

ENTREPRENEURIAL GAINS OF WASTE TO WEALTH (WTW) IN AGRICULTURAL PRACTICES AND MANAGEMENT IN NIGERIA

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Abstract

Entrepreneurial gains are the wealth obtained through waste recycling of agricultural wastes in Nigeria especially in wealth creation. Unemployment problems, consequences, indiscriminate dumping of refuse/waste materials and their collective harmful, environmental negative and hazardous impacts and effects will definitely reduce to unacceptable levels, in waste recycling thereby fostering Waste to Wealth (WTW) in agricultural practices cum management and leading to high Gross Domestic Product (GDP). This paper examines the waste to wealth or the recycling in agricultural wastes. It discusses the relevance of entrepreneurial gains of Waste to Wealth in agricultural activities. Data of the study were mainly secondary data and the researchers' knowledge of agriculture, ecology, biology, health, chemistry, physics, geography, environmental sciences and economics duly assisted to put the study work in proper direction. The study rounded off that entrepreneurial gains are wealth creation and recommends that Waste to Wealth creation be used to boost Waste to Wealth, increased recycled products, organic manures, fertilisers, agricultural productivity and employment endangered in the non-existence of waste recycling and management technology in Nigeria and elsewhere.

Keywords: *Entrepreneurial Gains, Waste to Wealth, Waste Recycling, Agricultural Wastes, Management, Wealth Creation*

Introduction

The over profits, gains or wealth derived from waste and waste recycling and management are referred to as "Entrepreneurial gains" of waste to wealth. The generation of wastes is usually associated with human activities and indeed socio-economic processes in families, villages, communities, regions, states, federals, nations and world over (Ume, 004). Waste is defined by Advanced Learner's Dictionary as useless and

thrown away things normally that are not wanted. Examples are waste papers, metals, plastics, rubbers, agricultural waste products, unwanted materials after a manufacturing process in small medium and large scale enterprises (Ume, 2004). Waste can be something not needed. However, the level of technology and culture of the people predicate what is termed waste. Wealth is referred to as the amount of quantity of resources or resource materials and their related quantifiable financial or monetary values, uses and renderable services to an individual(s), groups, communities, states, federal governments, firms and industries.

Waste to Wealth is the act of turning or putting waste to wealth. This implies that the process by which waste products or materials are being put into use or recycled into further useful purposes and usage by consumers or end users. The act of Waste to Wealth is not only for the production of resources/resource materials and profit maximisation and economic growth known as "Wealth Creation"; but also for the creation of employment, establishment of small, medium and large scale enterprises, firms, markets, agencies, medium men, research and development centres, organisations, associations, forums and sustainable development. It also calls for clean environment, hygienic and sanitation of individuals, houses, homes, buildings, streets, rural and urban cities in a given area in Nigeria. This supports the adage or saying that "cleanliness is next to godliness". It is also said that "a clean and wealthy nation is a healthy nation".

Agricultural practices includes activities common in the cultivation of crops, rearing of animals for food, fibres, shelters, income, meat, hides and skins by man to end-users or consumers. Agriculture was the main stay of the nation's economy before the discovery of mineral oil (petroleum) in the early 1956 in Nigeria. Today agriculture is no longer what it used to be and lacked

diversification and investment and reinvestment approach of the nation's economy as to meet the youth employment challenges and other related and associated crimes and societal ills (corruption, kidnapping, terrorism, mineral oil theft and robbery) emanating from such menace. The clarion call is that agriculture should be revisited, funded, refunded with regard to its position, role and importance to the nation's primary sector, economic growth and sustainable development in Nigeria, respectively. By so doing, the other two sectors of the economy (secondary and tertiary sectors) will be involved simultaneously and parallelly to usher in higher productivity and benefits, when no stone is left unturned in terms of tapping the available resources and the diversification of the economy.

