A COMPARATIVE ANALYSIS OF PROBLEMS OF SANITATION IN MINNA AND SULEJA ABATTOIRS, NIGER STATE, NIGERIA

BY

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DECLARATION

This project titled "**A COMPARATIVE ANALYSIS OF PROBLEMS OF SANITATION IN MINNA AND SULEJA ABATTOIRS, NIGER STATE, NIGERIA**" is an authentic report of my study. Information derived from published and unpublished work of others has been acknowledged in the text.

GULU, MOHAMMED SHEHU

13/9/08

DATE

CERTIFICATION

This thesis titled **A COMPARATIVE ANALYSIS OF PROBLEMS OF SANITATION IN MINNA AND SULEJA ABATTOIRS,** by ***GULU, MOHAMMED SHEHU (M.Tech/SSSE/2005/1347)*** meets the regulations governing the award of the degree of Master of Technology (M.Tech) of the Federal University of Technology, Minna and is approved for its contribution to scientific knowledge and literary presentation.

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DEDICATION

I have dedicated this work to all the world's men and women who cherish the ideal of a clean environment.

ACKNOWLEDGEMENT

I must first of all thank Allah, the Almighty creator of every thing in both the Earth and the Heaven for giving me the physical and financial abilities with which I successfully passed through the difficulties of the course.

I also have special thanks and appreciations for my wife and children for sharing my difficulties in one way or another of their living conditions. May Allah reward them for their endurance.

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ABSTRACT

This study was on Minna and Suleja abattoirs to identify and compare the levels of filthiness, reasons for the filthiness, effects of such filthiness to man and the environment. The study adopted the use of questionnaires, physical assessment of the entire premises of the two abattoirs and verbal interview. In addition, soil analysis was carried out in the two abattoirs aimed at assessing the levels of some selected chemical elements contained in certain abattoir wastes and the likely danger they pose to human beings. Water analysis was also carried out to identify possible pollution and the effects such has on health. These generated the data that is used in achieving the set objectives of the study. The percentage differences in the respondents' responses from the two abattoirs including the differences in the volume of chemical elements discovered in soil analysis of the two abattoirs provide the analytical methods in the study. The daily volume of wastes generated from each of the abattoirs including the daily water requirements were also estimated. The study revealed some information that informed the conclusions and suggestions made. Both abattoirs were conclusively found to be operating below acceptable sanitary standards. Solid wastes in decaying conditions are dumped carelessly everywhere, foul water mixed with blood, dung and meat debris openly flow across the abattoir walls. The whole air environment is also usually darkened by blackish smoke emerging from burnt tyres used to roast goats and cow heads. Both abattoirs are under-funded and ill-equipped with the government seemingly indifferent to their conditions. It is recommended that stakeholders should embark on composting abattoir wastes, establishment of waste water treatment plants, public-private partnership in abattoir management and so on in order to entrench acceptable operational standards.

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CHAPTER ONE

INTRODUCTION

Since the creation of human beings, there has been a continuous struggle to explore ways and means of getting food. The struggle becomes necessary because survival would have been impossible without food. As a divine sympathy, the creator of human beings also created food and endowed human beings with the intelligence and wisdom of not only how to look for food but also different classes of food.

These classes of food include carbohydrates, proteins, fats, vitamins and so on. Since human survival is tied to the availability of any or all of the above classes of foods, human beings are always engaged in an endless struggle to ensure their availability. Protein is one of the important classes of food. It is known to be responsible for body building if taken in acceptable quality and quantity.

Protein is obtainable from Beans, Eggs, Fish, Meat, and so on. which is obtained from animals is widely used as a favourite source of protein. To ensure its availability always, domesticated animals like Cows, Sheep, Camels, Goats, Poultry and so on. are slaughtered daily,

With increasing human population followed by a corresponding increase in urbanization, the demand for meat as a source of protein has also increased. This also means that increasing number of animals must be slaughtered to meet growing demand for meat. "***It is estimated that 38 Million cows and calves, 95 Million hogs, 5 Million Sheep and Goats, 278 Million Turkeys, 20 Million Ducks and over 7 Billion Chickens are slaughtered annually to meet the growing demand for meat***" Murtle, (1997).

Adeyemo, (2002) also made the same observation when he said "..... ***Urbanization is associated with changes in food consumption patterns, together with human population and income growth, it is a major driving force influencing the global demand for livestock products***"

To ensure that meat exposed for sale is wholesome and fit for human consumption, governments at all levels all over the world have it as a duty to make rules and regulations that regulate the slaughtering of animals and sale of meat. If this type of measure is not taken by the authorities, the dangers of consuming injurious meat will be very high because anyone can slaughter anything, anywhere and anyhow. There is even the danger of dead animals being cut up and sold out for public consumption.

