

## Evaluation of waste management strategies in some selected sawmills in Ondo State, Nigeria

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### ABSTRACT

Wood waste is a major environmental problem in all wood industries and its management is a major challenge in most wood processing industries. This study, therefore, assessed the waste management strategies in some selected sawmills in Ondo State, Nigeria. Face-face interviews and physical observations using a multistage sampling technique were employed for data collection. Twelve (12) major sawmills were assessed and the waste being generated was categorised into: sawdust, wood offcut, and log-bark. Data collected were subjected to descriptive statistics using frequency and percentages. The results showed that the wastes were mostly disposed of by respondents daily (41%), weekly (50%) and monthly (9%), respectively. The average volume of waste generated per sawmill ranged from (2.70 - 8.04m<sup>3</sup>). Methods of waste disposal by the respondents show that 67% is disposed of by open dumping through bagging, followed by land-filling outside the town (17%), household users for domestic cooking (8%), and poultry farmers (8%). Moreover, 91% understand its negative influence on the environment, viz; environmental pollution and air pollution during the burning of the waste generated. Hence, most sawmills were aware of the guidelines, and regulations governing the treatment and disposal of sawmill residues, but they hardly abide by them. The personnel employed to sanitise the mill environment possessed inadequate safety wares. Inadequate awareness campaigns and training by Government officials towards the management of the waste in sawmills were observed. Therefore, there is a need to enlighten the public and sawmill workers on the dangers of indiscriminate disposal of sawmill waste on the environment.

**Keywords:** Sawmills, management strategies, wood waste, environmental pollution

### INTRODUCTION

The primary global consumer of wood is the forestry industry (Ogunwusi *et al.*, 2013). Sawmills are the primary users of wood resources in Ondo State, with widespread use in both rural and urban regions (Ogunwusi, 2012). Different sawmills have machineries like horizontal band saws (CD series) and a few sparsely spaced vertical band saws throughout their mills (Shepherd, 1990). The rapid depletion of the nation's timber resources is mostly due to equipment employed to convert logs. The number of trees cut down each year for lumber production can be reduced,

according to Fuwape (2004), by using efficient technology in sawmills. Another noteworthy source of wood residue is in the forest during timber harvesting, which has caused a setback to the sustainable management of the forest and the sustainability of the forest business (Eshun *et al.*, 2012). These residues cause a variety of issues, including the degradation of urban environments, a decrease in aesthetic value, the production of foul odours during rainy seasons, and the release of smoke into the atmosphere when residues are burned indiscriminately (Badejo, 1990).

Disposing of solid residue is the last stage of a management system (Iqbal *et al.*, 2020). In cutting-edge technology, engineering tasks like sorting and quantity reduction come before disposal (Kabera, 2020). With separate materials that can be converted into something with economic value, this is done. Residue can be disposed of in a number of ways. Any approach can be chosen, but there are many variables to consider. Characteristics of the solid residue to be disposed of, cost consideration (i.e., how much is available and how much the method could cost), availability of disposal facilities (cost of land, for example), cost of labor, and technical implications of the methods are a few of the factors, (Ogunbode *et al.*, 2013). Any community, whether developed or one with less development, is free to select among the following solid residue disposal options: conversion/recycling, sorting and salvaging, open dump, regulated tipping/sanitary, landfill/daily burying. Composting, burning, and disposal into the ocean are some further options (Ogunbode *et al.*, 2013).

Therefore, Environmental education (EE) is essential for sawmill personnel to develop an environmentally appropriate disposal method (National technical expert, 2004). Environmental education is a learning process that increases people's knowledge and understanding of their environments and the threats it faces. It is also a method for developing the skills and expertise needed to meet those challenges, and its aims are to build attitudes, motives, and commitments to make informed decisions and take responsible actions. These educational advancements and awareness tactics will help improve sawmill workers' attitudes. (Wu, *et al.*, 2013). Residues from sawmills are the final by-products of sawing and producing dimensional timber from unfinished wood. Natural residue products from sawmills include sawdust, wood off-cuts, wood backs, plain shavings, and wood rejections.

