Factors Affecting Wood Sawdust Handling in Ungogo Local Government Area of Kano State

*[1]Abanikannda, J. O. [1] and [2]Aminu, B

*[1]Department of Forestry and Wildlife Management, Bayero University, Kano

Aliko Dangote University of Science and Technology, Wudil, Kano State

Corresponding Author Email; abanikay@gmail.com;

Abstract

Sawdust is a wood waste, with economic potentials. This study assessed factors affecting sawdust handling in Ungogo local government, Kano State. Two stage sampling technique was used to select respondents. Data was collected using structured questionnaires administered to sixty timber handling sheds in Ungogo, using snowball sampling. Data were subjected to descriptive and inferential analysis. Result showed all timber handlers to be males, 80 % married, full time traders, and 63% with non-formal education. Most (33%) were 31 - 40 years old and 53 % have 1-10 years experience. Circular saw machines were the commonest (57%), with 70% of them being 1 - 5 years old. It was also observed that 53 % produce 41 to 50 bags of sawdust monthly. Sawdust was disposed by storing (27 %), regular sales (70 %), and by burning off (3 %). Also, 43% of sawdust buyers use it for cooking. Sawdust was chosen due to its relative cheapness (50%), availability (16%) and simplicity (7%). Age and experience of timber handlers were significant factors influencing sawdust utilization in the study. Bulkiness / storage problem (40%), pollution (33.33%), and transportation (10%) were major challenges facing sawdust handling in the study area. The study recommends the provision of financial aids and technical supports for sustainable timber management, better education and technical training, provision of modern processing machines at affordable rates, provision of cheap and safer cooking energy, better transportation network, and value addition to wood wastes foe efficient waste utilization and, to stimulate industrial development and sustain rural livelihoods.

Keywords: Sawdust, Timber sheds, Disposal, Handling, Circular saws

Introduction: Sawdust is among the most abundant wood wastes generated in sawn timber operations in Nigeria (Nnaji & Udokpoh, 2022). This is because circular saws, the common machine in timber handling sheds, have thicker blades, multiple teeth, and larger (swage) kerfs, resulting in large sawdust generation, during wood splitting and cross cutting operations (Silveira da Silva, 2022). Proper wood selection; proper machine selection, blade setting and installation; regular maintenance, and prompt replacement when the need arises, are essential steps in sustainable timber and waste handling (Ogunwusi, 2014). The greatest waste in Nigeria is from sawmilling, followed by small scale furniture industries (Ogunwusi, 2014). Waste generation is increasing in Nigeria because of species, human, and technological factors; such as, timber geometry and anatomy, newly introduced species that are unpredictable, outdated technology and financial constraints (0gunwusi, 2014). Kukogho, J., Aghimien., E.V., Ojo, M.O., Adams, B.A., and Akinbosoye, B.S. (2011) reported a significant difference between sawdust generation and tree species. An appraisal of these variables is necessary to achieve sustainable wood conversion and utilization. The objective of this study is to identify the socio economic characteristics of timber handlers (who also handle wastes), sawdust disposal and utilization methods, factors influencing sawdust handling, and the problems facing its efficient handling and utilization in the study area. The study makes use of primary data collected through personal observations, structured questionnaires and secondary information sources.

Wood wastes are unavoidable by-products in timber processing and marketing. Nigeria generates a lot of wood waste which end up as landfills and environmental nuisance in most part of the country. Sawdust is the largest waste generated in Nigeria, which is underutilized due to insufficient and outdated technology, poor handling skills, lack of awareness and inadequate research. (Ogunwusi, 2014).Wood wastes, especially sawdust, are significant by-products of timber processing in the savannah regions of Nigeria, with economic potentials. Sawdust has been observed as a promising source of wealth and sustainability (Romoniyi, 2017). The assessment and utilization of sawdust and other wood wastes as alternative sources of energy and composite materials, has the potentials to reduce deforestation, which is increasing as a result of overexploitation of forest resources, and contribute to sustainable forest management (Udokpoh and Nnaji, 2023). This knowledge gap may affect the effective management and utilization of these potential resources. There is insufficient data on wood wastes utilization, especially in the aspects of quantification, regional variability, and socio-

economic assessments. This study is essential in assessing the patterns and indicators of wood waste utilization in the timber markets, to facilitate sustainable management decisions.

