EVALUATION OF MAINTENANCE CULTURE OF SOME AGRICULTURAL PROCESSING MACHINE IN OYO STATE, NIGERIA

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ABSTRACT

A survey on maintenance culture of some Agricultural processing machines was carried out in Oyo state to investigate the type of maintenance practices carried out by stakeholder in the small scale agro- processing industry. Well structured questionnaire was used to source information on common machine fault, availability of spare parts, technical knowhow and types of maintenance carried out. A total of 150 questionnaires were administered while 86.7% were retrieved, collated and analyzed using descriptive statistics. The study showed that 39% of the respondents practice predictive maintenance, 24% practice preventive while 27% combine both predictive and preventive maintenance, 8% of the respondents prefer overhauling and 3% corrective. The technical know-how for the service maintenance of the machines surveyed is spare part dependent as most of the machines are locally fabricated. However, 34.6% of the respondent tends to leave their machine for a period of six month before maintaining during the off season period. A good and effective training program on maintenance procedures should be extended to stakeholder in the agro- processing industry to keep those machines in optimum working condition.

Keywords: Agro- processing machine, maintenance, technical knowhow.

Introduction

Postharvest technology deals with handling of biomaterials to enhance the economical value of the products, increase the life span of the material, to maintain the standard and quality of the farm products by the use of Agricultural processing machinery. As the world population is increasing, especially in developing countries, the demand for food is likewise increasing. To meet this demand for food security, agro-processing machines provide enabling environment to keep pace with the trend by providing product quality, quantity and delivery targets through an efficient maintenance management system that yield improved operating performance. Agricultural mechanization, which started in Nigeria in 1939 (Odigboh, 1996), encompasses diverse category of equipment needed to aid processing of some Agricultural produce and other food items to finished products consumed by human and industrial uses . Mechanization of processing operations have been found to enhance human capacity, leading to intensification and increase in production (Davies *et al*., 2008). This machinery include, cassava grater, hydraulic press, feed mill, maize sheller, burr mill, oil expeller , palm oil digester, dryer, pelletizing machine among others. These processing machines are powered by petrol/diesel engine or electric motor and are frequently used. Because of the complexity of their mechanism and area of application, adequate and efficient maintenance practices are to be strictly adhered to.

Literature Review.

Moubray (1997) defined maintenance as the execution of activities, which ensure physical assets continue to do what their users want them to do. It was also defined as the routine and recurring process of keeping a particular asset or machine, in its normal operating condition so that it can deliver its expected performance or services. Maintenance practice can be grouped as preventive, corrective, predictive and overhauling. Preventive maintenance is based on elapsed times or hours of operation that are based on statistical or historical data for specific type of machine. It aimed at maintaining reliability and improving activities such as the replacement of machine elements, inspection, testing and checking of working parts during their operations. Corrective maintenance is carried out following the failure of the machine and is so designed to return the component to its normal operating condition. It is used where the consequences of failure are not significant and has low cost. Predictive maintenance, however, involves taking of measure and applying the technology or process to predict failure. Predictive maintenance can reduce the overall cost of facilities operation and involves both policy of operating equipment properly as well as within its range of capacity and keeping the equipment clean as well as in prime operating condition. Overhauling maintenance is the isolation, stripping down and replacing of all machine parts and components which have deteriorated beyond specified standard (Mobley, 2002/1982)

One of the ways of reducing post harvest losses is to increase Agricultural processing activities through economy of scale. Economy of scale of Agricultural product processing (APP) can only be efficient by adhereing to an appropriate maintenance culture as observed Naveh and Erez (2004) on *process conformance*. The other important factor is stabilizing the stakeholders in the industy. Glebbeek (2004) and Zeynep and Huckman (2008) observed that many research reports have argued that turnover has negative effects on operating performance due to the disruption of existing routines. These would bring about reduction in number of abandoned processing machine. This work therefore seeks to investigate the common maintenance cultures of agricultural processing machines among the practioners in Oyo State an agrarian state at the evergreen Southwestern Nigeria. This is with a view to knowing how appropriate are these maintenance culture and the common maintenance problem among the practioners. To meet the need for food of the increasing population, the attitude of users of these machines to every specified maintenance practices will definitely determine its performance. The objective of this work was, therefore, to investigate the maintenance culture of some agricultural processing machines in Oyo State.