According to Stewart (2000) the potentials of agriculture as an industrial and economic springboard of development cannot be underrated. However, agriculture remains the single livelihood for most rural communities and transported to urban areas in most low income and less industrialised countries. Kandlinkar and Risbey (2000) maintained that the agricultural sector provides employment for more than 60% of the population and contributes about 30% of GDP in Africa.

Ayinde, et al. (2011) and Magong, et al. (2005) stated that agriculture is the main source of food in Nigeria and about 60 – 70% of the population is engaged in agricultural systems practices. These agricultural practices are embedded in agricultural systems including the followings: bio-practices, natural practices, organic practices, mechanical practices, physical practices, chemical practices, automation practices. Agricultural systems include: ecological agriculture/ecosystem agriculture, biological agriculture, organic agriculture or organic farming, mixed farming, mixed cropping, pastoral farming, agroforestry, alley cropping, intercropping, inter planting, shifting cultivation as the case may be.

Manage means control. Therefore, waste management may be said to be controlling of waste as a way to reduce hazards which result from waste materials (Ume, 2004).

Wealth creation is the act of creating resources or resource materials and the enabling environment to process or harness such resources/or resource materials into useful utilizations with the inclusion of their various benefits and importance.

Concept of Waste

Waste as was defined in the introduction, is anything not required again in the activity such as manufacturing, cooking, residues, eating, particularly effluents and many others (Ume, 2004). However, things which are thrown away are either rubbishes or wastes. There are three categories of wastes namely: solid, liquid and gas. Solid wastes are divided into three major categories as industrial solid wastes, commercial and domestic wastes (Ume, 2004; Nze,

2011). Both Ume (2004) and Nze (2011) maintained that industrial solid wastes are waste materials generated in the course of manufacturing processes. They include metal scrapes, chips, grits from machine workshops, sawdust, waste paper, pieces of glasses, pieces of plastics (from polymerisation), rocks, stones and concretes, pieces of wood and clothing materials and many others.

Other industrial wastes include leaks of gases, organic matter, grease, oil, radioactive materials, water used in washing or cooling industrial plants and machines and others. Commercial solid waste include packing and wrapping materials, spent grains, damaged goods and spoilt materials and decomposing agricultural products. Domestic solid wastes include by-products of house-keeping activities and consumption. They include fuel residues, wrapping leaves and papers, polythenes, empty cans or containers, spoilt food stuffs and left-overs, crop and animal food materials, peels and others (Ume, 2004; Nze, 2011). Wastes according to Ume (2004) and Nze (2011) can be toxic radioactive, flammable (combustible), degradable and non degradable. The two authors added that some wastes are more of nuisance than danger to man. This is because these wastes present ugly sights of mountainous urban garbage. Some solid wastes are degradable and are taken care of by nature. Manures or organic fertilizers are produced during and after the process of degradation or decomposition. Nevertheless, the process of degradation of some solid waste produce and give off methane, nitrogen, carbon monoxide and others that are offensive and sometimes very dangerous to human health, animals, plants and environment (Ume, 2004; Nze, 2011). This calls for waste to wealth (WTW) in Agricultural practices and management and its related entrepreneurial gains in Nigeria.

Generation of Waste in Rural and Urban Areas

Wastes generated in rural and urban areas vary from one rural and urban area to the other. Ume (2004) and Nze (2011) stated that food is one of the body requirements which is needed every day to enhance health, and in the process of food preparation wastes are produced. There exist lots of markets and food preparation, processing and consumption units in rural and urban areas in Nigeria. Waste from food preparation items or materials include tins, cans, plastic wrappers, leftover food, peels, vegetable and waste from washing. Others include oils and caustic soda used in washing.

Resident Waste

Ume (2004) and Nze (2011) maintained that some rural and urban areas in Nigeria are highly populated and as a result, generate huge lots of waste materials and pollution. The rural and urban areas' gaseous matter emission is such that are emitted

during the course of normal body metabolism and respiration.

