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Assessment of Wood Waste Management Practices in Small and Medium Scale Enterprises in Minna, Niger State.

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Abstract

The purpose of the study is to assess the management practices adopted by small and medium scale enterprises in managing wood waste in Nigeria. Wood waste mismanagement is a serious environmental threat in Niger State. The evident disposal of wood wastes on the streets, water bodies and the open air burning indicates that wood waste management practices which includes the collection, disposal, recycling and reuse of wood waste are inefficient and insufficient and therefore will pose a great threat the sustenance of Nigerian timber forests, human health and environmental balance. The objectives of the study are to identify: wood waste collection practices, wood waste recycling practices and wood waste disposal practices in SMEs in Niger State. The study adopted Survey research design. Data were collected from administration of questionnaire. The population of the study was 17 respondents. The respondents were drawn from six medium scale enterprises and 11 small scale enterprises in Minna, Niger State. Survey was carried out to identify SMEs in the study area. The respondents for the study were drawn from 6 medium scale enterprises and 11 small scale enterprises. The total population was used for the study hence there was no sampling technique. Data collected from the questionnaire was analyzed using Mean and Standard deviation and t-test. Mean and standard deviation was used to answer the research questions, while t-test was used to test the Null Hypotheses at 0.05 level of significance. The findings of the study on wood waste collection revealed that wood waste generated in SMEs are collected by poultry and animal farmers and used as animal beddings and others are collected by households and used as cooking fuel, the remnant of the wastes are burnt while others are used as landfills. The findings also revealed that wood waste are not collected by waste collection agencies nor composite boards manufacturing industries.

The findings on wood waste recycling practices revealed that there are facilities for recycling, treatment and sorting of wood waste in Minna. In addition, there are wood waste disposal, storage or incineration facilities in Minna. Therefore, this study recommends that the agencies and bodies that are mandated to check and regulate wood waste should be appraised annually to ensure that their duties are effectively carried out. It is also important that necessary facilities for waste collection, storage and recycling should be made available in Niger State by the government so as to maximize wood waste utilization and create wealth and jobs in the state.

Keyword: Assessment, Wood Waste, Wood Waste Management, Management Practices, Small and Medium Scale Enterprises

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INTRODUCTION

Waste is referred as any unwanted substance that is left from a material after its initial or intended use is achieved. Some materials may be purchased as brand new products but may not serve nor satisfy its intended and expected purpose, therefore, it is termed as waste. Wood waste (WW) are residues generated in the processing of wood and wood products. Owoyemi *et-al* (2016) defined wood waste as woody residues generated from the process of converting log of wood into usable products, in construction and demolition of structures and in the manufacturing of furniture and wood products. Wood wastes include a large spectrum of wood products from primary and secondary processing such as bark, slabs, sawdust, chips, planer shavings, sander dust, end trims, used pallets, and construction residues. Wood residues also include logs, branches, and brush from urban tree removals, construction-related land clearing, farming, and industrial projects (Nzokou, *et-al*, 2011). Wood waste are classified according to how they are generated. Sawmills generate mostly sawdust, trimmings, shavings, wood chips, barks, off-cuts, while furniture industries generate waste which includes: shavings, cut-offs, panel trims and timber with defects.

Other sources of waste wood include chemically treated wood from railroad ties, telephone and utility poles, chipped brush and limbs from utility, highway, and railroad right-of-way maintenance; and industrial waste wood outside typical waste streams. Some of this material is being reused, burned, or disposed of in hazardous waste landfills. The most common and disturbing types of wood waste are those generated at sawmills and furniture

manufacturing industries. Plate A and D are pictures of wood bark in chips and sawdust generated from sawmill, while Plate B and C are timber cut-offs and planer shavings generated from furniture industries.



