

MECHANISM FOR IMPROVING COTTAGE AND SMALL SCALE
INDUSTRY IN THE RECYCLING OF SOLID WASTE MATERIAL
IN MINNA, NIGER STATE.

BY

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CERTIFICATION

I Dauda Nagenu with matric no. 2007/27297BT an undergraduate student of the department of industrial and technology education certify that the work embodied in this project is original has not been submitted in part or full for any other diploma or degree of this or any other university.

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DATE

signature

APPROVAL PAGE

This is to certify that this project has been carried out by Dauda Nagenu, in accordance with the standard procedure for project preparation in industrial technology Education department, Federal University of Technology, Minna.

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DEDICATION

This research work is dedicated to Almighty Allah, the creator and sustainer of humanity, Prophet Mohammed (S A W), our parents who have beard our absence during our school.

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Abstract

The study is on mechanism for improving cottage and small scale industries in the recycling of solid waste material in Niger State to determine the possible items that could be reproduce from these wastes. Four research questions were formulated for the study and two null hypotheses were also tested at 0.05 level of significance. The target population for the study included the managers and workers of recycling industries in Minna town. Six (6) Managers and Thirty Three (33) workers, mean score of the respondents' standard deviation and t-test were used as statistical tools to analyse the data collected from the respondent on mechanism for improving cottage and small scale industry in recycling of solid waste material in Minna. A Forty One 41 items questionnaire was used as instrument for data collection, which were analyse according to the research question and based on findings, the result shows that the recycling of solid waste require through planning, organizing and legal action in order to achieve and reasonable success must be obtained to pick the abandoned solid material for recycling into scrap that can be processed or reuse by industries. Therefore from the findings, the study shows that recycling of various type of waste can be a lasting solution for solid waste pollution problems and means of conserving our natural resources.

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CHAPTER I

INTRODUCTION

Background of the study:

Cottage industry is a specialised form of small scale industry where the production of the commodity takes place in the homes and the labour is supply by the family members only. The machinery or means utilized for the production of the commodities generally are the common ones used at homes. The basic characteristics futures of cottage industry is that it is basically unorganised in nature and come under group of small scale industry type.

The commodities that are being produce by these industries are basically consumable ones and are produce through the utilisation of traditional techniques. Cottage industry especially started its function in the county sides of the country where unemployment along with under employment are prevalent. Thus this industry helps the economy by absorbing a huge amount of surplus labour of the rural economy. Another glaring future of cottage industry is that it is not a Mass producer of commodities.

The main risk that is being faced by this industry is from the factory based medium or large industry which are again capital intensive in nature. This is because of the fact that these large industries utilize all sort of cost effective technologies which enable them to supply the products at low price. On the other hand, the cottage industry is basically labour intensive and utilizes traditional techniques in production process which are generally not cost effective in nature which escalates the price of their product. The products thus face risk of extinction if they don't receive enough financial or other form of support from the Government.

Cottage industries often characterize by its enormous potential for employment generation and the person getting employed is basically regarded as a self-employed one. The most common form of support extended by the government towards this industry is through forwarding of capital subsidies.

In Small-scale industries the use of power, machinery and external labour separate it from cottage industry. Products made are for sale in market. For example brassware industries, recycle etc.

Solid wastes are solid materials that are considered pollutant in an environment. Solid waste can be grouped into metallic and non-metallic materials which are indiscriminately disposed off and eventually litter the environment thereby culminating into environmental degradation (Atsumbe and Onodugu, 1988). They further said metallic waste material can be classified into two that is ferrous and non-ferrous, while the non-metallic include plastics, woods, rubbers, ceramics, packing materials such as bottles, cans and polythene bags etc.

Igbox and Abdul (2000) researched into how some of these solid wastes are generated and of what sort they are. According to them, a complex engineering product may consist of component made from wide range of materials. The automobile for example is assembling for component made from steel, cast iron, aluminium and plastics. Other materials include rubber, glass, fibre and foam. In the course of producing the parts, wastes are inevitable. They could be generated as chips from the machining processes, and may come from the production and assembly processes, when the resultant product fails to meet design specifications.

Perhaps the majority of scraps came from automobile and machine that have reached the end of their useful life. Mduruoa, (1993) stressed that with time even the highest quality product becomes a scrap as a result of wear and tear or damage following the natural cycle of

growth bloom and decline, Mduwa went on to say that most of our major cities today are littered with worn out motor tyres consisting environmental pollution, hoodlums use them burn fire during demonstrations. Again the resultant carbon monoxide generated in the cause of burning these tyres if inhaled can cause very serious environmental and health hazard. In recent times the use of plastic in manufacturing industries has grown by more than 500% from 1970 and 1990 (Banard, 1988). The use of plastic is expected to continue to rise because of their many benefits which include reduction in overall weight, less cost and corrosion resistance, among others. It is pertinent to stress here again that most domestic utensils today are made out of plastic. But Atsumbe and et al, 1998 observed that despite the advantages of these plastics, it effects on environmental degradation leaves much to be desired. This is so because the lifespan in use is small that resulted our major cities down to the smallest hamlet in Nigeria are completely littered with broken plastic, chairs, plates, cups and lots of other items.

Of importance it is to mention the waste generated from the industrial system. Virtually all our beverages and other forms of foods are packed or canned in metallic tins. But it is disturbing today that after the consumption of the content of these tins, no effort is made to recycle them. These together with polythene bags used for packaging pure water are either burnt or left to litter in the environment. Theses indiscriminate in generation, result in fumes, pollution of surface and ground water system, as this product gradually depredate into the soil. Akpan et al, (1997) observed that dumping of these waste products poses a great potential hazards for the transmission of pathogens that causes spread of most communicable diseases e.g. Cholera, typhoid etc.