However, other visible waste materials generated in the rural and urban areas include the following:

- ❖ Packets of food items, papers, cartons, tins, cans, polythenes (water proof), packets of fruit drinks and other waste materials.
- ❖ Sanitary papers, such as toilet papers, sanitary pads, hair shavings
- ❖ Hair – dressing materials including wigs, haircuts and attachments
- ❖ Excreta which are improperly disposed. In some rural and urban areas including some institutions of learning and higher learning dispose this dangerous waste recklessly. Feaces/Excreta or shit are scattered in public places in the rural and urban areas and around hostels, thereby constituting hazards and danger for public health.

Other Waste Materials

These include wastes resulting from cleaning of offices, pathways, grass cuttings, fallen leaves and fruits from trees, waste, water, sewage from broken network of soak-away, broken bricks, blocks and sandcrete (Ume, 2004; Nze, 2011). These various generation of wastes in the rural and the urban areas calls for waste recycling which promotes entrepreneurial gains of waste to wealth in agricultural practices and management in Nigeria.

Insight into Quantity of Waste Generated in Rural and Urban Areas

In waste generation, Ume (2004) citing NEST (1991) ascertained that the average per person per annum in Nigeria is 20kg person per annum. With an estimated of 120 million people in Nigeria claimed by some population analysts, the annual waste generation will be over 2.4 million tons a year. It implies that an average Nigerian produces 20kg of waste per year. The huge amount of waste generated in the rural and urban areas constitute nuisance, environmental degradation, pollution, unhealthy conditions of human beings, animals, plants and the atmosphere. To this end, if adequate removal measures are not quickly put in place, for proper disposal of waste, waste recycling and management of waste, such environment will be uninhabitable. All these wastes and their related impacts and effects, therefore constitute one of the problems of environmental sanitation environmental hazard in Nigeria.

These problems of environmental sanitation and environmental hazards in the rural and urban areas through waste recycling which will further usher in Entrepreneurial Gains of Waste to Wealth (WTW) in Agricultural Practices and Management in Nigeria.

Waste Disposal in Rural and Urban Areas

Rural and urban areas in Nigeria are now being over populated with consequent collapse of infrastructure and rapid increase in waste accumulation. Ume (2004) and Nze (2011) noted that the population of rural and urban areas is dynamic, changing with periods of festivities, days and great influx and movement of people or rural-urban migration on course call for increase in waste generation disposal and dumping.

According to (Ume, 2004; Nze, 2011) the arrangements for the waste disposal have been ineffective or insufficient in rural, urban areas, institutions of higher learning, hospitals and other private and public places. The scholars, Ume (2004) and Nze (2011) maintained that in many rural and urban areas including institutions of learning in Nigeria, waste disposal arrangements have been ineffective or insufficient. Waste are indiscriminately dumped or dropped on open plots of land, fields, streets, roads, paths, burrow pits, classrooms, hostels, hospitals, private and public premises and surroundings. The unsanitary conditions in which solid wastes are collected and disposed have contributed greatly to rural and urban areas environmental degradation.

Ume (2004) further stated that apparently there exist few regulations/rules that specify the type of containers to be used to store waste or refuse. This has led to the indiscriminate dumping or disposing of waste as a result of unavailability of waste bins in strategic places around and within the rural and urban areas.

Problems of Waste Management in Rural and Urban Areas

There are many problems of waste management in Rural and Urban areas in Nigeria. These problem according to Ume (2004) and Nze (2011) include the following:

- Fund and capital, scarcity of fund to procure mechanization devices: Such as evacuation trucks and even simple modern and sophisticated machines.
- Non-compliance to directives on waste minimization by producers of waste
- Inadequate or absence of throw-in-baskets/containers at strategic points.
- Irregularity on the Environment Agency and corporate bodies to remove waste on daily basis.
- Irresponsible attitude of rural and urban dwellers towards disposing waste anyhow.
- Inability to dump wastes to Bin Buckets/Baskets/Containers provided by the relevant Environmental Agencies and Corporate Bodies in-charge of waste dumping and disposal

- Insufficient supply of Automotive Gas Oil (AGO).