National Technical Experts (2004) explain that several residue types, including wet waste from cutting wood logs and dry residue from processing cut timber, exist in woodworking enterprises. The wood-work sector produces a sizable amount of sawn timber (which will

subsequently be further processed into a semi-finished product), with smallholder sawmills providing a sizable portion of the supply. An estimated 40% of sawn-timber demand is met by small-scale sawmills, with 60% coming from manufacturers. In Akure, Ondo State, Nigeria, there are a lot of small-scale sawmills run by individuals. Sawmills accounted for 93.32% of Nigeria's wood-based sector in 1997, (Fuwape, 1998). This study evaluated waste management practices in some selected sawmills in Ondo State and identified the various approaches to managing sawmill residues with adequate suggestions made.

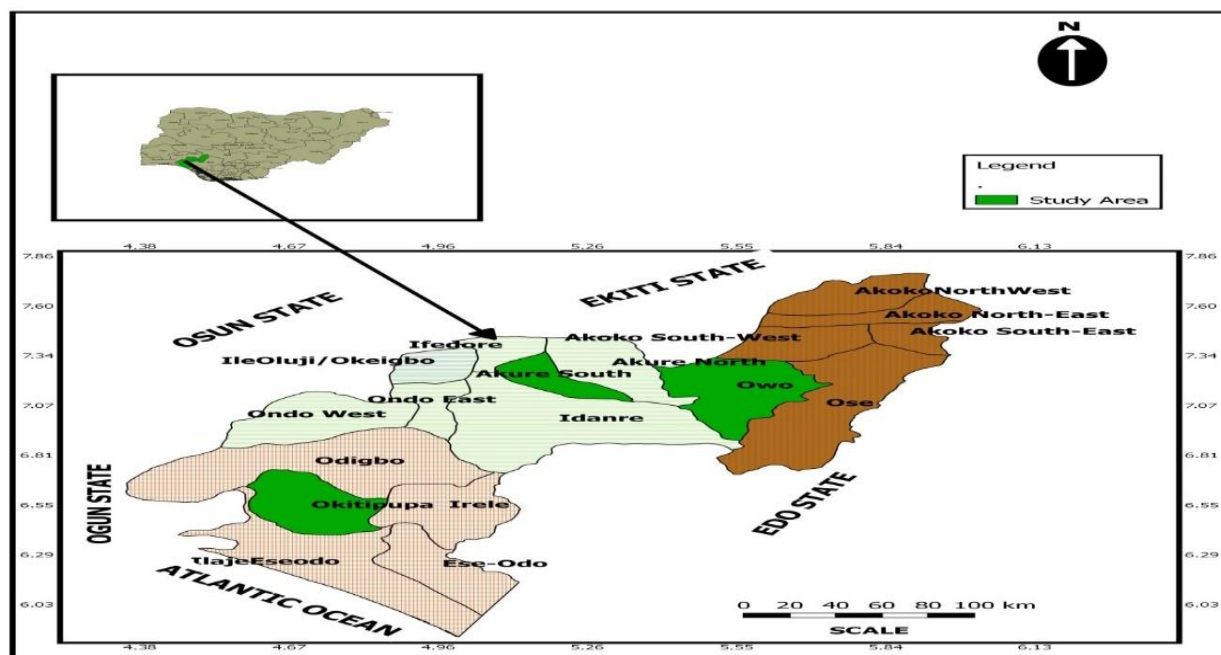
## **METHODOLOGY**

### **Study area**

The study was carried out in Ondo State. The state consists of Eighteen (18) Local Government Areas (LGAs). The study was carried out in the three (3) Senatorial districts of the state, in which one (LGA) was randomly selected from each senatorial district. The LGAs selected are Akure South, Owo, and Odigbo (Fig.1). Ondo State is referred to as the "Sunshine State". It was created by the defunct Western State on 3<sup>rd</sup> February 1976. Before its creation, the state existed as the Ondo Province of the old Western State. The state covers a land area of 14,793 square kilometers with its administrative capital at Akure. The projected population of the state was 3,895,367 (Eme and Idike, 2015).

### **Sampling technique and data collection**

The multistage sampling technique of Ogunbode *et al.* (2013) was used for the study. The three senatorial districts in Ondo state were selected for the study, from the senatorial districts, one local government was selected and four sawmills were randomly selected for the administration of the questionnaire. Ten sawmill workers were selected from each sawmill and to whom the questionnaire was administered. A total of 120 copies questionnaire were administered to the respondents. Data were analysed through descriptive statistics using frequency and percentages. The volume of logs converted in each sawmill was calculated using Newton's formula while the lumber volume was also calculated.