It is a matter of great concern today because the effect of un-recycled solid waste materials has become a great source of both environmental and health hazard to Niger state. For example, Igbox et al, 2000 noted that improperly disposed industrial waste is not only an

eye sore, but leads to the environment getting chemically polluted as a result of oxidation processes taking place especially on the metallic scraps.

They further stressed that chemically corrosive coating are washed off thereby contaminating surface and underground waste with devastating effects on plants and aquatic life.

In the face of these problems the question therefore is what can be done with these metallic and non-metallic wastes generated annually and running into millions of tons and their eventual consequences on the health of Nigerians.

The problem of environmental pollution most especially by metallic and non-metallic waste disposal has increased in magnitude in Niger State. If left unchecked, it will threaten not only our health and comfort but also our existence. Preservation of the environment will presuable dictate the utilisation of all obsolete capital goods including the solid wastes that constitute a reasonable percentage. If wastes can be recycled, pollution will reduce since the latter is only material in the wrong place at a particular time.

A small proportion of metallic scraps are recovered by scavengers from dump sites. These are sold to artisans who either reshape them into simple tool and equipment's or refurbishes them for sales. Some of these craft men scavenge for beverage food tins and cans. They recycle these products into domestic product such as local lamps and flour sieve. In as much as the efforts of these men be commended it is important to state that in most cases the refurbished components fail shortly after being refitted into use or at best only dismal performance can be expected from them. The reason for this is not for fetched as these as these craft men are not in any way trained (Atsumbe, 2004).

Currently the Federal Government has stamped a heavy ban on importation of certain raw materials that are used in production, such as plastic, wood, rubbers, certain ferrous and non-ferrous metals etc. This ban has caused a sudden death (fold up) of small scale industries. It is only these correct to state at this point that some waste materials could be recovered and serve as raw materials could be recovered and serve as raw materials for certain industries, above all many of our graduates that are roaming about the streets today without job could be trained on how to recycle or use some of these waste. Especially recovering into domestic products that are readily needed.

Statement of Problem

Solid waste management has remained a growing concern in many parts of the country and particularly, Minna metropolitan area. Increase in industrial production, population and commercial activities have led to increase waste generation (Momoh, 2004). Most industries, organizations and communities in Nigeria that generate both metallic and non-metallic waste do not have a well-articulated programme of waste management. As such waste products in any form and shape can be found everywhere in the streets, around the homes, within industrial premises, and even dumped in the rivers and canals. While some of these wastes are dumped at designated land free sites. Much of it ends up at site other than designated ones. Some of the waste products that require treatment before being disposed off end up not being treated at all.

A lot of engineering wastes such as obsolete equipment, light and heavy vehicles and their components end up abandoned and left to deteriorate on our major roads. Elekwa, (2001) lamented that apart from environmental abuse and eyesore caused by these products. Many ghastly accidents that have terminated the lives of Nigerians had occurred as a result of these vehicles abandoned on our roads. Improperly disposed industrial waste is not only an

eyesore, but leads to the environment getting chemically polluted as a result of oxidation processes taking place especially on the metallic scraps. The chemically produced corrosive coating are washed off thereby contaminating surface and underground water with devastating effect on our ecosystem.

The development of an efficient recovery system, training in the technologies for converting metallic and non-metallic waste materials into usable items will be needed as the answer to the environmental problems. Based on the forgoing the study was set to identify all available useable metallic and non-metallic waste materials, determine possible items that could be reproduced from these waste and strategies for retaining the worker in the process of recycling

Purpose of the Study

The purpose of the study was to determine mechanism for improving cottage and small scale industry in the recycling of solid waste material in Niger state. Specifically this study will find out the following,

1. The available metallic and non-metallic materials.
2. The possible items that can be reproduced from the waste materials.
3. The problem being encountered by workers in the recycling company in the process of recycling.
4. The strategies that can enhance effective recycling of these waste materials.

Significance of the Study

This study when successfully completed will be a guide to cottage and small scale industries particularly in selecting available waste material and also identifying various items that can be reproduce from these wastes as well as widening their awareness of the available

metallic and non-metallic wastes. it will also help them to identify their major problems in the process of recycling.

Having such waste product in any form and shape everywhere in the street, around the homes, within the industrial premises, and even dump in the rivers and canals which causes serious hazard and result in getting the environment chemically polluted as a result of oxidation process taking place especially on metallic scraps which are washed off and contaminating surface and underground water, with devastating effect on plant, animals and even human lives. When waste products are effectively utilized it will reduce to the beeriest minimum the problem of environmental deterioration and the reward goes to the society.

The study will be of great significance to the Nigerian society as it will provide adequate information on the employment opportunities for the unemployed, which is one of the major social problem facing Nigeria in general and Minna in Niger state in particular.

Scope of the Study

This study is limited to solid waste product such as beverage tins and cans, discarded vehicles bodies, tyres, tubes, papers, polythene bags etc. It also restrict to cottage and small scale industry in Minna, Niger state.

Assumption of the Study

It is assumed that the answer provided by the workers in the recycling company will provide meaningful information that will enhance recycling of waste materials.

Research Questions

The following research questions were formulated to guide the study.

1. What are the available metallic and non-metallic waste materials?

2. What are the possible items that can be provided from these waste materials?
3. What are the problems being encountered by the cottage and small scale industries in the process of recycling?
4. What are the strategies that can enhance effective recycling of these waste materials?

Hypothesis

HO₁: There is no significant difference between the mean responses of the workers and Managers on the available metallic and non-metallic waste materials used in the industries.

HO₂: There is no significant difference between the mean responses of the workers and Managers on problems encountered during the process of recycling solid waste material.

CHAPTER II

REVIEW OF RELATED LITREATURE

This chapter review the related literature under the following subheadings.