Waste Management and Disposal in the Rural and Urban Areas

Ume (2004) and Nze (2011) noted that the most vital thing concerning waste management is to take waste and recognise it as a resource. Ume and Nze (op.cit) were of the view that the philosophy behind wastes transformation into useful resources has yielded laudable results in managing wastes at the point of generation. They noted that appropriate waste management starts from point of generation. Experts recommend that six containers with the inscriptions 1, 2, 3, 4, 5, 6 must be put at strategic points to capture what is designated to each container. Bin 1 should be used to collect biodegradable such as those that are of organic origin. Bin 2 will capture waste papers and cartons. Container 3/bin 3 should be used to collect plastics, rubber and polyethylene. Bin 4/container 4 will capture metals. Bin 5/container 5 should be used to collect glasses. Bin 6/container 6 will capture woods, wooden materials, household combustibles (sanitary pads, hairs, shaved hairs) and other combustibles or flammable substances. As soon as these materials are gathered in their respective containers, each content of the container/bin should be disposed adequately and routinely (Ume, 2004; Nze, 2011).

Before undergoing recycling processes of these classes of waste materials into useful needs and purposes, the act of sorting must take place. Once the sorting of the wastes are done, the various recycling processes of the classes of wastes begin. For the biodegradable wastes, they are recycled into useful purposes and products like organic fertilisers which are nutrients in the soil for plants and crops uptake leading to high agricultural productivity and bumper harvest. Such biodegradable wastes produce methylene gas (bio gas) as source of energy and power for provision of electricity. The waste papers and cartons are recycled into further production of reprocessed/recycled waste paper products as papers, cartons and toilet papers. The same applies to plastic, rubber materials and polyethylene materials. This extends to metals of various kinds, where the recycled metals are used for the production of new recycled produce and products. The combustible and inflammable waste materials are put into fire in incinerators for burning. This must be done using a constructed furnace to avoid pollution and lesser pollutants escape. This is not good due to its bad/environmental negative effects, causing atmospheric pollution. The ashes can be used for agricultural and road construction work and industrial purposes. However, such waste materials if not burnt can also be recycled. Ume (2004) and Nze (2011) postulated that the changing of waste to useful purposes is referred to as "waste to wealth". Both authors argued that proper waste management

disposal and recycling yield income, create wealth, provide employment and ushers in sustainable development and provides recycled product, raw materials and products which serve useful purposes to end users, dependable entrepreneurs and positive nation building – growth and sustenance.

Infrastructural Facilities for Waste Management

There should be adequate arrangement in the rural and the urban areas in Nigeria by local, state and federal government authorities to provide facilities and as well as mapping out designated sites for waste disposal away from activity areas. The provision of waste/refuse bins for the collection of wastes from source areas to the waste deposits or depots by the various levels of governments in both the rural and urban areas involved with the enabling rules, regulations and laws or policy instruments/measures guiding such waste generation and its related environmental problems and hazards.

There should be routine collection of wastes from the points and designated sites to the sites of disposals on daily basis. The rural and municipal authorities must be given adequate time schedules and notification made as to evacuate waste dumps regularly before they constitute a health hazard zone.

The various levels of governments should encourage private individuals and public companies or entrepreneurs to invest and provide such infrastructures for waste management up to recycling without any impediments such as corruption, bribery, kick-backs and kick fronts as order of the day.

It is by so doing that the full benefits and relevance of the entrepreneurial gains of waste to wealth in Agricultural practices and management could be achieved through the level ground and enabling environment suitable for such private individuals and public companies or entrepreneurs to invest and establish such ventures.

Polluter-Pay-Principle (PPP)

Ume (2004) noted that every one generates wastes. However, not everyone can remove waste. Wastes are not difficult to remove, although they are regarded as refuses or wastes containing no usefulness which only few people will want to handle. Ume (2004) and Nze (2011) disclosed that waste management is very expensive. Enough fund is needed to run waste management not to talk of waste recycling. Ume (2004) indicated the polluter-pay-principle (PPP) with simple illustrations.