Materials and Methods

Small and medium agro-processing machineries in eighteen local government areas namely: Afijio, Ibadan North-West, Ibarapa North, Ibarapa East, Akinyele, Iseyin, Ona Ara, Kajola, Oluyole, Saki West, Saki East, Ogo Oluwa, Oyo East, Ido, Ogbomoso South, Atiba, Atisbo and Iwajowa Local Government of Oyo State were surveyed by means of one hundreds and fifty structured questionnaire and personal interview. To ensure that information gathered were true representation of what should be obtained, reluctant respondents were persuaded with extensive explanation on the survey. Some of the issues addressed by the questionnaires include (1) type of processing machine used (2) problem encountered (3) maintenance system/culture practiced (4) availability of spare parts (5) educational background of the processor (6) gender relationship on operating processing machines. The data was subjected to descriptive statistical analysis (frequency and graphs) and cross tabulation analysis using chi square statistics. Chi square statistics test for the significant difference(s) between the observed and the expected frequency of respondents for related items of the study tools (questionnaire). The resultant statistics were compared with the critical $\chi_{149,0.05}^{2}$ for appropriate decision.

Results and Discussions

A total of 130 processing machine centers were visited in the 18 Local Government Areas of the State. Interviews with various stakeholders were successfully held without any hindrances and the general responses to the questions are shown below.

Socioeconomic Characteristic of the respondent

The distribution of the questionnaire (Table1) indicated uneven presence of the processing machine across the selected local government. 10% of the questionnaire was distributed in Afijo and Ogbomosho South while 3.8% were distributed in Akinyele, Ibarapa East, Ibarapa North, Iddo, Iseyin and Oluyole local Government area respectively. This may be due to the fact that small scale agro-processing industries are common feature in those areas aforementioned. Common processing machines found in the selected areas include feed milling machine (42), cassava grater (34), oil expeller (20) and maize sheller (17).

Table 1. Distribution of the questionnaire across Local Government of Oyo State.

Local Government	Frequencies	Percentage
Afijio	13	10
Akinyele	5	3.8
Atiba	6	4.6
Atisbo	9	6.9
Ibadan North West	8	6.2
Ibarapa East	5	3.8
Ibarapa North	5	3.8
Iddo	5	3.8
Iseyin	5	3.8
Iwajowa	7	5.4
Kajola	10	7.7
Ogbomosho South	14	10.8
Ogo Oluwa	2	1.5
Oluyole	5	3.8
Ona Ara	4	3.1
Oyo East	7	5.4
Saki East	8	6.2
Saki West	12	9.2
Total	**130**	**99.8**

Others include pelletizing machine, burr mill, and digester. The frequency distribution is shown in Table 2.Analysis of socio-economic characteristics of the respondents (Table 3) showed that 87% of the respondents were male while the rest were female. This apparently implied that the business is a male favored one. This may perhaps be due to its laborious nature. Majority of the respondents are within the age of 41-50 years (46%) and then 31-40 years (35%).

Table 2: Type of processing machine observed during the study

Machine	Frequency	Percentage (%)
Maize Sheller	17	13.1
Maize Sheller & Burr Mill	3	2.3
Burr Mill	1	0.8
Cassava greater	34	26.2
Electric dryer & Cassava grater	1	0.8
Oil Expeller	20	15.4
Feed mill	42	32.3
Feed mill & Pelletizing machine	4	3.1
Pelletizing Machine palm Oil	2	1.5
Digester	1	0.8
Palm Oil digester & hydraulic	1	0.8
N/R	4	3.1
Total	130.00	100.00

It is apparent that the adults dominate the business of processing machine. This may not be unconnected with the fact that it is only the adult that can gather the substantial money required by the business. 48% of the respondents were SSCE holders (Figure 1) while higher education certificate holders are 24%.The least group in term of education are those without formal education (12%). This showed that majority of the respondent have one level of education or the other.