Materials and Methods: **Description of the study area**: The study was carried out in Ungogo, one of the 8 local government areas in Kano metropolis. Ungogo is located between latitudes 12º 05" 26' and 12º 09" 06' N, longitudes 8º29"48' and 8º 49"67' E. The total land area is 204 km², with a human population of 369,657 (NPC, 2006). It has eleven wards. It borders with Dawakin Tofa to the North, Dala to the west and Minjibir to the South. Eastern Ungogo local government falls within the Sudan Savanna agro-ecological Zone. There are two seasons (dry and wet season). The dry season comprises of harmattan period (low temperature, dry, windy, dust and sometimes with low visibility), sunny and hot, usually between November and April, while wet season is usually warm, humid and variable rainfall, usually between May and October of the year (Tukur, S., Aliko, A.A., Mukhtar, Y., Bashir, R.A., Mohammed, A., and Ahmad, A.J. (2022). The annual temperature in Kano ranges between 56 ^{0}F and 101^{0}F and is rarely below 51^{0}F or above 106^{0}F, while the annual rainfall ranges between 0.5 inches and 6.8 inches, usually between April and August (Weather Spark, undated).

Method of Sampling: Purposive multistage sampling technique was adopted in the study. Four wards were purposively selected from Ungogo local government, based on timber marketing and handling activities. An inconsistent figure on the population of timber marketers (handlers) precludes the use of a sampling frame. Snowballing was used to select a total of sixty (60) small scale timber selling / handling sheds from the 4 wards (table 1). Each shed manager/operator was chosen to serve as the timber handler/seller (respondent).

Method of Data Collection: The study was preceded by a reconnaissance visit to the study area, to identify timber marketing/ handling and waste handling activities. Data was collected using structured questionnaires. Questionnaires were administered to sixty (60) small scale sawn timber handling / marketing sheds, using snowball sampling technique. Data was collected on: socio economic characteristics of timber/sawdust handlers, sawdust utilization and disposal, technical factors affecting sawdust yield and, problems facing timber / sawdust handling in the study area. The timber seller/handler was chosen as the major respondent in the study.

Method of Data Analysis: Data collected was analyzed using descriptive statistical tools of frequency counts, percentages and modal counts, in form of tables and charts. A multiple linear regression analysis was carried out to identify factors actually influencing sawdust handling in the study area. Data was entered and analyzed using excels software. Sawdust handler's monthly income (Y) was regressed against demographic variables (X_1, X_2, X_3, X_4 and X_5). Y is the dependent variable (monthly income), while X are independent variables (age, sex. marriage, education and experience).

Result and Discussion: Assessment of sawdust handler's socio economic variables: Socio economic information is important in the management of resources. Table 2 showed socio economic variables affecting the handling and utilization of sawdust in the study area, to include: age, gender, marital status, major occupation, ethnicity, level of education and handling experience. Age is an important driver of resource management and skills. Table 2 showed that most (33 %) timber handlers/traders were 31 – 40 years old. This showed they were in their productive ages, as timber handling activities requires strength and agility. Babatunde, T.O., Babatunde, O.O., Babatunde, K.O., Aduloju, A.R., Oluwalana, T., and Inyang, V. (2020) reported most timber marketers in Ife East local government area to be 40 - 49 years old and; Diwe, K., Duru, C., Iwu, A., Merenu, I., Uwakwe, K., Oluoha, U., Ogunniyan, T., Madubueze, U., and Ohale, I. (2016), reported most timber workers in South East Nigeria to be 20 - 39 years old. This revealed timber handling activities are dominated by young and middle aged people that have the strength and agility to cope with the stress.