Ume (2004) ascertained that we eat to be healthy. We eat food, drink the liquid, drinks must be used by the body. As soon as the body made use of what it needs, the resulting food materials must be removed. "Each person carries within him food eaten long ago but when they are not removed, the person goes on his business interacts with others and stays with his excreta/feaces or urine inside him. Once nature allows that some materials be given off from

the body, no one likes to sit near his excreta/feaces or urine. Now the problem is who is willing to remove "one's excreta"? The one who will accept to remove your excreta will put price on it hence he will charge you much to execute action and suffer hazards it will present.

Another illustration which Ume (2004) used as an example of polluter-pay-principle is the producers of food stuff, hoteliers, manufacturers, students, lecturers, workers and medical staff and patients will not want to remove any waste product or material they generated easily. A charge of fee is put on it; if someone is to carry out the removal of such wastes. Nze (2011) concluded that such "charges or fees" are normally high compared with the easy management of the said waste. They further maintained that in order to ensure that producers of waste get cautioned and minimise waste production the principle of "polluter-pay-principle" is normally applied. This principle is normally applied whereby producers pay according to the magnitude of wastes generated. It all means that heavy waste generators/producers will pay high amount of money for waste disposal, while the light producers pay little amount of money. Normally, in our rural and urban areas in Nigeria, polluter-pay-principle is not instituted to their disadvantages in raising funds for waste disposal. Producers of waste or operators capitalise on this and recklessly produce waste.

It should be noted, that, if the "polluter-pay-principle" is being put in place as a policy instrument to checking or reducing waste productions by producers of wastes/operators through local, state, federal, national and international governments and agencies which will equally generate taxes as incomes/revenues for proper waste cleaning and disposal and eventually recycling of waste by recyclers.

Waste Recycling and Management

The entrepreneurial gains of waste to wealth (WTW) in agricultural practices and management in Nigeria is achievable through various waste recycling and management processes. A new methodology for economical management of solid waste in urban areas can also be possible in the rural areas (Nze, 2011). The underlying philosophy of the concept is: reprocessing, resources recovery and recycle according to (Nze, 2011).

Experimental work at the University of California (2006) citing Nze (2011) reviewed most solid waste from urban areas contain significant amounts of valuable materials which could be re-processed and put back into economical use.

Furthermore, advocates of alternative energy sources have started to examine and develop appropriate technology for generation of electricity by utilising the gases emitted from waste deposits. In Nigeria, non-toxic fertilisers to boost production can be manufactured from solid waste Nze (2011). For

the purpose of this research paper, only solid waste is treated briefly.

Benefits and Relevance of Waste to Wealth in Agricultural Practices and Management in Nigeria

The benefits and relevance of waste to wealth in agricultural practices and management in Nigeria cannot be over emphasised. The benefits and relevance of waste to wealth in agricultural practices and management in Nigeria ensures quick and better water holding capacity of the soil and infiltration capacity through the addition of organic manure. This also ensures and helps the speed at which water percolate into the soil. Tirado and Cotter (2010) have said that such practice helps the soil to cope with heavier rains expected under climate change and increases productivity. Practices such as addition of organic manure or compost improves soil structure under ecological agriculture include cover cropping, mulching and crop rotation (Magdoff, 1998).

The benefits and relevance of waste to wealth serves and promotes entrepreneurial skill acquisitions, training centres, human capital and capacity building programmes in the rural and urban areas thereby ensuring youth empowerment, engagement and employment opportunities in different dimensions.