Plate A: *Wood Bark in chips*

Source: Ogunbode (2012)



Plate B: *Timber Cut-Offs*

Source: Nwankwo (2021)



Plate C: *Timber Shavings*

Source: Nwankwo (2021)



Plate D: *Sawdust*

Source: Nwankwo (2021)

These waste are generated in the day to day wood processing activities of small and medium scale enterprises (SMEs) which include sawmills and furniture manufacturing industries. These processing activities ranges from conversion of logs, ripping, planing, turning and sanding. Large amount of wastes are generated from the wood processing activities carried by the SMEs. In developed nations, all types of wastes ranging from plastic wastes, electrical/electronic wastes, metal wastes and wood wastes have designated dumpsite and storage facilities where they are sorted, treated and recycled. In Minna Niger State, the only designated area for waste dump in Kuyi Village where all forms of refuse are dumped without sorting them.

With the constant indiscriminate disposal of large amount of waste generated by Small and Medium Enterprises (SMEs) it shows that these SMEs lack the managerial ability and knowledge to manage the waste they generate.



Unsorted wood waste disposed with ceramic waste in Kuyi Village, Minna, Niger State.

Source: Nwankwo (2021)



Plate 2.10: *Burning of Logging Waste in the Forest*
Source: (Zafar, 2017)

SMEs are businesses which are small and medium in sizes, these businesses are conceived as a result of entrepreneurial activities of individuals (Eseh, *et-al*, 2012). Small and medium scale enterprises (SMEs) are generally regarded as the engine of economic growth and equitable development in developing economies. They are labour intensive, capital saving and create jobs. SMEs provide feeder industry services as they serve as major suppliers of intermediate goods and components to large-scale industries as well as major agents for the distribution of final products of such industries; they provide opportunities for the development of local skills and technology acquisition through adaptation (Mba, 2014). The wood industry which includes sawmills, furniture industries and plywood manufacturing industries in Nigeria is characterized by small and medium scale operators who mostly process timber with machines (Ekhuemelo, *et-al*, 2015). Small and medium scale wood enterprises that comprise of sawmill and furniture construction enterprises have contributed so much to foreign exchange and growth of Nigeria's economy. These SMEs in their daily processing and production activities generate much wood waste which are poorly managed by been disposed and burnt on the streets and waterways constituting environmental and health hazards.

Waste management involves some practices which includes; collection, disposal, minimization and regulation enforcement. Onu *et al.*, (2012) defined waste management as the application of techniques and skills that will ensure the proper execution of the functions of collection, transfer, recycling, reduction, treatment and disposal of waste. Wood waste management is the collection, refurbishing, recycling, reuse and proper disposal of wood residues (Ormondroyd, *et-al*, 2016).

Wood waste collection is the organized transfer of wood waste from the point of generation to the point of disposal and use. These points of collection ranges from forests, sawmills and furniture industries. The point of disposal or use includes dumpsites and recycling industries, landfills. Wood waste minimization can be achieved by the use of modernized and advanced wood machines and technology designed to generate less waste. Recent technology for wood processing took into cognizant the need for eco-friendly technology and machines that generate less waste, consume less energy and less emission of gases. Regulation and enforcement of wood waste collection and disposal is the most important aspect of wood waste management.

There exist great benefits in proper management of wood waste, they include: recycling of wood wastes for production of wood panels and furniture components. Recycling and reuse of wood waste is found to be effective to reduce the total amount of waste and the use of new wood aterials. Recycling of wood waste reduces the demand of raw timber and directly reduces the pressure of logging of forest woods. Wood waste recycling and reuse will create jobs and wealth for the economy and improve technology as a result of research in upgrade and production of modern wood products. These may be achieved by the use of wood briquettes in place of firewood, utilization of wood waste to generate industrial energy, utilization of bark for adhesives and foam production and production of medium density fiberboard and engineered wood products from wood waste generated locally (Ogunwusi, 2016). Nwankwo (2022) posited that wood waste management that involves the recycling and reuse of wood waste are generally beneficial to the environment, economy and ecosystem; and reduces the pressure on forests as this gives the forest time to regenerate and for the harvested trees to be replaced.