The table also showed that all (100%) timber handlers were males. The nature of timber handling activities is usually masculine in nature. This is in line with Diwe *et al*, (2016) who observed 95.9% of timber workers in South Eastern Nigeria to be males. Babatunde *et al,* (2020) reported most timber marketers in Ife East to be males and, Babatunde, T.O., Babatunde, O.O., Adejumo, A.A., and Okeleke, S.O. (2017) reported most timber workers in Ondo sawmill to be males. The result is at variance with Babatunde, O.O., Babatunde, T.O., Olokeogun, Y.S., Babatunde, K.O., Ademigbuji, A.T., and Adepoju, G.A.(2022) who reported majority of timber marketers in Kajola Local Government area of Oyo State to be females. Also, 80 % of the respondents were married, while 16 % were single. Timber trades are seen to be generally lucrative enterprises (Babatunde *et al*, 2020) in which married people are more engaged, because they're more responsible, aspiring to care for their household. This result agrees with Diwe *et al*, (2016) who observed most timber workers in South Eastern Nigeria to be married and Babatunde *et al*, (2017) who reported most timber marketers in Ondo sawmill to be married. Babatunde *et al*, (2020) stated that marriage influences household size, available labour supply, family income and savings pattern.

Furthermore, 63 % of respondents have non-formal education. This disagrees with Diwe *et al*, (2016), with 93.1% timber workers having primary/secondary education in South East Nigeria and, Alawode and Jimoh (2021), who observed that all timber workers in Ibadan were literates with varying levels of education. Babatunde *et al*, (2020) asserted that higher education status brings better profit from the use of sound business principles and wise business decisions. Faleyimu (2014) asserted that formal education is advantageous over some deficiencies in non-formal education, and could influence the adoption of innovation and increase peoples level of awareness and perception. Equally, 53 % of respondents have 1 - 10 years experience in timber handling trade, indicating majority are new in the business. Little experience may affect timber handling

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efficiency and consequently, leading to poor lumber recovery (Aghimien, E.V.,Akinkuoroye, O.H., and Adams, O.T., 2020). The result disagrees with Alawode and Jimoh (2021) who reported 57% of timber traders in Bodija market having 21 - 30 years experience in timber trading. Adedokun, M.O., Olawumi, A.T., Soaga, J.A., Oluwalana, S.A and Mologhe, M.R. (2017) identified years of experience as one of the factors affecting timber marketing. Aremu, F.J., Olugbire, O.O., Adebayo, D.A., and Apata, O.V. (2015) asserted that experience is a vital skill needed in achieving good returns on investment by producers and marketers. Aghimien *et al*, (2020) stated that machine operator's skill and experience can significantly influence lumber recovery (waste reduction). Alagbada (2021) reported that machine operator's expertise knowledge contributes to lumber recovery, consequently, waste reduction.

Assessment of sawdust handling in the study area: Figure 1 showed that 70 % respondents dispose their sawdust through regular sales, 27% store sawdust for booking while, only 3% burn off their sawdust. On the contrary, Nnaji and Udokpoh (2022) observed that open dumping (76.75%) and burning off (71.7%) were the commonest sawdust disposal method in Enugu timber market. 21.7% waste was collected by households and 10% by poultry farmers in the study. Nyemba, W.R., Hondo, A., Mbohwa, C., and Madiye, L. .(2018) reported that 51% and 34% of wood wastes were used for cooking and poultry farming, respectively, in Cameroun. Okorie (2021) reported that waste disposal in Akure was mainly by open air burning. The result also revealed that, 50 % of sawdust handlers indicated that their customers prefer sawdust as their cooking fuel because of its relative cheapness and affordability. Onochie, U.P., Aliu, S.A., Nosegbe, U., and Adama, K.K. (2020) reported that sawdust abundant availability as wood industrial wastes makes it to be one of the most promising cooking fuel materials.

Uses of sawdust: Figure 2 revealed uses of sawdust, according to the handlers as, domestic users (43%), poultry/animal bedding (33.30%), industrial uses (6.7%), and undisclosed uses (16.7%).