1. Current trends in waste disposal/recycling effort
2. Recycling and Environmental protection
3. Recycling Metallic Scraps
4. Technology developments in recycling solid waste in cottage and small scale industry

Current Trends in Waste Disposal/Recycling Effort

In Nigeria today, most industrial, commercial and domestic homes that generate waste/scraps do not have a well-articulated programme of waste management. As such waste products in any form and shape can be found everywhere in the street, around the home, within industrial premises and even dumped in rivers and canals. Oyinlola, (1994) Based on the available data affirm that the percentage composition of solid metal waste for very large centres range from 14.4 to 26.2% for Lagos, 12.8 to 20.8% for Ibadan, 6.4 to 8.5% for Kano and 2.8 to 6.7% for Oshogbo. He added that for large centres like Port-Harcourt, Onitsha and Aba the percentage ranges between 8.3 to 10.5%, 6.1 to 8.7% and 3.5 to 10.5% respectively. Also Jos and Warri which are considered to be medium size centres, the percentage composition of solid metal waste range from 4.2 to 7.5% and 4.2 to 22.0% respectively. Small centred like Oyo and New Bussa, the solid waste range between 14.8 to 17.4% and 5.2 to 10% respectively. For all areas surveyed, mean of 6% of solid waste by weight was recorded for Abuja and Suleja that is considered as small centres. The Bayelsa state minister of environment,(2000)reported that, Yenagoa the state capital is still a small developing city. Yet, Municipal waste management has become a surgical problem. There is need for

scientifically identify suitable disposal sites on account of the very high underground water level, ubiquity of surface water and the attendant possibility of their contamination.

Solid waste poses a lot of danger to the Environment of Borno state (Aboundu, 2000). Most of the dumping sites experiences erosion and contamination of underground water through leaching. As such diarrhoea and typhoid fever are rampant in some of these places. Aesthetic value of the town is reduced where there are such heaps of waste. Any attempt to burn the waste creates an environmental hazard.

Considering the industrial waste from machining processes Igbax and Audu,(2000) observed that lot of swarf, chips, cut off)as well as obsolete equipment and vehicle, and/or their component end up abandoned and left to deteriorate.

On the other hand, there is no serious industrial recycling activities going on in Nigeria today. Oyinlola, (1994) stated that the industrial development of the country shows that recycling activities have been given very little consideration, if not neglected. There is no independently established recycling industry in the country as yet. Owing to the prevailing conditions in the country, some state Government have embarked on what can be regarded as mini-recycling project. Few industries such as Dunlop industries Nigeria limited, Lagos and Nigeria paper Mill, Jebba engaged in mini-recycling activities within the industry. Furthermore, the economic situation of the country has forced some industries to embark on the reuse of their container items.

It is observed that virtually all the plastic from house hold items and other products are not recycle (Igbax and Audu, 2000). These together with damaged tyres are either burnt, or left to litter the environment.

Akinbode, (1996) developed a sawdust stove burning sawdust and rice residue from grinding mills. He concluded that the development of this stove would alleviate the suffering of rural and urban dwellers in the quest for energy. It will also reduce the waste found in our big cities.

Recycling and Environmental Protection

The environment and its pollution are now emerging as one of the major problems confronting the country, particularly in Minna metropolitan. Despite the rigorous campaign on radio, television and in national dailies, most of our towns and cities are heavily polluted by solid waste. Preservation of the environment will presumably dictate the utilization of all obsolete capital goods including the solid waste that constitute a reasonable percentage.

In corroboration to this, Akinbode, (2004) observed that developing a sawdust stove, burning sawdust and crop residues will reduce the solid waste found in our big cities. It will reduce deforestation.

Metallic materials are the most widely used materials in engineering for the manufacture of industrial, domestic and other articles. Old and wrecked automobile are abandoned along city streets and highways, wrecked automobile dumping is done indiscriminately wherever space is available. Adekoya, (1998) pointed out that the drinking of water with metallic pollutants can cause body disorder such as cancer, infertility, cardiovascular diseases and genetic mutation. He made suggestion that prevention of such potential dangers can be achieved through the establishment of the recycling industry, He added that the recycling of solid waste in general and metal waste in particular will play a major role in the creation of pollution free environment.

Of increasing use in recent times, are plastic materials, which in the automobile, has grown by more than 500% between 1970 and 1991 and account for about 8% of the weight of an average passenger car (Igbax and Audu, 2000).The use of plastic is expected to continue because of their many benefits; reduction in overall weight corrosion resistance, amongst other.

Recycling involves among other things the use of recovered waste materials and used resources to develop new product for the same, or a different application. This indicates that recycling activities ultimately result in minimizing the amount of waste in the environment, thus protecting it.

Recycling Metallic Scraps

Metallic scrap can be divided into three major categories: home, prompt industrial and obsolete all of which are discards, Felix, (1993) home scrap and prompt industrial scrap are involuntary by-product of manufacturing processes. Obsolete scrap arises when a product made of metal has served its useful life and is discarded. The largest single source of obsolete scrap is old automobiles. other example of obsolete scrap are items that are discarded from demolition project, manhole cover, old water pipes, kitchen sinks, etc as well as household discards such as toys, lawn mowers, lawn furniture, pots and pans, tins/cans etc.

Micheal,(1974) observed that the importance of recycling metal scrap not only is producing other useful items from scrap efficient, it obviously keeps obsolete metal items from making their ways into landfills, which alleviates an environment problem. Production steel from scrap is also desirable in term of energy conservation Felix, (1993),relates that it takes much less energy to make steel from scrap than iron ore. Estimates are that it takes four

times more energy to produce steel from ore than from scrap. The activities involved in the recycling process are:-

Discard, collection, processing, melting, fabrication, and return to customer use; and eventual discard once again. If one of these key elements is missing then recycling has not occurred.