A large amount of wood off-cut are generated daily in the forests, sawmills and furniture manufacturing workshops which are not converted into utilizable or value added products. Processing of wood waste for specialty wood products are one of the few value addition techniques in vertically integrated processing mills. Some wood

conversion centers in Nigeria have not embraced further processing of wood waste because of affordability of the technology, cost and returns of processed wood waste (Larinde, *et-al*, 2014). There are great economic benefits of recycling wood wastes into composite boards (Medium Density Fiberboard, High Density Fiberboard, Particle Boards) and Laminates which are environment-friendly as it uses wood waste in construction and makes more efficient use of the left over wood in wood processing centers (Larinde, *et-al*, 2014). The recycling of wood waste for the production these boards are not just eco-friendly, but they are also economically beneficial because they help in wealth and job creation and also reduces the pressure of illegal logging imposed on forest reserves. These environmental friendly practices are not carried out in Niger State as heaps of wood wastes are burnt for days, disturbing visibility and causing pollution thereby endangering health of residents, motorists and passersby. Wood waste that entered into water ways leached their extractives in the water, thereby, polluting the water (Ogunwusi, 2014). Proper collection and disposal of wood waste will reduce the littering of wood waste on the environment, while improper disposal of wood waste causes drainage blockages and air pollution

Statement of the Problem

Wood panels and engineered wood products are produced daily from the utilization of wood wastes. Wood waste are regarded as useful resources for production of wood panels and also used as bio fuels in developed nations. These nations make sure that these wastes are also collected, sorted, treated, recycled and stored, while the unrecyclable ones are burnt in incinerators. These practice has helped to sanitize the environment against disposal or burning of wood waste on the streets.

However, in Minna, Niger State, wood waste are seen on the streets, drainages and burnt in open air. This is an indication that wood wastes are not managed as they should and it has contributed greatly to environmental pollution and health hazards and also contributed to the challenges faced by waste regulation agencies in Minna. Therefore, there is need to assess the wood waste management practices adopted by the SMEs, identify the challenges they face in managing wood waste and proffer solutions to these challenges.

Purpose of the Study

The purpose of the study is to assess the wood waste management practices adopted by small and medium scale enterprises in Minna, Niger State. Specifically, the study will:

1. Identify the wood waste collection practices adopted by SMEs in Minna Niger State.
2. Identify the wood waste recycling practices adopted by SMEs in Minna Niger State.
3. Identify the wood waste disposal practices adopted by SMEs in Minna Niger State.

Research Questions

1. What are the wood waste collection practices adopted by SMEs in Minna Niger State?
2. What are the wood waste recycling practices adopted by SMEs in Minna Niger State?
3. What are the wood waste disposal practices adopted by SMEs in Minna Niger State?

Research Hypotheses

1. There is no significant difference between the mean responses of small scale enterprise and medium scale enterprise on wood waste collection practices for SMEs in Minna, Niger State.
2. There is no significant difference between the mean responses of small scale enterprise and medium scale enterprise on wood waste recycling practices for SMEs in Minna, Niger State.
3. There is no significant difference between the mean responses of small scale enterprise and medium scale enterprise on wood waste disposal practices for SMEs in Minna, Niger State.

METHODOLOGY

Survey research design was adopted for the study. Data was collected by questionnaire administration. The population of the study was 17 respondents. The respondents were drawn from six medium scale enterprises and

11 small scale enterprises in Minna, Niger State. Survey was carried out to identify SMEs in the study area. The total population was used for the study hence there was no sampling technique. Data collected from the questionnaire was analyzed using Mean and Standard deviation and t-test. Mean and standard deviation were used to answer the research questions, while t-test was used to test the Null Hypotheses at 0.05 level of significance. The Statistical Package for Social Sciences (SPSS) version 25 was employed for all statistical calculations. Based on the five point rating scale which are assigned numerical values of 4,3,2,1 and 0 for Strongly Agree, Agree, Disagree, Strongly Disagree and No Opinion respectively. Decision regarding the research questions as based on real limit of numbers as shown in Table 1.0. Decision regarding the null hypotheses was based on comparing the Significant. 2 Tailed value with the stated level of significance. Significant 2 Tailed value above the significant level (0.05) was regarded as there is significant difference while the Significant. 2 Tailed value below was regarded as there is significant difference.