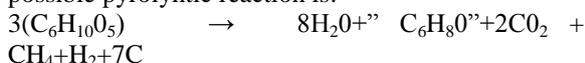
- As source of employment opportunities for the youths and other average Nigerians
- As source of income generation for the rural and urban dwellers
- As source of tourist attraction centres
- It provides environmental cleanliness
- It improves good health of the rural and urban dwellers.
- It is for the promotion of recycled and natural produce, products in agriculture, homes, offices and industrial uses and applications as case may be, into ensuring sustainable development and economic growth.
- As a source of raw materials for small scale and medium enterprises (SMEs), entrepreneurs, firms and industries thereby ensuring speedy economic growth and sustainable development in rural and urban areas in Nigeria
- Improvement in the standard of living – a key indicator for sustainable development economically, socially, politically, environmentally and ecologically
- Serves as an indicator for sustainable development in the different sectors of production as spelt in the Millennium Development Goals (MDGs), thereby ushering in economic growth.
- For the provision of infrastructures in rural and urban areas in Nigeria

- As source of natural/organic manure as to boost higher agricultural productivity
 - For the promotion of low input technologies and local resource materials for manufacture and service Sectors resulting in economic growth and sustainable development in the rural and urban areas in Nigeria as a whole.
 - It will serve as investment indicator – which is a parameter to ensuring economic growth cum attaining a sustainable development. It is an aspect and determinant factor in measuring economic growth cum sustainable development in macro economics. Investment and investors are aspects of entrepreneurial gains of waste to wealth or waste recycling in agricultural practices and management in Nigeria. It helps in the reduction of rural and urban poverty.
 - As a source of saving indicator – it is also an aspect and determinant factor for the measurement of economic growth cum sustainable development in macro economics. The establishment of waste recycling and management technologies will eventually bring savings in sectors of production and economy (primary, secondary and tertiary sectors).
 - Savings without importation – the waste recycling and management technologies will go a long way to improving savings of money which could have been used in the importation of raw materials and finished produce, products and goods in rural and urban areas in Nigeria as part of many entrepreneurial gains of waste to wealth. Such as plastics, rubbers, synthetics, polymers, biogas, diesels, energy, power, food, oil, starch, wood, metals and glasses for production and usage.
 - Savings through exportation – the establishment and execution of waste recycling will go a long way to provides savings with exportation of finished and recycled goods, produce and products.
 - It provides recreational centre for workers and the general public in the rural and the urban areas.
 - As source of energy and power – the establishment and execution of waste recycling or involving waste to wealth will provide energy and power in the form of “Biogas” and bio-diesel or Ethanol to complement the needed quantity in rural and urban areas in Nigeria. This will help to meet the transformation agenda of this present government administration especially in the energy and power sector in Nigeria. This will also promote the use of renewable energy and other similar resources
 - Research and development centre – the establishment and execution of waste recycling or turning waste to wealth in agricultural practices and management in rural and urban areas in Nigeria will help in enhancing and improving the abilities of entrepreneurs, students, industrial attachment and skill acquisition applicants, trainees, teachers, instructors, practitioners, researchers and developers of various classes and perspectives.
 - For the reduction in rural-urban migration. The establishment of waste recycling form(s) that is turning waste into wealth will go a long way to reducing rural urban migration and urban bias. Urban bias is the notion that most governments in low income countries favour the urban sector in their development policies, thereby creating a widening gap between the urban and rural economies (Todaro, and Smith, 2011).
Todaro, and Smith, (2011) stated that rural-urban migration is movement of people from rural villages, town and farms to urban centres (cities) in search of jobs.
 - For the improvement and promotion of the standard of living. The establishment of waste recycling and turning of waste to wealth and management to assist in the improvement and promotion of the standard of living in rural and urban areas in Nigeria.
 - Promotion of taxation for governments in rural and urban areas – as royalties for government projects and development of such areas.
 - It promotes polluter-pay-principle, whereby heavy polluters pay more taxes or compensations, while light polluters pay lesser taxes.
 - It provides the platform for resource diversification in the location of small and medium Enterprises (SMEs), firms, industries and rural and urban areas in Nigeria.
 - It helps to reduce over dependence on mineral oil (petroleum) in rural and urban areas in Nigeria
 - It promotes wealth creation by entrepreneurs in rural and urban areas in Nigeria.
- Description and Mechanics of the Plant Required in Phase One (Processing of Solid Waste using Modified Re-cycling Model – Pyrolysis)**
- Historically, refuse has been considered as a waste material and handled to the dump for disposal or in the urban areas to an incinerator for combustion. With recognition of the magnitude of