Reasons behind user's preference for sawdust: Figure 3 showed the reasons behind user's preference for sawdust. The result revealed that 50 % of sawdust handlers indicated that their customers prefer sawdust as their cooking fuel because of its relative cheapness and affordability. Onochie *et al*, (2020) reported that sawdust abundant availability as wood industrial wastes makes it to be one of the most promising cooking fuel material.

Technical factors affecting sawdust handling: Table 3 showed the technical factors affecting sawdust handling in Ungogo. Factors identified in the study include type of wood handling/conversion machinery, machine age, timber supply, operator's skill and experience, and nature of sawn timber species. Machinery type and operators skill have been identified among important causes of wastes in conversion operations (Aghimien *et al*, 2020). A proper understanding of the waste generated due to the type of wood processing machinery contributes to waste management and quality

control and its possible utilization as industrial raw materials. (Dias Júnior, A.F.,Andrade, A.M., and de Costa Junior, D.S., 2014). The type of saw blade and number of teeth can lead to different amounts and formats of waste, and consequently they may have different destinations. Table 3 showed circular saws as the commonest wood conversion machine in the study area (57%). Bello (2017) stated that circular saws produce substantial density of sawdust, followed by chain saws and band saws Machine age affect its performance efficiency. In same light, 70 % of the wood conversion machines were not more than 5 years old. Adhikari and Ozarska (2018) stated that an improved and new variety of machinery, instead of old and obsolete ones, helps *in reducing wood wastes*. He further stated that the major causes of wood wastage are either technology-based factors such as the use of obsolete equipment and inefficient procedures and production methods. Aghimien *et al* (2020) reported that most wastes found in selected sawmills in Kajola local government area of Oyo State were due to old age machines used and, the form and shape of the wood.

Due to variations in wood anatomy and chemistry and, consequently, its density and other mechanical properties, the waste generated varies with species. Silveira da silva, C.E., Xavier, C.N., Amanda Arantes Junqueira, A.A., Osmar de Freitas Neves Junior., Leal de Cavalho., P.C., Torres, A.C., and Monteiro de Cavalho, A. (2022) reported that difference in species anatomy affects wood processing time. He reported that a longer processing time implies more exposure to the effects of the saw blade teeth. He also added that the effects of softwood or hardwood may also influence waste generation. (Ogunwusi, 2014) reported that among the causes of voluminous wastes is the introduction of new lesser known timber species whose properties are not well understood. *Chrysophylum delavayi* is a new species in the markets, whose properties have not being fully examined. Silveira da silva, et al., (2022) reported that *Pinus caribaea* var. *hondurensis* wood generates a higher waste compared to *Tectona grandis* wood. Kminiak and Gaff (2015) reported that the surface quality of the processed wood material also affects waste generation.

Factors influencing sawdust handling in the study: Table 4 revealed that handler's age and handling experience are statistically significant at 1% and 5%, respectively. Age was negatively related to handler's monthly income, while experience was significant and positively related to handler's income. This implies that a unit increase in years of experience increases monthly income by 974.282, i.e., sawdust sales (monthly income) is a function of years of experience in the study area, i.e. experienced people make more income from sawdust in the area. An increase in handler's age decreases monthly income by 597.6365, i.e., aged people handle/sell less sawdust (make less income by selling less sawdust)

Challenges of sawdust handling in the study area: The major challenges facing sawdust handling and disposal, in order of ranking, include: sawdust bulkiness / storage space (40 %), environmental pollution (33 %) and, high handling and transportation costs (10 %). Nnaji and Udokpoh (2022) identified lack of transportation to take wastes to designated

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dump sites as one major limitation of sawdust disposal in Enugu. Ogunwusi (2014) identified lack of incentives for wood waste utilization and inadequate information on economic returns of wood waste utilization, as major constraints to effective wood waste utilization in Nigeria.