Table 1.0: Real Limit Table

S/N	Lower Limit		Upper Limits	Decision
1	4.50	-	5.00	Strongly Agree
2	3.50	-	4.49	Agree
3	2.50	-	3.49	Disagree
4	1.50	-	2.49	Strongly Disagree
5	1.00	-	1.49	Undecided

RESULTS AND DISCUSSION

Research Question 1

Table 2.0 Responses of the Head of Operations on the wood waste collection practices adopted by small and medium scale enterprises in Niger State

S/N	Wood Waste Collection Practices	\bar{X}_1	\bar{X}_2	\bar{X}_A	Remark
1	Wood waste are collected by waste collectors from waste management agencies	4.00	3.88	3.93	Disagreed
2.	Wood waste are collected and stored in SME collection facility	3.87	3.88	3.88	Disagreed
3	Wood waste are collected and transported to state collection sites	4.07	3.94	4.00	Disagreed
4	Wood waste are collected and sorted for waste collectors	4.13	3.88	4.00	Disagreed
5	Wood waste are collected by households and animal farmers	3.93	3.76	3.84	Agreed
	Grand Mean	3.99	3.88	3.93	Agreed

The findings of the study on wood waste collection revealed that wood waste generated in SMEs are collected by animal farmers and households to be used as animal beddings and cooking fuel. The findings also revealed that wood waste are not collected by waste collection agencies nor composite boards manufacturing industries.

Research Question 2

Table 3.0 Responses of the Head of Operations on the wood waste recycling practices adopted by small and medium scale enterprises in Niger State

S/N	Wood Waste Recycling Practices	\bar{X}_1	\bar{X}_2	\bar{X}_A	Remark
1	Wood waste are recycled to produce usable items	4.00	3.88	3.93	Disagreed
2.	Wood waste are sorted for various treatment before recycling	3.87	3.88	3.88	Disagreed
3	Wood waste are treated for recycling	4.07	3.94	4.00	Disagreed
4	Wood waste taken to recycling and treatment plants	4.13	3.88	4.00	Disagreed
5	Wood waste are sold to recycling plants	3.93	3.76	3.84	Agreed
	Grand Mean	3.99	3.88	3.93	Agreed

The findings on wood waste recycling practices revealed that the SMEs do not recycle wood waste they generate. The generated wood waste are not treated nor taken to treatment and recycling plants.

Research Question 3

Table 4.0 Responses of the Head of Operations on the wood waste disposal practices adopted by small and medium scale enterprises in Niger State

S/N	Wood Waste Disposal Practices	\bar{X}_1	\bar{X}_2	\bar{X}_A	Remark
1	Wood waste are disposed at disposal facilities	3.87	3.82	3.84	Disagreed
2	Wood waste are disposed at designated dumpsites for wood waste alone	3.80	3.94	3.88	Disagreed
3	Wood waste are burnt at generation site	4.00	3.94	3.97	Agreed
4	Wood waste are disposed by waste collection agencies	3.87	3.94	3.91	Disagreed
	Grand Mean	3.86	3.91	3.90	Agreed

The findings of the study revealed that wood waste are not disposed at designated dumpsites in Minna, rather they are burnt in open air and disposed on drainages. It also revealed that waste collection agencies do not collect these waste from the SMEs for disposal.

Hypothesis One

Table 5.0: T-test analysis for the test of significant difference between the mean responses of small scale enterprises and medium scale enterprises on wood waste collection practices in small and medium scale enterprises

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	2.052	.162	1.017	30	.317	.10654	.10477	-.10743	.32050
Equal variances not assumed			1.048	26.772	.304*	.10654	.10168	-.10217	.31525

Table 5.0 showed that, the significant (2-tailed) value of t-test for equality of means with variance not assumed was 0.304 which is greater than the stated level of significance. Since 0.56 is greater than 0.05, the difference between the mean responses of small scale enterprises and the medium scale enterprises on the wood waste collection practices in small and medium scale enterprises is not statistical significant. Hence, the null hypothesis (H_{01}) is accepted.

Hypothesis Two

Table 6.0: T-test analysis for the test of significant difference between the mean responses of small scale enterprises and medium scale enterprises on wood waste recycling practices in SMEs

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	.998	.338	-.256	12	.802	-.05741	.22440	-.54633	.43152
Equal variances not assumed			-.313	11.826	.760*	-.05741	.18357	-.45802	.34320

The significant (2-tailed) value of t-test for equality of means with variance not assumed presented on Table 6.0 was 0.760 which is larger than the stated level of significance (0.05). This connoted that, there is statistical significant difference between the mean responses of small scale enterprises and medium scale enterprises on wood waste recycling practices in SMEs. Therefore, the null hypothesis was upheld.