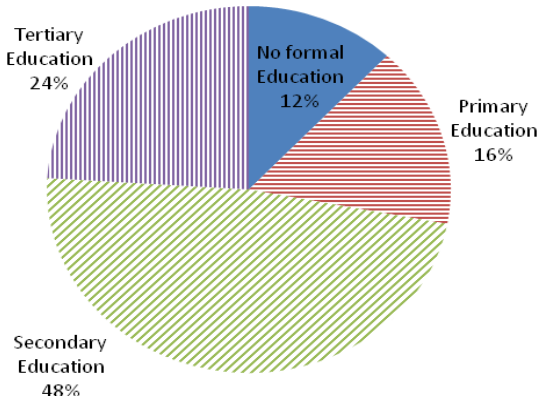

Figure 1. Educational Background

Table 3. Socio Economic Features of the Respondents.

Indices	Option	Frequencies	Percentages	Cummulative Percentage
Age	< 30 years	5	4	4
	31 – 40 years	46	35	39
	41 - 50 years	60	46	85
	> 50 years	19	15	100
	Total	130	100	
Educational Background	No Formal education	16	12	12
	Primary School	21	16	28
	SSCE	62	48	76
	Tertiary Education	31	24	100
		130	100	

Common machine faults and type of maintenance carried out.

The problems faced in the processing business according to respondents include, belt and bearing, wearing of parts/shafts, burning of coil and others (Table 4). The maintenance system/culture practiced by respondents are predictive (39%), preventive (24%), predictive as well as preventive (27%), overhauling (8%) and corrective (3%). It showed that the respondents practiced one form of maintenance or the other. This might be unconnected to the fact that maintenance keeps the practitioner on the job. It was observed that more than half of the respondents (55%) do not manage malfunction parts rather they repair or replace the parts (Table 5). Others used to manage malfunction parts for between a day and 2 weeks and after which it is been replaced. Agricultural products are usually heavy and to convey it required effort to load it onto the machine. It was from the respondent that loading product for processing is a difficult task and affect feeding rate which leaves the machine to run idle (no load) thus reducing production capability as they need to employ more hands. 18% of the respondent were not were not able to specifically identify any problems as to the use of the machine while 47% combine all the problems identify in Table 4. All the respondents complaint of erratic power supply which make them to have an independent power generating plant.

Table 4. Problems encountered by the Practitioners.

Problem Encountered	Frequencies	Percentage	Cummulative Percentage
Bearing	9	7	7
Bearing, Electricity and burning of coil	5	4	11
Bearing and wearing of Parts	2	1	12
Labour	3	2	14
Load	5	4	18
Wearing of parts/shaft	4	3	21
NR	24	18	39
Belt	4	3	42
Belt and Bearing	13	10	52
Other combinations	61	47	99
Total	130	99	

Table 5. Maintenance System/culture characteristics.

	Options	Frequencies	Percentages	Cumulative Percentages
Maintenance System/culture Practiced	Corrective	3	2	2
	Overhauling	10	8	10
	Predictive	51	39	49
	Preventive	31	24	73
	Predictive and preventive	35	27	100
Length of Managing malfunctioning parts	Not done	71	55	55
	within a day	44	34	89
	within a week	8	6	95
	within 2 weeks	7	5	100
Break down Time	6 months	45	34.6	34.6
	Monthly	34	26.2	60.8
	a year	11	8.5	69.2
	Rarely	40	30.8	100

Technical know-how and spare part.