**Fig.1:** Map of Ondo State Showing the Study areas

## RESULTS AND DISCUSSION

Table 1 shows the twelve major sawmills randomly selected from the three (3) Local Government Areas in Ondo State, were observed to be located along the major highways and this result highlights the importance of motor roads on the spatial distribution of wood primary processing establishments in the highways leading to other States of the nation. As observed, this has provided easy access and possibly providing substantial savings in logging costs.

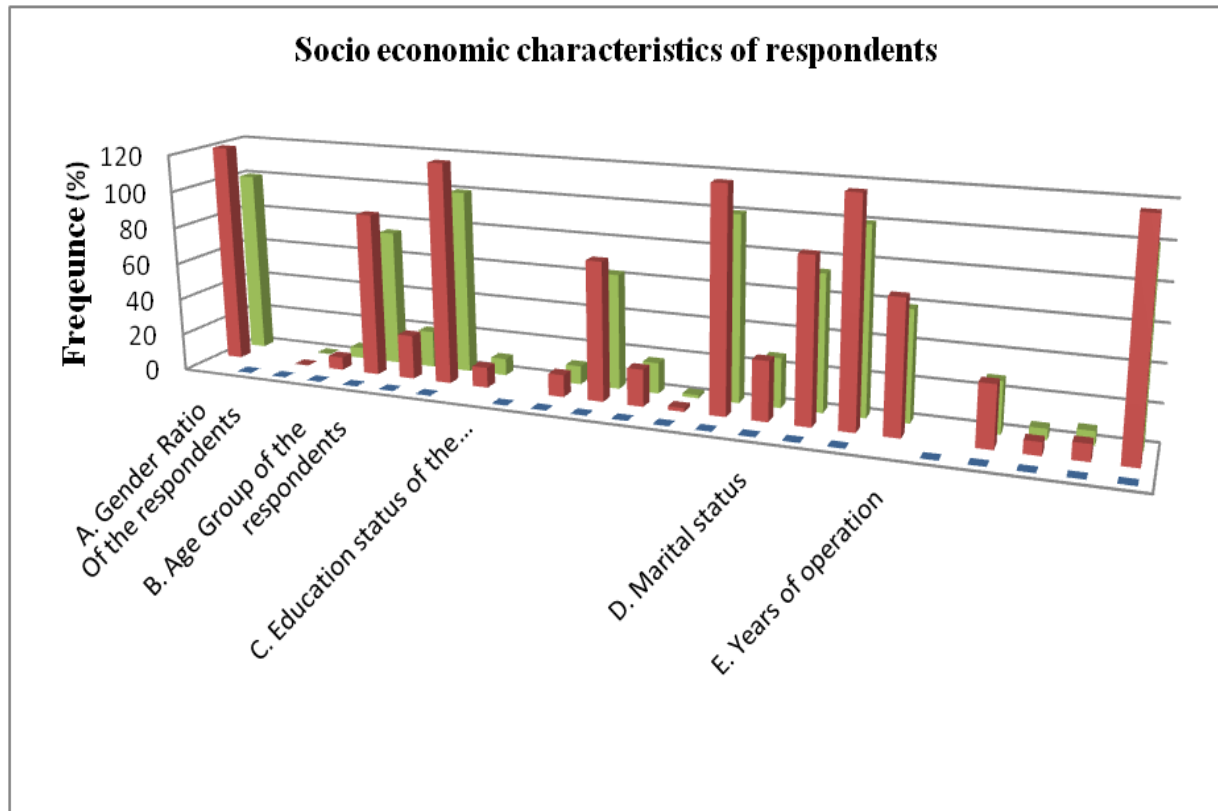
### Socio-economic characteristic of respondent

The socio-economic characteristic of the respondents in terms of gender, age, educational background and marital status, was revealed that all the respondents working at the sawmills were male, which may be as a result of heavy machine used at sawmills. The age of the operators varied which shows that 6% are below 20 years, 74% are in the range of 21-40 years and 20% are between the age ranges of 41- 60 years. This shows that majority of the sawmill workers were youths. The educational backgrounds of workers showed that 9% had no formal education, 2% had adult education, 10% had Primary education, 63% had secondary and 17% had tertiary education, also majority of the

workers were married while the years of operation varied with the majority having between 1-5 years of experience as shown in Fig. 2. As per Dosunmu and Ajayi (2002), different outcomes from studying waste management strategies in the research region are thus expected.