Conclusion and Recommendations: The study concluded that most of the respondents were young to middle-aged married males, with non-formal education, who earn substantial income from the sales of sawdust. Circular saw was observed to be the commonest handling machine and the major source of sawdust in the timber sheds. Sawdust was mostly disposed by regular sales to domestic cookers and poultry farmers in the area. The respondents prefer sawdust as cooking fuel because of its relative cheapness and simplicity. *Chrysophyllum delavayi* was observed as the species that generates the largest sawdust, compared to other recorded species. The study also identified respondent's age and business experience as significant factors influencing waste handling in the study. The major challenges facing sawdust handling in the area are: bulkiness, which complicates handling and transportation, and atmospheric pollution. Sawdust has the potentials to generate substantial income, stimulate small scale industries, and support domestic energy needs in the region.. The study recommends better formal education and technical training for timber workers in modern timber handling and waste management techniques, provision of good transportation network, provision of modern timber handling machines at affordable rates, value addition to wood wastes by establishing wood-based industries that can efficiently utilize wood wastes to generate energy and value-added products for rural development.
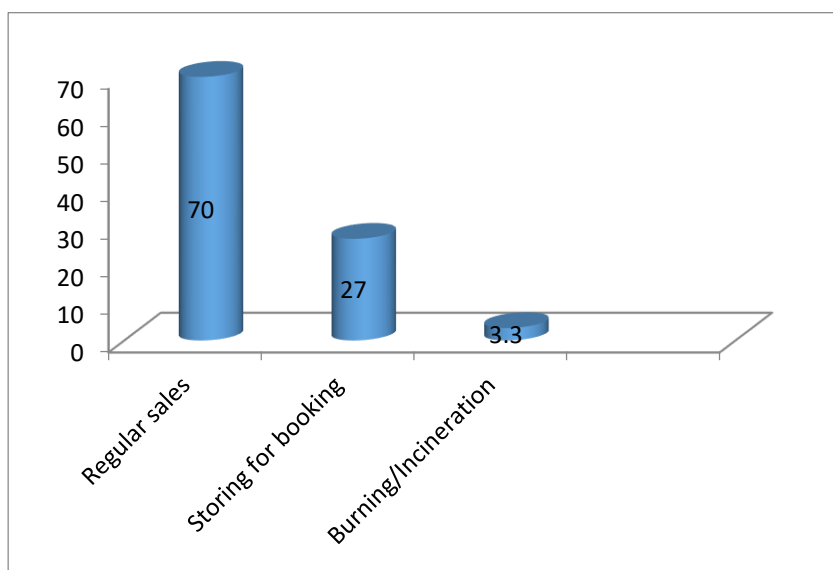

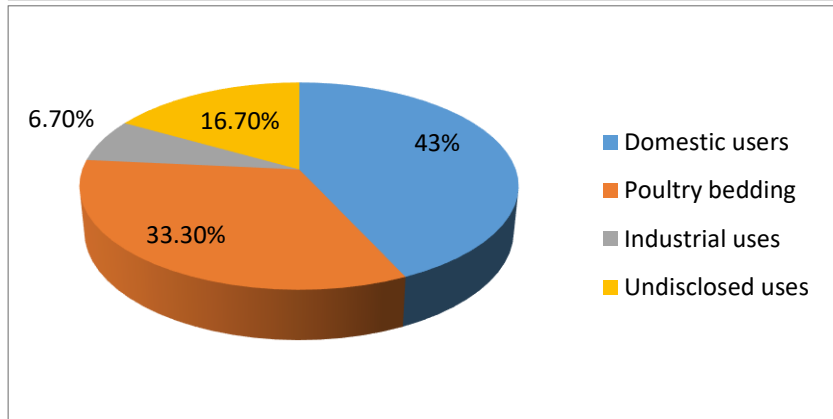**Figure 1**: **Major sawdust disposal methods in the study area**