All recycling effort has been directed into two areas (Igbax and Audu, 2000), in plant and at specialized plants. For in closed-loop recycling, scrap material from the industrial process and in-plant waste are utilized for the production of parts or for energy. This includes on one hand, feeding back the scrap in the appropriate form into the appropriate stage of the production process. For example, moulded plastic spruce can be grounded into granules, cast metal spruces and runners are broken up into pieces.

On the other hand, oil can be recycle into machining or lubricating oil, casting sand to reclaimed sand, furnace ash to asphalt sheet, and so on.

However, most of the post-use product (junk) constituting the majority of material scraps are initially recycled at specialized plants where they are shredded into first-sized chunks and passed through magnetic separator and air classifiers. Here, ferrous scraps are separated from non-ferrous scrap. On-ferrous metals are recovered by heavy media separation, allowing aluminium and magnesium to float while zinc, copper and other heavier metals sink.

Oyinlola, (1994) pointed out some of the problems in metal recycling. He observed that car hulks and domestic appliance are categorized as fragmental scraps. It is difficult and costly form of scrap to recycle because of its awkward physical shape and contamination by

non-ferrous metals. This may hinder the process of the successful recovery of steel from the scrap.

Technological Development in Recycling Solid Waste in Cottage and Small Scale Industries

It is pertinent to observe, however, that in the past few years, attention of research on SWM in Nigeria Has focused essentially on contextualizing waste recycling as an approach to urban environmental Management and livelihoods (Adeyemi et al., 2001; Agunwamba, 2003; Nzeadibe and Eziuzor, 2006;Nzeadibe and Iwuoha, 2008). Unfortunately, SWM and recycling appear to have received little attention from Nigerian social scientists especially from the viewpoint of the socially-related Millennium Development Goals (MDGs) (Nzeadibe, 2009).

In particular, research on the solid waste sector in Niger state urban area of southeastern Nigeria, has so Far focused attention on waste characterization and composition (Ogwueleka, 2003), and on the capacity needs of the sector for improved solid waste and resource management (Nzeadibe & Ajaero, 2008). However, the socio-economic and demographic circumstances, which appear to motivate peoples' decisions to recycle waste, and contributions of the informal waste sector towards achieving some of the MDGs, have not elicited serious investigation.

Summary of Reviewed Literature

From the related literature many people have discover the following:-

- Most of industrial, commercial and domestic homes that generate waste/scraps do not have a well-articulated programme of waste management.
- solid waste poses a lot of danger to our environment.

-The industrial development of the country says that recycling activities have been given very little consideration if not neglected.

-Recycling metal scraps not only is producing other useful items from scraps, it obviously keeps our environmental clean and healthy.

-Provision of the National policy on Education that a vocational centre will be established in each Local Government Area of the Federation to cater for the practical skill training all need of all shade of persons.

Having knowing all the above problems and benefits caused by solid waste materials, up till now there is no serious industrial recycling activities going on in Nigeria today, which is the answer to environmental pollution problems.

CHAPTER III

METHODOLOGY

This chapter deal with the method used in carrying out the study, It focus on the design and procedure used ,area of study ,population, sample, instrument for data collection, validation of the instrument, administration of instrument and method of data analysis.

Research Design

The design adopted in this research work is a descriptive survey type of research. The research design is considered appropriate since information will be collected on existing and opinion of respondent will be analysed to reach decisions. Nworgu, (2001) stated that “a survey research is the one in which a group of people or items considered to be representatives of the entire group”. In the same angle, this study seeks the opinion of the cottage and small scale industries in the recycling of solid waste material in Niger state, Minna metropolis.

Area of the study

The area of study of this research was conducted by different part of companies and streets where solid waste materials are recycle in Minna metropolis. The area include

1. Usman Kontagora Pipes and Plastics (Kontagora Plaza),
2. Imurate (maikunkele),
3. Gwari Market (Yangongoni) and
4. Golden age (shango)

Population of the study

The population of the study consist of 39 people, total of six (6) manager and thirty five (35) workers in the selected recycling company in Minna environs in Niger state, one small scale industry from Golden age and two cottage industries from Imurate and Usman Kontagora pipe and plastic. The method was used so as to cover the dominant players in the recycling industries of Minna, Niger State

Instrument for data collection

The data used for this study were analyse using statistical means score method and standard deviation and t-test of independent sample will be used for analysis. All items were responded by indicating the response best perceive using a 4-point scale

Strongly Agreed (SA) = 4point

Agreed (A) = 3point

Disagreed (D) = 2point

Strongly Agreed (SD) = 1point

Validation of the instrument

The questionnaire constructed by the researcher was validated by two lectures in the department of Industrial and Technology Education, Federal University of Technology, Minna for appropriate correction before producing the final copy needed for answering the research question. The validated questionnaire was used to collect data for this study.

Administration of the instrument

The questionnaire for the study was administered to the workers in the industries by the researcher. For those who cannot read and write, the researcher and the research assistants interpreted the questionnaire to the respondent and tick the column of the option.

Each questionnaire was accompanied by a letter introducing the researcher and the purpose of the study to the respondents. Sufficient guides were also provided. A total of 39 questionnaires were distributed to the respondents and all the questionnaire were returned.

Method of data analysis

The data were analysed using mean and hypotheses were tested using t- test statistics. The mean was used to determine the degree of acceptance or rejection of questionnaire items, while t- test was used to test the hypotheses at 0.05 level of significance.

Decision Rule

The mean of 2.50 was used as decision point for every questionnaire item. Consequently, any item with a mean response of 2.50 and above was considered agreed and any item with a mean response of 2.49 and below was equally considered as disagreed in Section A, B, C and D respectively. Also the t- test was used to test the hypothesis at 0.05 level of significant to compare the mean response of the groups. A critical value of ± 1.96 was used based on the degree of freedom at 0.05 level of significant. Therefore, any item with t-calculated value less than the critical value was regarded as not significant. While any item with calculated value equal or greater than the critical value was regarded as significant.