**Table 1:** Description of the selected sawmills

LGAs	Name of Sawmills	Locations
Akure South	Kola Sawmill	Owo-Benin Express way
	Austine Sawmill	Owo-Benin Express way
	Olukayode Sawmill	Ondo Road
Odigbo	Alihu Sawmill	Ondo Road
	Zifat Sawmill	Ore Express way
	Dada Sawmill	Ore Express way
	Zemfam Sawmill	Ore Express way
	Olurimisi Sawmill	Ore Express way
Owo	Aruwajoye Sawmill	Owo Express way
	Ajibolade Sawmill	Owo Express way
	Igbalaye Sawmill	Owo Express way
	Agro-Forest Sawmill	Owo Express way
		Owo Express way



**Fig. 2:** Socio-economic character of the respondents

### Types of waste generated

The composition of sawmill wastes generated in various sawmills in Ondo state were similar, There were differences in quantities generated due to the scales of operation, saw machine, type of logs and the levels of the operation as shown in (Table 2). The wastes generated comprise sawdust, wood off-cuts and bark of logs. It was also observed that after a whole day's job, the various saw mills produced wastes of approximately 40 bags (24kg) of sawdust which is equivalent to 240 bags weekly respectively depending on patronage and stability of power supply. This large quantities of wood wastes (slabs, barks and off-cut) generated by the sawmill were sold to surrounding communities as firewood for cooking and the sawdust were burnt though some were used by poultry owners for bedding and landfill etc. Also in order to dispose of the ever-produced sawdust waste and due to the absence of proper disposal methods of the residue in Ondo State, 100% of the sawmill in the three local government areas engaged the open air burning as means of discarding the resulting sawmill residue, thus contributing to air pollution which is a cause to

climate change and global warming. From the Twelve (12) sawmills sampled in Ondo state, it was observed that residue disposal remains one of the biggest challenges facing sawmills.

The field results in Table 3 show that the average volume of wastes generated per sawmill, ranged from 2.70 to 8.04 m<sup>3</sup>. The highest volume of residues generated was found at Aruwajoye Sawmill with 8.04 m<sup>3</sup> and the lowest volume of residues generated was recorded at Alihu Sawmill with average volume of 2.70 m<sup>3</sup>. The average number of bags (24kg) of saw dusts generated per sawmill, ranged from 20 to 70 bags. The highest number of saw dusts bags was recorded at Aruwajoye Sawmill with 70 bags (24kg) and the lowest number of saw dusts bags (24kg) was recorded at Alihu and Ajibolade Sawmills with average number of 20 bags.

**Table 2:** Types of waste generated

Type of waste	F	%
Saw dusts	120	100
Slabs	120	100
Barks	120	100
Off-cuts	120	100

**Table 3:** Average volume of wood waste generated per day

Sawmills	Average volume of wood waste generated (m <sup>3</sup> )	Average Bags of saw dusts produced (24kg)	Average volume of Saw dusts generated (m <sup>3</sup> )	Average volume of Slabs and Barks generated(m <sup>3</sup> )
Kola Sawmill	4.17	30	2.88	1.29
Austine Sawmill	3.71	25	2.40	1.31
Olukayode Sawmill	5.28	50	4.80	0.48
Alihu Sawmill	2.70	20	1.92	0.78
Zifat Sawmill	4.23	30	2.88	1.35
Dada Sawmill	4.14	40	3.84	0.30
Zemfam Sawmill	4.63	45	4.32	0.31
Olurimisi Sawmill	4.96	45	4.32	0.64
Aruwajoye Sawmill	8.04	70	6.72	1.32
Ajibolade Sawmill	3.76	20	1.92	1.84
Igbalaye Sawmill	5.89	48	4.61	1.28
Agro-Forest Sawmill	5.84	50	4.80	1.04
Total	57.35	473	44.69	11.94

**Table 4:** Correlation matrix of wood waste mix

	Volume of wood waste	Saw dusts	Slabs/Barks
Volume of wood waste	1		
Saw dusts	0.920*	1	
Slabs/Barks	-0.039	-0.344	1