One of these rules and regulations call for the establishment of Slaughterhouses where animals are kept in sanitary condition, inspected before slaughter and the meat products hygienically handled and proven to be disease free before being sent out for public consumption. This becomes necessary because a lot of dangers are inherent in the consumption of meat. There are diseases that are transferable from animal to man by way of eating an infected meat. It is also possible for meat to become contaminated during meat processing or transportation to the places of sale. The existence of properly functional slaughterhouses helps in reducing the incidences of zoonotic diseases affecting human beings.

A slaughterhouse may be a slaughter slab or an abattoir. A slaughter slab is simply a place designated for the inspection and slaughter of animals including the meat products meant for human consumption. This is seen in rural settings. An abattoir, on the other hand, is serving the same purpose like the slaughter slab but possesses more modern facilities for animal keeping, slaughtering and meat processing.

Whatever the type and size of a slaughterhouse, there is the need for the maintenance of a high degree of environmental sanitation. All the places of use from the time the animal arrives at the slaughterhouse up to the time the meat is sent out for consumption must possess acceptable level of cleanliness. Other facilities for use by the workers like toilets, washing rooms, dressing rooms, and so on must also always be kept clean.

As necessary as the sanitary requirements listed above are, it is disheartening that the condition of many slaughterhouses, particularly those in the developing countries are in shambles. "***Last of all, slaughterhouses do least proficient job of cleaning up after animals are killed. It would be bad enough living near a slaughterhouse, but many neighbours say the worst thing is not the thought. They are constantly inhaling the nauseating stench each and every day. Neighbours also have entrails, skins, joints and blood being dropped onto their property. There are usually rivers of blood flowing around the slaughterhouses and sometimes make it as far as to were the neighbour can see or smell it. The bones are boiled on the slaughterhouses premises which causes them to create further pollution and stench .....***" **Murtle (1997).** It is common to see the premises of slaughterhouses littered with over grown weed or animal waste like heeps of dung, blood, horns, bones and so on. It is also possible to notice that animals are kept in very horrifyingly dirty condition and meat processed on bloody and dung-stained bare floor. If the Slaughterhouses are characterized by filthy and stinky environment, then the condition of the animals, the health of the workers and above all, the wholesomeness of the meat products meant for public consumption will not be guaranteed.

Most of the above enumerated negative conditions exist today in nearly all of our abattoirs in Nigeria. And the situation continues to deteriorate without visible efforts being made to halt the trend. Some sort of measures need to be taken and quickly too in order to reduce the risk of disease due to dirty abattoir environment or due to the consumption of unwholesome meat product.

This fear is also expressed by professor Sharubutu. (2008) when he said that "***Most of our abattoirs across the country are nothing but reservoir of infections and diseases. In fact, many of them are in the state of sorry sight and the few that are manageable are now going worse. Therefore, the***

Government has to do something urgent about them, unless people that consume meats that are processed in these abattoirs would continue to experience one infection or the other and there could be out break of diseases in such abattoirs".

1.1 HISTORY OF MINNA

Minna is located on latitude 9"37' North and longitude 6"33' East with an area of about 884 hectares. Minna has grown over the years thereby swallowing some suburb settlements like Bosso, Maitumbi, Dutsen-Kura, Kpakungu, Shango and Chanchaga. The northeastern part of the city is characterized by continuous steep outcrop of granite, which occurs and limit urban expansion in that direction.

It is suggested that Minna got its name from a Gwari word "***Myina***" meaning "***to spread fire***". This is from the Gwari spiritual bonfire festival that used to be celebrated on the Paida hill. This further suggests that the early settlers of Minna are Gwaris.

The modern history of the present Minna started in 1905 when the railway line was extended to Minna. This brought about the influx of many professionals, technicians, labourers, traders and so on to the town. This was followed by the setting up of administrative machinery. In 1908, a leader, assisted by a secretary was appointed to preside over the social issues of the then permanent settlements of the present Kwangila, Limawa and Keteren-Gwari.

Further developments occurred in 1910 when the Sarkin Kuta was asked to move to Minna by the Resident Officer as a plan to establish a new headquarters in Minna. This invitation was not honoured because the sarki did not want to work with the Hausas who had then established prominent presence in Minna. A similar invitation was extended to the Sarkin Wushishi. He obliged and the headquarters of Kuta Division was moved to Minna. The Division was made up of nine administrative districts of Wushishi, Kuta,

Paiko, and Galadima Kogo, Fuka, Maikukele, Bosso, Guni and Gini. These events led to the demotion of Sarkin Kuta and the promotion of Sarkin Wushishi.

The Sarkin Wushishi, Ibrahim, upon arrival in Minna appointed Mallam Mu'azu Sokoto as the local native judge "*Alkali*" because he was learned in Islamic religion. Capt. Taylor, the Resident, also appointed people to occupy various administrative positions of Sarkin Dillali (head of middlemen) Magajiya (head of women), Sarkin Pawa (head of butchers) and so on. Mu'azu was serving as judge, native treasurer and Chief Imam. In 1917 the official Imam was appointed in person of Mallam Aliyu.