Hypothesis Three

Table 7.0: T-test analysis for the test of significant difference between the mean responses of small scale enterprises and medium scale enterprises on wood waste recycling practices in SMEs

	Levene's Test for Equality of Variances		Independent Samples Test						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	1.165	.289	.60	30	.552	.06446	.10725	-.15458	.28350
Equal variances not assumed			.61	27.28	.542*	.06446	.10429	-.14943	.27835

Table 7.0 presented that, the significant (2-tailed) value of t-test for equality of means with variance not assumed was 0.542 which is greater than the stated level of significance (0.05). This confirmed that, the difference between the mean responses of small scale enterprises and medium scale enterprises on wood waste recycling practices in SMEs was not statistical significant. Thus, the null hypothesis was withheld.

Discussion of Findings

The implication of this finding is that the community will continue to suffer the consequences of waste mismanagement if proper waste management strategies are not adopted and implemented. This inference is supported by Ferronato and Torreta (2019) whose work revealed that lack of sustainable plan which entails infrastructure for waste collection, recycling, transportation, treatment and final disposal, management planning, financial resources, know-how and public attitude reduces the chances of improvement of waste management and good environmental protection can be accomplished by organized waste collection, recycling and composting.

Five out of the six items were agreed on as performance indicators of wood waste management for the wood waste framework. These items include: social participation, environmental needs, economic impact, health impact, and public acceptance level. The remaining one item that was disagreed on which is 'Extended Producer Responsibility' was not considered to be a performance indicator of wood waste management for the wood waste framework wood waste management for the wood waste framework in small and medium scale enterprises in Niger State.

This implies that performance indicators are basic measurement tools for monitoring and evaluating waste management system or framework for waste management and it is also measured by the social participation of the community, the environmental needs of the waste management system, the economic and health impact of waste management and public acceptance of waste management. This position agrees with the submission of AlHumid *et al*, (2019) who noted that performance indicators are needed measurement tools for a sustainable solid waste management system that include: Economic and financial indicators, environmental indicators, sustainability indicators, physical indicators, personnel indicators, operational indicators, public services and participation indicators. These indicators helps waste management implementation and monitoring teams to successfully execute their tasks in ensuring that wood wastes are properly managed so satisfy the expected goals.

It was found out that the respondents agreed on all three items and these includes: Human resources, Material resources and Economic resources as resources needed for wood waste management in small and medium scale enterprises in Niger State. This confirms that wood waste management cannot be carried out effectively and efficiently without human, material and economic resources. The human resources needed for wood waste management include: skilled personnel for wood waste collection and sorting, skilled personnel for wood waste treatment skilled person for wood waste recycling and killed personnel for wood waste management researching. The material resources needed includes: wood waste collection vehicles, wood waste dump sites, wood waste storage facilities, wood waste recycling plants and wood waste incineration facilities. The economic resources

includes: financial provision for waste management facilities, personnel, researchers and waste collection vehicles. These resources are interdependent and must function as a collective entity.

The implication of this study is that when these resources are adequately made available as indicated in the developed framework for wood waste management, the SMEs and stakeholders can jointly and efficiently implement the strategies listed in the wood waste management framework and this will in turn yield a successful and sustainable wood waste management in Niger State. In favour of this finding, Haider *et al.*, (2019) Ferronato and Torreta (2019) reported that to achieve a sustainable solid waste management system, all the key components need to perform efficiently with available technical, human, and financial resources. Therefore, this means that the key resources needed for an efficient and sustainable wood waste management is the availability of human, material and economic resources.