\*Significant at 0.05 level

Table 4 shows a significant ( $p < 0.05$ ) and positively strong relationship between volume of wood waste and sawdust. This indicates increase in the volume of sawdust with increase in volume of wood waste produced. Slabs/barks showed no significant relationship with volume of wood waste produced or amount of sawdust ( $p > 0.05$ ). This may be attributed to the large sawkerf of the headrig used for the conversion of logs to lumber in many of our large and small scale sawmill, especially in the developing countries like Nigeria (Ogunwusi, 2014). Therefore, to be able to drastically reduce the general volume of wastes generated from these sawmill, volume of saw dust generated must be considered. The result is consistent with the findings of Nnaji and Udokpoh, (2022) who reported that sawdust was the most common type of wood waste generated, accounting for

28.4 percent of the total wood waste from sawmills in Enugu State, Nigeria. However, the result is sharp contrast to the finding of Aghimien *et al.* (2020) who reported slight higher volume of slaps over sawdust in Oyo State, Nigeria

As summarised in Table 5, the results of methods of the waste disposal by the respondents was largely (67%) by open dumping through bagging, followed by land filling outside the town (17%), household users for domestic cooking (8%), and packing by poultry farmers for warmth (8%). The results are similar to previously findings of Owoyemi *et al.* (2016) who reported that wood wastes are mostly disposed of by open burning around the sawmills in Nigeria.

**Table 5:** Method of waste disposal by respondents

Methods	F	%
Open dumping	80	66.7
by bagging		
Packing by	10	8.3
Households		
Packing by	10	8.3
Poultry owners		
Landfill	20	16.6
Selling the	0	0
sawdust		
<b>Total:</b>	<b>120</b>	<b>100</b>

**Table 6:** Awareness about environmental impact of sawmill

Variable	Response	F	%
Awareness on environmental pollution	Yes	108	90.8
	No	11	9.2
Awareness from the Government	Yes	40	33.3
	No	80	66.7

The result in Table 6 shows that 91% of sawmills in Ondo state were aware of the environmental pollution especially air pollution during burning of the residues generated. Since most sawmills were aware of the guidelines and regulations governing the treatment and disposal of sawmill residues, they hardly abide by them. The personnel who were assigned to sanitize the mill environment possessed inadequate safety wares. And there was no proper awareness and training by the Government towards the wastes management on sawmills in Ondo state (Maity, 2018).

## CONCLUSIONS

The findings from this study revealed a high quantity of sawmill waste being generated in Ondo state and the sawmill environment is littered with the dominance of sawdusts, unlike slabs, offcuts, and bark which are locally often demanded for domestic uses. Since sawmills by nature generate a lot of residues, proper disposal methods must be identified and implemented otherwise, the contaminations of open spaces and adjoining air will become uncontrollable in the state, especially in the three (3) Local Governments areas studied. The problems of wood residue provide an adequate opportunity to creatively manage the environment of the city. Burning of the waste cannot be totally ruled out, because burning is often the easiest means of disposal. Based on the study conducted, it

was concluded that the amount of wood residue generated by sawmills visited can always be managed without burning it and rendering the climate and humans in danger. It was also observed that there were no training programmes for sawmill personnel on residue management and as a result, safety wares such as nose guides and safety glasses were not worn always, even when they are aware of the need to do so. Most sawmills in Ondo state are not complying with the guidelines for the disposal and treatment of sawmill residues. This may be due to the fact that the government agencies charged with the responsibilities of enforcing laws governing the disposal and treatment of sawmill residues have not been active. For instance, it was gathered that sanitary inspectors and Environmental Regulatory agencies did not visit sawmills at all. This is why the Nigeria Environmental Study/Action Team, NEST (1991) put it that laws and legislations are often set in Nigeria but enforcement of the laws becomes difficult. Authorities and workers in the sawmills point out that there is a need for seminars and workshops that would help them to manage the sawmill residue generated properly. About one-third of the total amount of material used in the woodworking business is wasted. The primary challenges in utilizing this trash are the economics of collecting adequate quality garbage to warrant the installation of further waste processing plants. About one-third of the total amount of material used in the woodworking business is wasted. The primary challenges in utilizing this trash are the economics of collecting adequate quality garbage to warrant the installation of further waste processing plants. They also recommended that research organizations get more actively involved in instructing and training people on how to handle and recycle sawmill waste locally.

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