger State. As revealed from the analysis the p-value (0.11) is greater than the stated standard of 0.05 level of significance hence, the null hypothesis was upheld. Thus, there was no significant difference in the mean responses of managers, machine operators and saw doctors on the maintenance coordinating practices of machines in sawmill industry.

Hypothesis 2: There was no significant difference in the mean responses of managers, machine operators and saw doctors on the ways sawmill machines maintenance practices are evaluated in sawmill industries.

Table 4 Analysis of Variance (ANOVA) of respondents on the ways machine maintenance practices are evaluated in sawmill industry.

Source	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	0.060	2	0.030	0.202	0.818
Within Groups	12.591	84	0.150		
Total	12.652	86			

Table 4 Showed the result of the ANOVA on maintenance evaluating practices of saw machines in sawmill industry in Niger State. As revealed from the analysis the p-value (0.82) is greater than the stated standard of 0.05 level of significance hence, the null hypothesis was accepted. Thus, there is no significant difference in the mean responses of manager, machine operators and saw doctors on the maintenance evaluating practices of sawmill machines in sawmill industry.

Discussion of findings

The finding of the study on maintenance coordinating practices of sawmill machines in Table 1 revealed that the delegation of workers to execute specific operation in wood processing industry is highly practiced. The finding is in agreement with Oluwu (2013) which said that

coordination is a delegation of duties in orderly manner. Delegation in industry could refer to when manager placing workers to their jobs so that he can be realize to other jobs.

The finding on the motivation of workers through the provision of adequate working materials, training and development is moderately done. The finding conformed to the work of Ajayi and Ayodele (2009), which opined that, one of the biggest motivation skills is to consider a feeling of wanting and predisposition of people to use. It assisted other fellow workers to improve in their various area of work when the ability is been known, more also for workers to do well in their works requires motivation.

Finding revealed that improving the safety arrangement in sawmill industry by providing different safety devices, proper handling of materials during and after operations among others are slightly done in sawmill industries. The finding is in contrast with the finding of Ragbuwanshi (2008), which state common safety measures in wood processing industry. Such as: loose clothing is not allowed when working with machine, tools should be kept in the respective places, guards should be use at all times when operating machine, feed the work by holding it firmly and others. The finding is in negative with the finding of Akpa (2014) which stated that, inspection is the necessary tool for moving workers to perform their work effectively in their respective area. The materials together with the products could also pass through inspection in order to meet market demand it could be during and after production.

Finding on Hypothesis one revealed that there was no significance difference on the mean responses of managers, machine operators and saw doctors on the ways machine maintenance practices are coordinated in sawmill industry. The finding is in consistent with the finding of Akpakwu (2008) who stated that coordination is the synchronization of the workers and the materials to achieve effective instruction of workshop. In this view the managers could fellow the coordinating activities such as supervision, individual worker effort should be unified and analyzing, interpreting different types operation to the workers and others.

The finding of the study on maintenance evaluating practices of sawmill machines in Table 2 revealed that good human relation among manager and other workers is highly practiced. The finding is in agreement with the study of Oluwo (2013) who viewed management as a professional discipline that assembles and uses resources in terms of human resources, financial resources, physical resources and time to accomplish objective. This implies that management involves the use of human resources through the process of planning, organizing, coordinating and controlling various activities which could done through good human relation among manager and other workers. The finding revealed Check the maintenance practices in sawmill industries, Check the workers welfare, these finding were moderately evaluated. The findings are inadequate with the finding of defence logistics agency (2016) which stated that maintenance includes operational and functional checks, servicing, repairing or replacement of necessary devices machinery, equipment in industry business. This implies that workers of sawmill industry need additional maintenance practices in order to do better in the area of their work.

Finding on Hypothesis two revealed that there was no significance difference in the mean responses of managers, machine operators and saw doctors on the ways machine maintenance practices are evaluated in sawmill industry. The findings are in agreement with the finding of Bukola and Samuel (2012) which determined the various evaluation of maintenance culture

used for enhancing the performance of maintenance personnel in the industry. And supported by Sak and Burke (2012) who stated that evaluation is the process of making effort and collecting data in order to identify the effectiveness or efficiency of the work. This implies that evaluation result, helps the managers, beneficiaries of sawmill industries, partners and others to acquire experience and promote on the next intervention.

Conclusion

Based on the findings of the study, it is understood that the respondents need adequate maintenance planning practices of sawmill machines in sawmill industry, maintenances organizational practices of sawmill machines in sawmill industry, maintenances coordinating practices of sawmill machines in sawmill industry, maintenances evaluating practices of sawmill machines in sawmill industry. Such practices include proper planning of human and material resources, provision of access road to sawmill industry, positioning of machines in order of their operation, arranging the equipment and machines in sawmill industry to enhance productivity and adequate supervision of workers in wood processing industries. If these practices are carried out during wood processing activities ,the objectives of sawmill industries would be achieved and recorded in such that accident free, smooth condition of machines, among others. When the maintenances management practices are not implemented and reinforced, the rate of timber production will decline. Conclusively, this study identified some sawmill machines maintenances practices that need to be work upon and restructure in sawmill industries.

Recommendations

Based on the findings of the study, the following recommendations are made.

1. Government and sawmill owners should organized seminars and training for their workers to improve on planning of maintenances activities in sawmill industries. This will help them to adequately provide spare parts before breakdown of machines and also contribute to safety of workers and customers.
2. The government and sawmill owners should consult facility planners for effective sawmill layout. This will also improve safety of the machine and the personnel.
3. The maintenance activities in sawmill industry should be well evaluated to ensure that the maintenance activities planned are well implemented. This can be done daily, weekly or monthly.

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