The findings on the criteria for monitoring the implementation of wood waste management framework for small and medium scale enterprises in Niger State revealed that compliance to waste management objectives, addressing issues of wood waste pollution, compliance to environmental health and sustainability and compliance to waste to wealth creation plan and addressing issues related to socio-economic impact of wood waste are all criteria to be used in monitoring the implementation of wood waste management. This view is justified by the result of the study carried out by Thyberg *et al.*, (2015) on management framework for municipal solid waste systems and its application to food waste prevention who reported that in monitoring the implementation of wood waste management, its benefits should include environmental, economic, and social priorities; efficient performance monitoring; and a structure to continually define, review, and improve the systems.

The findings on the criteria for evaluating wood waste management framework for small and medium scale enterprises in Niger State revealed that all four items listed which include: satisfaction of the wood waste management framework objectives, satisfaction of the environmental health and sustainability, satisfaction of Zero waste management theory and satisfaction of waste to wealth creation plan were all agreed by the respondents as criteria for evaluating the wood waste management framework for small and medium scale enterprises in Niger State. This confirms that the IBSME and WRABSME are in agreement with the criteria for evaluating wood waste management framework.

This implies that in evaluating the success of the developed framework in managing wood waste, the evaluators should be able to ascertain if the framework addresses the issues of wood waste menace, they should determine the efficiency of the framework in helping the SMEs utilize the generated waste, ascertain if the framework addresses issues related to environmental health and sustainability and also determine if the framework helps in creating wealth and jobs for SMEs. This is in agreement with Ferronato & Torreta (2019) who reported that stakeholders and governments should know that solid waste management is a complex system that involves environmental, social and economic issues, which should be evaluated holistically for improving the life cycle of waste, creating wealth, reducing water, soil and air contamination due to open burning and open dumping, practices widespread worldwide.

The findings on the suitability characteristics of the framework revealed that: the framework can be used for wood waste collection, wood waste recycling, wood waste disposal, environmental wood waste pollution prevention, skills development for waste to wealth creation, identification of stakeholders in wood waste management, identification of the economic benefits of wood waste, prevention of wood waste hazards and for prevention of wood waste hazards. It implies that for an effective and sustainable wood waste management in Niger State, the SMEs should be equipped with the framework and familiarize themselves with information in the framework needed for wood waste management. This is supported by the study by Taelman *et al.*, (2018) who reported that availability of plan with comprehensive data should be the priority for managing waste because it helps to develop and analyze specific urban waste management. The type of data required are: the amount of waste generated, the composition and value of waste and secondary goods, the direct and indirect emissions to water, soil and air, the geographical location of unit processes, the actors involved and the costs and revenues. The implication of this finding is that the utilization of the developed framework by the SMEs will successfully address the problems of wood waste in Niger State.

Conclusion

Wood waste management is regarded as a sensitive issue in Nigeria because of its effects to the environment, human and animal lives, and the economy and forest reserves. Several policies and approaches have been in place to address the issues of wood waste in Niger State but they have failed to address it as expected hence wood waste

mismangement still remain a problem in Niger State. Many studies have tried to address the problems of wood waste by suggesting the improvement of policies for wood waste management and provision of funding for waste management activities. The findings of this study revealed that for wood waste to be properly managed, the SMEs who generate these waste should be the primary and first contact in addressing the issue. The findings of the study helped in developing vital components for managing wood waste which includes: objectives of wood waste management, contents of the wood framework, strategies for managing wood waste, resources needed for wood waste management, criteria for monitoring the implementation of wood waste management and criteria for evaluating the wood waste management framework. These components were used in developing the wood waste management framework for small and medium scale enterprises in Niger State whose objectives is to identify the strategies for wood waste management, determine the performance indicators for measuring wood waste management, identify the resources for wood waste management, identify the criteria for monitoring the implementation of wood waste management and identify the criteria for evaluation of the wood waste management for small and medium scale enterprises. The developed framework when utilized will address the problems of wood waste in Niger State.

Recommendation

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

1. The agencies and bodies that are mandated to check and regulate wood waste should be appraised annually to ensure that their duties are effectively carried out else, most SMEs generating these wastes will not ensure proper management of wood waste.
2. A framework for wood waste management should be developed to address the problems of wood waste in Niger State.
3. Necessary facilities for waste collection, storage and recycling should be made available in Niger State by the government so as to maximize wood waste utilization and create wealth and jobs in the state.

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