The cross tabulation analysis of the distributions (Table 6) of the respondents by the length of change of spare parts showed that there is significant difference in the observed and expected frequencies of the length of change of spare parts. This is because the chi square statistics (108.925) returned for the cross

table analysis is significant ($p < 0.01$). The implication of this is that length of change of spare parts could be said to be local government specific.

Also, the cross tabulation of the size of the processing unit and the length of change of spare parts showed that there exist a significant difference between the observed and expected frequencies of the length of replacement of malfunctioned parts. This is because the chi square statistics (22.59) is significant ($p < 0.01$). The cross table analysis of the effects of age on repairing personnel (Table 7) showed that as the age group increases, the tendency to employ the expert for the repair job. This is because the cross table analysis produced a result (chi square of 12.0405) and it is significant ($p < 0.05$). The implication of this is that majority of the respondents use to employ expert in the repair of malfunctioned parts.

Table 6. Cross Table Analysis of the Local Government and size of Processing unit against maintenance period.

	Local Government	1 – 2 years	2 – 4 months	5 – 8 months	9 – 11 months	χ^2
Local Government and length of change of spare parts	Afijio	2	8	3	0	
	Akinyele	3	0	2	0	
	Atiba	0	3	1	0	
	Atisbo	3	1	4	1	
	Ibadan North West	6	0	1	1	
	Ibarapa East	0	3	2	0	
	Ibarapa North	3	2	0	0	108.925**
	Iddo	1	1	1	0	
	Iseyin	1	1	3	0	
	Iwajowa	0	2	5	0	
	Kajola	0	6	4	0	
	Ogbomosho South	0	2	7	1	
	Ogo Oluwa	1	0	1	0	
	Oluyole	2	0	3	0	
	Ona Ara	1	1	2	0	
	Oyo East	1	3	3	0	
	Saki East	0	5	3	0	
	Saki West	4	2	4	2	
	Total	28	40	49	5	
Size and length of change of spare parts	Maximum	1	5	0	1	
	Medium	17	10	21	1	22.59**
	Minimum	17	8	31	6	
	Total	35	23	52	8	

Table 7. Cross Table Analysis of the Respondents age against the Repairer of Malfunctioned Parts.

Option	Expert	Self	Expert and Self	χ^2 statistics
<30years	3	2	0	
31 - 40years	45	0	1	
41 - 50 years	51	7	2	12.0405*
>50years	17	2	0	
Total	116	11	3	

Conclusion

The goal of this study is evaluation of the maintenance culture of the processing machine in the study areas. It was apparent from the results that all maintenance culture types have been /are been practiced at one intensity or the other. Also, the type of repairer is found to be age specific. A good and effective training program on maintenance procedures should be extended to stakeholder in the agro- processing industry to keep those machines in optimum working condition. The resuscitation of the Directorate of Employment for trade test certification on the use of standard procedures should be given priority by the Government with a view to safe the industries

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References

Davies, R. M., Olatunji, M. O. and W. Burubai, (2008): A Survey of Cassava Processing Machinery in Oyo State. World Journal of Agricultural Sciences, 4 (3): 337-340

Glebbeek, A., E. Bax. (2004). Is high employee turnover really harmful? An empirical test using company records. Academic Management Journal. 47(2): 277–286.

Hans, L. (2000): Measuring maintenance performance. In search for a maintenance productivity index. International Journal of Production Economics, 33: 47 - 58.

Moubray, J. (1997). Reliability-Centered Maintenance II, 2nd Edition, Butterworth-Heinemann, Oxford.

Naveh, E., M. Erez (2004). Innovation and attention to detail in the quality improvement paradigm. Management Science. 50(11): 1576–1586.

Odigbo, E. U. (1996). Skill development in low-cost Agricultural Mechanization Practices. A keynote Address Presented at the National Workshop on Appropriate Agricultural Mechanization for skill Development in Low-cost Agricultural Mechanization Practices, Ilorin.

Zeynep Ton, Robert S. Huckman (2008). Managing the Impact of Employee Turnover on Performance: The Role of Process Conformance. Organization Science. 19(1): 56 - 68