CHAPTER IV

Presentation and analysis of data

The data collected for the purpose of answering this research question of the study were presented and analysed.

RESEARCH QUESTION 1

What are the available metallic and non-metallic waste materials?

TABLE 1-Mean response of the available metallic and non- metallic waste materials.

(N₁=6, N₂ =33)

S/N	ITEM	X ₁	X ₂	X _t	REMARKS
1.	Steel scrap	2.50	2.67	2.59	AGREE
2.	Vehicle body scrap	3.17	2.76	2.97	AGREE
3.	Beverage tin/cans scrap	3.50	3.30	3.40	AGREE
4.	Cast iron scrap	2.50	3.15	2.83	AGREE
5.	Non-ferrous scrap	3.33	2.88	3.11	AGREE
6.	Aluminium scrap	3.83	3.45	3.64	AGREE
7.	Worn out motor and motorcycle tyres	2.33	2.33	2.33	DISAGREE
8.	Motor vehicles tubes	2.00	2.61	2.31	DISAGREE
9.	Various forms of foam	2.17	2.36	2.27	DISAGREE
10.	Use of polythene bags	3.83	3.52	3.68	AGREE
11.	Abandoned plastic	3.33	2.73	3.03	AGREE

Key:

X_1 = Mean of Managers

X_2 = Mean of Workers

X_t = Mean Total

N_1 = Number of Managers

N_2 = Number of Workers

Analysis on the table shows that majority of the respondents agree with the mean ranging from 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11 with mean of 2.59 to 3.68 and disagree with the mean ranging for 7, 8, 9 with mean of 2.27 to 2.33.

RESEARCH QUESTION 2

What are the possible items that can be provided from these waste materials?

TABLE 2- mean responses of the possible items that can be provided from these waste materials.

($N_1=6, N_2 =33$)

S/N	ITEM	X_1	X_2	X_t	REMARK
12.	Plastic	3.33	3.06	3.20	AGREE
13.	cooking pot and pans	2.50	2.70	2.60	AGREE
14.	Local farm tools (hoe and cutlasses)	2.50	2.45	2.48	DISAGREE
15.	Local lamp	2.50	2.70	2.60	AGREE
16.	Metallic boxes	2.83	2.70	2.77	AGREE
17.	Local stove (tripod)	2.50	3.06	2.78	AGREE

18. Watering can	3.17	2.45	2.81	AGREE
19. Animal Feed container	3.33	2.15	2.74	AGREE
20. Polyethylene Bag	3.50	2.94	3.22	AGREE
21. Pipe	3.00	2.81	2.91	AGREE
22. PVC	2.83	2.67	2.75	AGREE
23. Rubber sandals	3.00	2.45	2.73	AGREE
24. Spoons	3.33	2.70	3.02	AGREE

Key:

X_1 = Mean of Managers

X_2 = Mean of Workers

X_t = Mean Total

N_1 = Number of Managers

N_2 = Number of Workers

Analysis on the table shows that majority of the respondents agree with the mean ranging from 2.60 to 3.22 and only one disagrees with a mean of 2.48.

RESEARCH QUESTION 3

What are the problems being encountered by the cottage and small scale industries in the process of recycling?

Table 3- mean responses of the problems being encountered by the cottage and small scale industries in the process of recycling.

(N₁=6, N₂ =33)

S/N	ITEM	X ₁	X ₂	X _t	REMARK
25.	Lack of basic education affect their activities	3.50	3.00	3.25	AGREE
26.	No enough fund to purchase raw materials	3.00	2.79	2.90	AGREE
27.	Lack of adequate tools in the workshop	3.00	2.21	2.61	AGREE
28.	The tools used are not standard	3.00	2.51	2.76	AGREE
29.	There is no machine tool for the production Of product	2.50	1.94	2.22	DISAGREE
30.	The material are easily obtained	2.67	2.21	2.44	DISAGREE
31.	There is no enough training for the Craftsmanship	3.50	2.48	2.99	AGREE
32.	Lack of sufficient space in the workshop	2.83	2.21	2.52	AGREE
33.	Lack of encouragement from the government	3.00	2.33	2.67	AGREE
34.	Lack of sharing ideas amongst recycler in their Related areas	3.33	2.79	3.06	AGREE

KEYS

X_1 = Mean of Managers

X_2 = Mean of Workers

X_t = Mean Total

N_1 = Number of Managers

N_2 = Number of Workers

Analysis on the table shows that majority of the respondents agree with the mean ranging from 2.52 to 3.25 and only two disagrees with means of 2.22 and 2.44.

RESEARCH QUESTION 4

What are the strategies that can enhance effective recycling of these waste materials?

Table 4- mean responses of the strategies that can enhance effective recycling of these waste material.

($N_1=6$, $N_2 =33$)

S/N	ITEM	X_1	X_2	X_t	REMARK
35.	Receiving further training from other related Workshop	3.67	2.00	2.84	AGREE
36.	Short term course conducted in the local Language can be used to up-date the master Recyclist knowledge	3.83	2.70	2.27	DISAGREE
37.	There should be induction programme for Local Recyclist	3.33	2.48	2.91	AGREE

38. Accessible to loan from government or Voluntary organization	3.16	2.12	2.64	AGREE
39. The local cyclist should be taught basic Technical theories once in a month	2.50	2.39	2.45	DISAGREE
40. Each local should have a minimum of Federal labour trade test being allow to Practice	2.33	2.61	2.47	DISAGREE
41. Inviting resource persons from polytechnics And universities for part time training	3.33	2.64	2.99	AGREE

Key:

X_1 = Mean of Managers

X_2 = Mean of Workers

X_t = Mean Total

N_1 = Number of Managers

N_2 = Number of Workers

Analysis on the table shows that the respondents that agree have the mean ranging from 2.64 to 2.99 and those that disagree have means ranging from 2.27 and 2.47.