the solid waste management problem and the impact improper management was having on the environment alternative methods for management of the refuse had been investigated. One of those methods, pyrolysis model involves a variety of processing systems to upgrade the quality of the refuse and simultaneously recover specific “streams” from the refuse (Nze, 2011).

The Pyrolysis Model

Pyrolysis is a process which has the advantages of incineration (volume reduction and sterilisation of the waste) and generation of refuse divided fuel. The pyrolysis process consists of heating the waste material in oxygen – deficient atmosphere so that thermal decomposition occurs rather than combustion. The major reacting component in municipal waste is cellulose and a possible pyrolytic reaction is:



Where

C₆H₈O represents a family of liquid products. Recent research report has proved the pyrolysis of 1 ton of municipal garbage at temperature of 500 – 900°C produces

Solid residue	-	250 – 290lb	of porous carbon
Tar	-	15	litres
Light ore	-	.11	litres
Liquor	-	500	litres
Gas	-	12.72	standard cubic feet

Nze (2011).

Municipal Garbage

The product from the pyrolysis of municipal garbage consists of:

- Solid residue
- Polyethylene

Solid Residue

Nze (2011) highlights that this type of plant can achieve a reduction in volume of solid waste of about 85% depending on the actual composition of the waste. Nze (2011) further stated that the residue has a porous carbon structure which can be disposed off as a safe, sterile landfill or possibly used as a low grade activated carbon in water purification. This is collected in the quench tank at the bottom of the reaction tube.

Rubber Motor Tyres

According to Nze (2011) the shredded motor tyre has been successfully pyrolysed under a variety of operating conditions producing large volumes of gas and oil. One tonne of rubber (100 tyres) yields 500 litres of oil or 22000 standard cubic feet gas and half tonne of char.

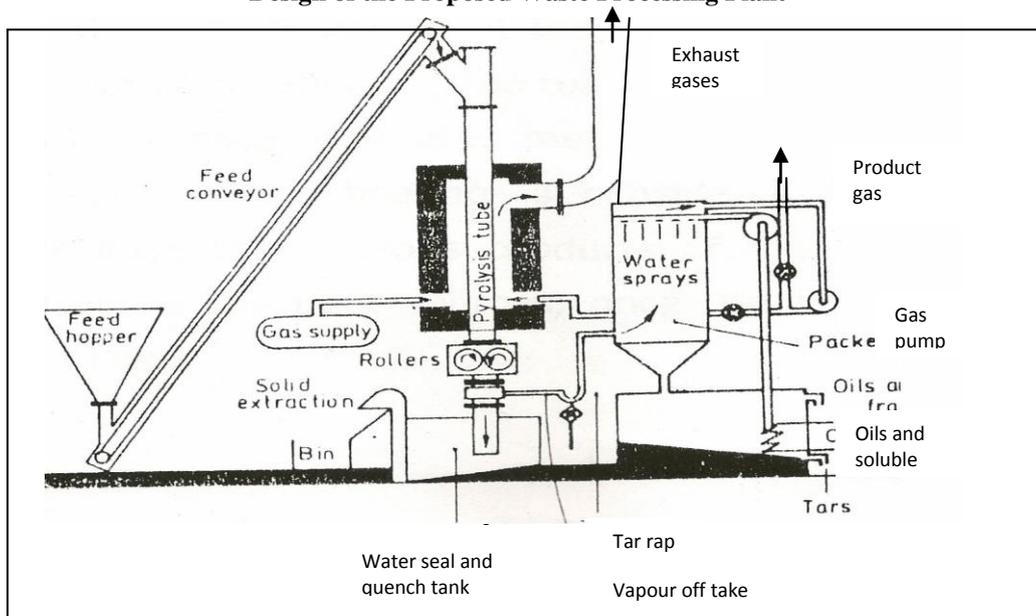
Polythene

It implies that with a feedstock such as plastic which forms virtually no solid residue, it is necessary to have a porous inert bed (e.g. coke) in the retort so that the liquefied plastic waste does not run straight into the quench tank. By varying the height of this bed it was found that the degree to which the (feedstock) feedstock is pyrolysed can be controlled (Nze, 2011).