Figure 2: Users of sawdust in the study area

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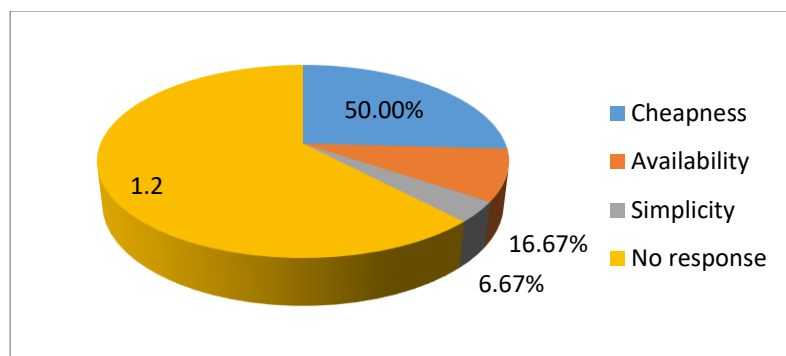
Figure 3: Users preference for sawdust

Table 1: Selected respondents in Ungogo local Government area

Selected wards (Study area)	No of selected timber handling/marketing sheds n=60
Rijya Zakki	22
Ungogo town	12
Bachirawa	16
Gayawa	10

Field survey, 2023

Table 2: Socio – economic characteristics of timber/sawdust handlers in the study area

Variables	Frequency N=60	Percent %	Modal variable
Age of Respondents (years)			
21-30	12	20.00	
31-40	20	33.33	31 - 40
41-50	16	26.67	
51-60	8	13.33	
Above 60	4	6.67	
Sex			
Male	60	100.00	Male
Marital Status			
Married	48	80.00	Married
Single	10	16.67	
Widow	2	3.33	
Level of Education			
Non formal	38	63.33	Non formal education
Secondary	20	33.33	
Tertiary	2	3.33	
Years of Experience			
1-10	32	53.33	1 - 10 years
11-20	12	20.00	
21-30	10	16.67	
31-40	6	10.00	
Monthly Income from sawdust			
40,000-50,000	20	33.33	
Above 50,000	40	66.67	Above 50,000 naira
Price of sawdust (50kg bag)			
100-500	24	40.00	
Unavailable	30	50.00	Unavailable
Monthly sawdust production Per shed / (50 kg bags)			
31-40	22	36.67	
41-50	32	53.33	41 - 50
Unavailable	6	10.00	

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Source: field survey, 2023

Table 3: Technical factors affecting sawdust handling

Variables	Frequency N = 60	Percent %	Mode
Type of machine			
Circular saw	34	56.67	Circular saw
Band saw	8	13.33	
Tie rod cutter	18	30.00	
Age of machine			
1-5 years	42	70.00	1 – 5 years
6-10	8	13.33	
11-15	2	3.33	
Sawdust yield from species			
Brachystegia eurycoma (Eku)	26	43.33	
Tectona grandis (Teak)	18	30.00	
Funtumia elastica (Ire)	16	26.67	
Chrysophylum delavayi (Ashwali)	40	66.67	Chrysophylum

Source: field survey data, 2023

Table 4: Factors influencing sawdust handling in the study area (Regression analysis)

Variables	Coefficients	Stdd Error		Tvalue	P>|t|
Age	-597.665	59.0496	-1.66	0.110*	
Sex	-3590.705	12690.26	-0.28	0.780ns	
Marriage	-454.11463	5264.025	-0.09	0.932ns	
Education	2782.76	3388.757	0.82	0.420ns	
Experience	974.282	385.001	2.53	0.019**	
Constant	40463.16	16289.98	2.48	0.021	

*: significant at 0.01 level   **: significant at 0.05 level   ns: not significant

Table 5: Challenges facing sawdust handling in the study area

Sawdust handling problems	Frequency	Percentage	Ranking
Bulkiness/storage space	24	40.00	1st
Pollution (smoke and odour)	20	33.33	2nd
Handling and Transportation costs	6	10.00	3rd
Unavailable	6	10.00	4th
Seasonality of timber	4	6.67	5th

Field survey, 2023

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