HYPOTHESIS 1: there is no significance difference between the mean responses of manager and workers on the available metallic and non-metallic waste materials used in the industries.

Table 5: t-test statistical Analysis of the Managers and Workers on the available metallic and non-metallic waste materials used in the industries

(N₁ = 6, N₂ = 33)

S/NO	ITEMS	SD ₁	SD ₂	t-cal	REMARK
1.	Steel scrap	0.76	1.05	-0.47	NS
2.	Vehicle body scrap	0.37	1.17	1.62	NS
3.	Beverage tin/cans scrap	0.76	1.07	0.55	NS
4.	Cast iron scrap	1.00	0.97	-1.47	NS
5.	Non-ferrous scrap	0.75	1.17	1.22	NS
6.	Aluminium scrap	0.37	0.90	1.75	NS
7.	Worn out motor and motorcycle tyres	0.94	0.96	0.00	NS
8.	Motor vehicles tubes	0.58	0.93	-2.13	S
9.	Various forms of foam	0.37	0.82	-0.91	NS
10.	Use of polythene bags	0.75	0.76	0.93	NS
11.	Abandoned plastic	0.75	1.01	1.70	NS

Key:

N₁ = Number Managers, N₂ = Number of Workers, SD₁ = Standard Deviation Mean of response of Managers, SD₂ = Standard Deviation Mean of response of Workers, S = Significant, NS = Not Significant, t - Cal= t calculated

Table 4.5 revealed that the t - test accept the *null hypothesis* only at items 8 at *0.05 level of significance*. Meaning that there is no statistical significance difference between the mean responses of respondents on the mean responses of the Technicians and Managers on the available metallic and non-metallic waste materials used in the industries.

Hypothesis II

HO₂: There is no significant difference between the mean responses of the level of skilfulness of the mean responses of the Managers and workers on problems encountered during the process of recycling solid waste material.

Table 6: t-test statistical Analysis of the managers and workers on the problem encountered during the process of recycling solid waste materials.

(N₁ = 6, N₂ = 33)

S/NO	ITEMS	SD ₁	SD ₂	t-cal	REMARK
1.	Lack of basic education affect their activities	0.76	1.17	1.35	NS
2.	No enough fund to purchase raw materials	1.15	0.93	0.42	NS
3.	Lack of adequate tools in the workshop	1.15	1.27	1.52	NS
4.	The tools used are not standard	1.15	1.03	0.98	NS
5.	There is no machine tool for the production Of product	1.26	0.92	1.04	NS
6.	The material are easily obtained	1.11	0.93	0.96	NS
7.	There is no enough training for the craftsmanship	0.76	1.03	2.85	S
8.	Lack of sufficient space in the workshop	0.90	0.93	1.54	NS
9.	Lack of encouragement from the government	1.34	1.22	1.14	NS
10.	Lack of sharing ideas amongst recycler in their Related areas	0.50	1.14	1.90	NS

Key:

N_1 = Number Managers, N_2 = Number of Workers, SD_1 = Standard Deviation Mean of response of Managers, SD_2 = Standard Deviation Mean of response of Workers, S = Significant, NS = Not Significant, $t\text{-cal}$ = t calculated.

Table 6 revealed that the **t - test** accept the *null hypothesis* only at items 7 at *0.05level of significance*.

Meaning that there is no statistical significance difference between the mean responses of respondents on the mean responses of the Technicians and Managers on problems encountered during the process of recycling solid waste material.

Findings:

Below are summary of findings from this study:

1. Aluminium scraps and polyethylene bags are the major metallic scraps and non-metallic materials available to be recycled
2. Many useful items can be reproduced from the waste materials, Examples are PVC, polyethylene bag, pipe, plastic, etc.
3. Many people engage in making polyethylene bag, plastic, spoons using waste polyethylene and abandoned plastic.
4. No standard machine tools for recycling of waste materials.
5. The workers lack basic education needed to function effectively.
6. Provision of regular practical workshop training should be organized for workers.
7. Regular practical skill training should be organized for the worker at certain interval.
8. A body should be established to certify the workers before they are allowed to practice.

9. National Directorate of Employment should organized a practical qualifying examination for workers.

Discussion of Findings

The findings under table 1 clearly reveal that Aluminium scrap and polyethylene bags form the largest proportion of metallic material in recycling industry, which shows that these are the highest and most available scrap material that can be found for recycling processes of solid waste material in Niger state.

From table II, item 20 attracted a very high mean of 3.22 that is probably items that can be reproduce from this solid waste, Respondents accorded production of polyethylene bag a very high mean. This finding is not coming as a surprise; this is because National Directorate of Employment (NDE) have conducted several training programmes in polyethylene bag making, Beside the Niger state youth Employment Scheme (YES) have for some years now being training youth in the basic rudiment of foundry technology.

It is also revealed from the table that beside the useful items that can be reproduce from these waste materials, the problem of unemployment for the citizen will be minimized. It is an additional avenue available to the authority to fight the social evils created by unemployment. Table II also indicate that most of the waste materials being recycled by industries Igbax and Abdul, (2000) observed that virtually all the plastics from house hold items and other product are not recycled. He added that these together with damaged tyres are either burnt, or left to litter the environment. This indiscriminate incineration, resulting in fumes is still a common sight in Nigeria today.

Further analysis shown in table III revealed that respondents agreed that there are no adequate tools in the workshop and hence the provision of machine tools and

enough fund to purchase raw materials for the workshop. This is telling us that funds and tools are the back bone of any investment. If the workers will be provided with funds and tools they will be encourage and effectively utilized the waste materials available.