Nze (op.cit) added that with a 600mm – 900mm bed into the hot zone large volumes of gas were produced. Again, enough gas was separate unit from value of the system. Finally, 300mm bed into the hot zone, mostly oil was produced.

Experimental results according to Nze (2011) of pyrolysis of polyethylene using the propose plant indicates 1 tonne of polyethylene yields 1000 litres of oil and 44000 standard cubic feet of gas.

Design of the Proposed Waste Processing Plant



Source: Adapted in experimental work at the University of California In: Nze (2011)

Capacity of the Proposed Plant

The thorough put capacity of the plant is approximately ½ tonne/hour. The capacity of the plant can be increased to handle up to 1 tonne of refuse in one (1) hour (Nze, 2011). This increases the efficiency and effectiveness of the plant and more of the entrepreneurial gains of waste to wealth in agricultural practices and management in Nigeria.

Attachments to the Plant

Particle Size Reduction Equipment – Shredder

It is important to note that all refuse processing systems must as a first step, consider the conditions of the refuse as it is received at the reduction, the rating of a shredding mill is on basis of a “nominal” particle size. A small hot produces a nominal particles size of 2” mill have a product in which 90% of the particles size less than 2”. The recommended shredder is the vertical shaft mill (Nze, 2011).

Plant Feedstock Loading apparatus: Conveyors

Nze (2011) maintained that the bucket conveyor provides a nearly vertical lift of refuse materials into the plants hopper. The capacity of the conveyor would be determined by the volume of the buckets attached and the speed at which these buckets are elevated.

Conclusion(s) and Recommendations

Waste management involves the act of deliberately and monitoring action that minimise waste generation and accumulation. Individuals, corporate bodies, governments and agencies are and remain stakeholders in waste management. The promulgation of laws and regulations is the only way to reducing waste production/generation and disposal, such as the aforementioned “polluter-pay-principle (PPP)”. However, for waste management and recycling in rural and urban areas to be effective all stakeholders will put their hands on deck. Sustainable waste disposal and recycling is necessary in order that the environment is not destroyed and future generation will have an environment that is healthy, friendly, scenic and beautiful which they will term their home.

The inherent problem of waste disposal is an ongoing trend in our contemporary time as necessary devices and instrumentation are lacking. This results in quick accumulation of waste at unauthorised sites and places. Once the problems of waste management and subsequent recycling are solved, sustainable development can be realistic only if the environment is rid of waste regularly so that we are not doomed and perished. Finally, waste recycling and management (waste to wealth) fosters wealth creation, employment opportunities, economic growth and sustainable development.

- The various levels of government laws and regulations guiding waste producers,

operators and generators using and applying the “polluters-pay-principle” for positive nationhood and as a reappraisal of values should be enforced.

- The provision of waste/refuse bins at strategic points should be encouraged and enforced by governments and agencies concerned for waste disposals.
- Frequent and routine waste collections through the availability of enough waste/refuse wagons/haulage trucks by governments and agencies should be encouraged.
- Encouragement and enforcement of public awareness, enlightenment, mobilisation campaigns for waste generations disposals and collections to the waste depots, eventual sorting and various recycling processes in rural and urban areas.
- Waste Recycling and Management involving the Entrepreneurial Gains of Waste to Wealth (WTW) in Agricultural Practices and Management in Nigeria can be achieved if various and appropriate waste recycling and management processes are pursued.

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