Education is the foundation of any development; the result shows that lack of basic education seriously effects output of these workers. In support to this Salami, K.A., (2004) observed that without education no meaningful development can take place; only educated people can understand the skills necessary for sustainable economic growth and for a better quality of life. This is really true because, from the response of the respondents, the recyclers assumed their tools to be standard because they can serve the purpose in which they are expected to perform. An educated person has a positive self-image, and takes an active part in decision making relating to himself, his family and the community at large.

A waste recycling industry is a viable venture that needs the cooperation of the three arm of our Government in providing a new social and economic order, which can managed our natural resources fairly an logically while at the same time aiming for high and equitable quality of life

The study further showed on table IV that the respondents attached great importance to the receiving further training from other related workshops as on the strategies that can enhance effective recycling of waste materials. The technological institutions and technical training agencies such as National Directorate of Employment (NDE) should organise training programme workers both in theory and practical skills, since these people are not in any way trained (Atsumbe, 2004).

Because of the level of their understanding there is need for enlighten campaign through radio, television and other media in other to make them aware of

the importance of training in the use of waste materials. The three tiers of Government and voluntary organizations should make loans available for the industry.

Planning and organization, location of industry, collection and transportation of raw and finished materials and technological know-how are major contributing factors to a successful launching into full operation of any recycling industry. Accordingly, the setting up of metallic and non-metallic recycling industries in Nigeria is therefore conclusively based on the aforementioned contributing factors (Oyinlola, 1994).

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary of the Study

The main focus of this research study was to find out mechanism for improving cottage and small scale industry in the recycling of solid waste material, determine the possible items that could be reproduced from these waste and the strategies for retaining the present local worker involved in use of recycled material in Minna metropolis.

Chapter 1 of the study discussed the background of the study, which examines the danger, the classifications and the benefits that can be derived from these solid wastes. The statement of problem, purpose, significance, scope, assumption of the study and the research questions were all stated and discussed for the conduct of this research.

The review of related literature looked into the current trends in waste disposal/recycling effort, recycling and environmental protection, recycling metallic scrap and practical skills development for industry. Various views of different authors concerning the topic were harmonized in a comprehensive literature review.

A survey approach was used to develop instrument for the study; the persons identified as the population of the study were the worker in the cottage and small scale industries of Minna metropolis. The entire members of workers were used. A number of 39 questionnaires were administered. The instrument used was analysed using frequency count, and mean scores. The research questions were discussed based on the findings from the responses and results of the instrument used. Some of the major findings includes, serious attention is needed for retraining the local workers, provision of soft loans and machine tools for effective recycling of the waste

materials, regular practical training should be organized for the industry at certain intervals etc.

Implication of the study and conclusions were also drawn from the findings discussed. Recommendations and suggestions for further study were formulated and stated according to the findings of the study.

Implication of study

The findings of this study have far reaching implications on the Government, the industries and the public at large.

The findings of the study regarding the utilization of solid waste materials show that a sound practical skills and theory that can enhance effective recycling must be possessed by the industry. Therefore Government should provide means of retaining workers for effective use and management of solid waste materials.

The findings also confirmed that the effort of industries in reshaping these waste materials has to be encouraged and motivated. Therefore National Directorate for Employment (NDE), youth Empowerment Scheme and other voluntary organizations should provide mean of encouraging the industries by the training, certification and provision of soft loans.

The implication of findings is also to the society that heaped up solid waste seriously affected our environment and public health. If waste materials are effectively utilized the nation economic is build up, social misconduct among the youth is reduced and the problems of unemployment is reduced.

The implication of finding is also to the workers to engage themselves in the enquiry of further training through related workshops and other source alike.

Conclusion

Based on the analysis of the findings and considering the number of solid waste that have been abandoned inside vacant building and along road side throughout major street in town, it is expected that more will be abandoned based on the prevailing economic conditions of the nation.

The recycling of solid waste through planning, organization and legal action in order to achieve a reasonable success must be obtained to pick the abandoned solid waste materials for recycling into scrap that can be processed or reused by industries. If properly applied recycling will minimize both energy consumption and environmental impact. It is therefore the duty for the government to provide technical assistance through her agencies to enhance effective utilization of the solid waste. The finding of this study draws our attention that recycling of various type of waste can be a lasting solution for solid waste pollution problems and meaning of conserving our natural resources.

Recommendations

Base on the findings of the study the following recommendation were made.

1. The state Environment protection Agency must urgently review and formulate new waste dumping and recycling regulations and ensure strict enforcement
2. Government should set up a centre where all recovered waste are kept (scrap metallic and non-metallic).
3. Government should encourage the setting up of recycling plant
4. Manufacturing industries should provide a system of getting their scrap/equipment delivered back to them for recycling into identical or similar product
5. Regular practical workshop should be organized for workers

6. Short term courses in the local language should be used to up-date the master workers knowledge
7. National Directory for employment (NDE) and youth Empowerment Scheme (YES) should provide more training, certification and soft loans for industries.

Suggestions for Further Research

The following suggestions were made for further study:-

1. Problem and means of considering our natural resources.
2. Lasting solution for solid waste materials

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APPENDIX II

QUESTIONNAIRE

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

SCHOOL OF SCIENCE AND SCIENCE EDUCATION

DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION

THIS QUESTIONNAIRE IS ON THE STUDY OF MECHANISM FOR IMPROVING COTTAGE AND SMALL SCALE INDUSTRY IN THE RECYCLING OF SOLID WASTE MATERIAL IN MINNA, NIGER STATE.

PART ONE

Introduction: This research work is on the study of mechanism for improving cottage and small scale industry in the recycling of solid waste material in Minna, Niger state.

Please kindly complete this questionnaire by ticking (√) the column that represents your perception about the above topic, marking the options that are closest to your experience. Be as honest as you can. All information provided will be highly confidential and strictly used for the purpose of this research work.

Production Manager

Workers

Gender: Male Female

Working Experience: **1-5**years **6-10**years **11-15**years **20**years and above

Place of work:

A Four (4) Points Rating Scale is used to indicate your opinion as stated below:-

Strongly Agreed (**SA**)

Agreed (**A**)

Disagreed (**D**)

Strongly Disagreed (**SD**)

SECTION A:

What are the available metallic and non-metallic materials to be recycled?

S/NO	Metallic waste Material	SA	A	D	SD
1.	Steel scrap				
2.	Vehicle bodies scrap				
3.	Beverage tin/cans scrap				
4.	Cast iron scrap				
5.	Non-ferrous scrap				
6.	Aluminium scrap				

NON Metallic Waste (Rubber and Plastic)					
7.	Worn out motor and motorcycle tyres				
8.	Motor vehicles tubes				
9.	Various forms of foam				
10.	Use of polythene bags				
11.	Abandoned plastic				

SECTION B:

What are the possible items that can be reproduced from the waste materials?

S/NO	ITEMS	SA	A	D	SD

12.	Plastic				
13.	Cooking pot and pans				
14.	Local farm tools (hoes and cutlasses)				
15.	Local lamp				
16.	Metallic boxes				
17.	Local stove (tripod)				
18.	Watering can				
19.	Animal feed container				
20.	Polyethylene bag				
21.	Pipe				
22.	P V C				
23.	Rubber sandals				
24.	Spoons				

SECTION C:

What are the problems being encountered by the worker in the of recycling company in the process of recycling?

S/NO	ITEM	SA	A	D	SD
25.	Lack of basic education affect their activities				
26.	No enough fund to purchase raw materials				
27.	Lack of adequate tools in the workshop				
28.	The tools being use are not standard				
29.	There is no machine tool for the production of the product				

30.	The material are not easily obtained				
31.	There is no enough training for the craftsmanship				
32.	Lack of sufficient space in the workshop				
33.	Lack of encouragement from the Government				
34.	Lack of sharing ideas amongst craftsmen in their related areas				

SECTION D:

What are the strategies that can enhance effective recycling of solid waste materials?

S/NO	ITEM	SA	A	D	SD
35.	Receiving further training from other related workshop				
36.	Short term course conducted in the local language can be used to up-date the master recyclist knowledge				
37.	There should be induction programme for local Recyclist				
38.	Accessible to loan from Government or voluntary organization				
39.	The local recyclist should be taught basic technical theories once in a month				

40.	Each local recycler should have a minimum of Federal labour trade test before being allow to practice				
41.	Inviting resource persons from polytechnics and universities for part time training.				

APPENDIX II

Mechanism for improving cottage and small scale industry in the recycling of solid waste material in Minna, Niger state

Table 1: the mean response of manager

Responses	X	F	fX
Strongly Agree	4	0	0
Agree	3	4	12
Strongly Disagree	2	1	2
Disagree	1	1	1
		∑f = 6	∑fX = 15

$$\text{MEAN } (\bar{X}) = \frac{\sum fX}{\sum f} = \frac{15}{6} = 2.50$$

Table 2: The mean of worker

Responses	X	F	fX
Strongly Agree	4	1	4
Agree	3	10	30
Strongly Disagree	2	0	0
Disagree	1	0	0
		∑f = 33	∑fX = 34

$$\text{MEAN } (\bar{X}) = \frac{\sum fX}{\sum f} = \frac{34}{33} = 1.03$$

Appendix III

Table 3: Standard Deviation of worker

Responses	X	F	FX	$(X - \bar{X})^2$	$f(X - \bar{X})^2$
Strongly Agree	4	19	76	$(4 - 2.23) = 3.133$	12.53
Agree	3	16	48	$(3 - 2.23) = 0.593$	1.78
Strongly Disagree	2	40	80	$(2 - 2.23) = 0.053$	0.11
Disagree	1	30	30	$(1 - 2.23) = 1.512$	1.51
		$\Sigma f = 33$	$\Sigma fX = 234$		$\Sigma f(X - \bar{X})^2 = 15.93$

Variance (S^2) given as $\frac{\Sigma f(X - \bar{X})^2}{N - 1}$

$$(S^2) = \frac{15.93}{33 - 1}$$

$$(S^2) = \frac{15.93}{32}$$

$$(S^2) = 0.50$$

Standard deviation = (S.D₁) = $\sqrt{s_1}$

$$(S.D_1) = \sqrt{0.50_1}$$

$$= 0.71$$

Table 4: Standard Deviation of W

Responses	X	F	fX	$(X - \bar{X})^2$	$f(X - \bar{X})^2$
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Strongly Agree	4	2	8	$(4 - 3.00) = 1.000$	2.00
Agree	3	4	12	$(3 - 3.00) = 0.000$	0.00
Strongly Disagree	2	0	0	$(2 - 3.00) = 1.000$	2.00
Disagree	1	1	1	$(1 - 3.00) = 4.000$	4.00
		$\Sigma f = 7$	$\Sigma fX = 21$		$\Sigma f(X - \bar{X})^2 = 8.00$

Variance (S^2) given as $\frac{\Sigma f(x-\bar{x})^2}{N}$

$$(S^2) = \frac{8.00}{7}$$

$$(S^2) = \frac{8.00}{7}$$

$$(S^2) = 1.142$$

Standard deviation = (S.D₁) = $\sqrt{s_1}$

$$(S.D_1) = \sqrt{1.142}$$

$$= 1.07$$

T – test

$$t - test = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S.D_1^2}{N_1} + \frac{S.D_2^2}{N_2}}}$$

$$t - test = \frac{3.00 - 2.23}{\sqrt{\frac{(1.07)^2}{7} + \frac{(0.39)^2}{105}}}$$

$$t - test = \frac{3.00 - 2.23}{\sqrt{0.164 + 0.001}}$$

$$t - test = \frac{0.77}{\sqrt{0.165}}$$

$$t - test = \frac{0.77}{0.406}$$

T-test = 1.90