In 1921, the Kuta Division was reorganized and Sarkin Wushishi was sent back to Wushishi and the headquarters of the Division relocated to Kuta. Sarkin Bosso, Abubakar Zarumai, assumed the administrative leadership of Minna.

The Minna Township Council was established in 1934. But in 1950 another administrative reorganization abolished the Town Council. In its place was Ward Administration. In the same year Alhaji Ahmadu Bahago was appointed both Sarkin Minna and Sarkin Kuta in council. Six wards were created namely:- Nassarawa, Kwangila, Makera, Limawa, Sabon-Gari and Keteren-Gwari. Later population increase brought Paida as the seventh ward in 1959.

In 1976 when the old Niger Province was excised from the then North Western State, the city became the capital of the then new Niger State. Apart from being the state capital, Minna is presently also the headquarters of Chanchaga Local Government.

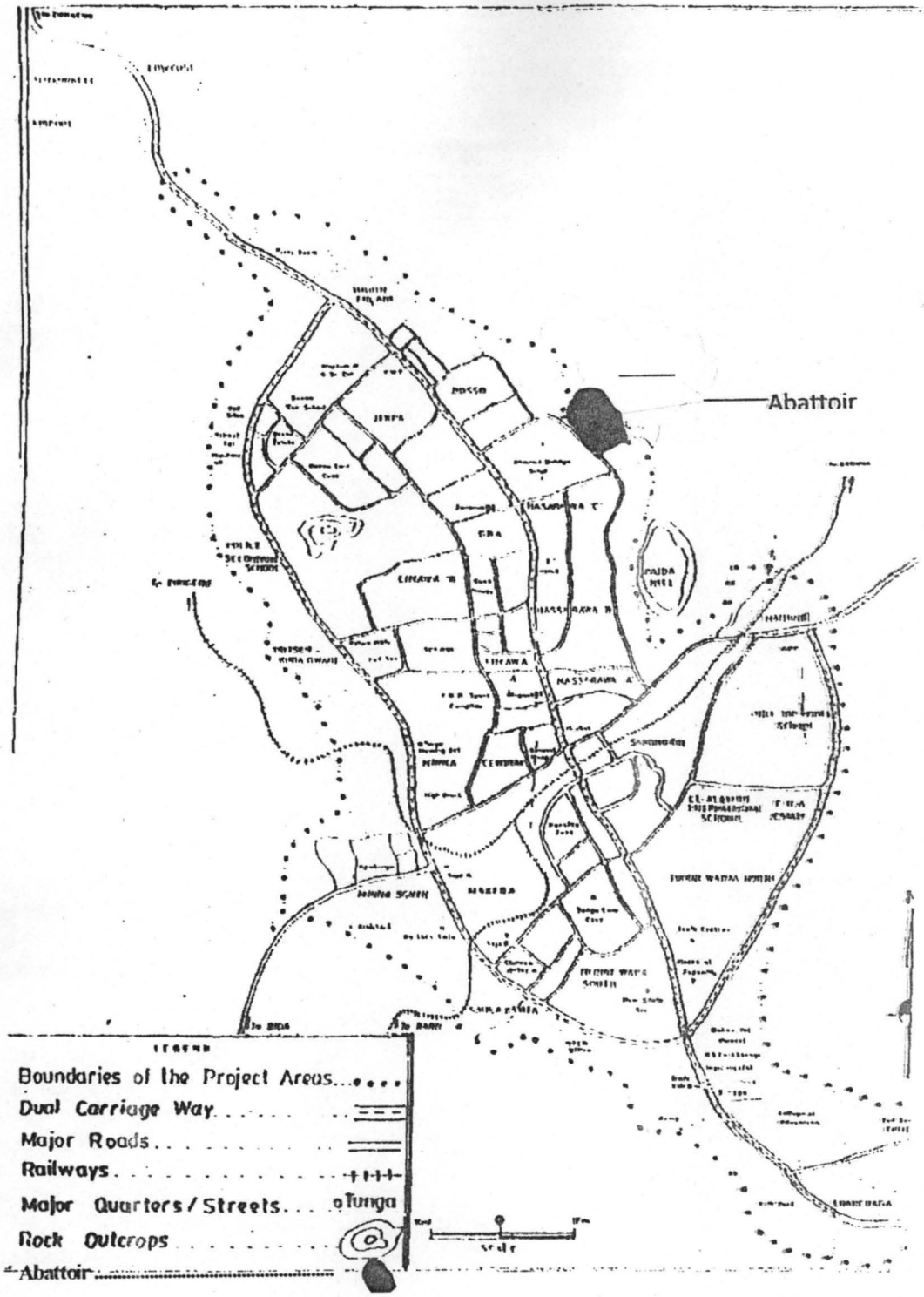

Fig 1.1: Map of Minna and it's Environs showing the study area
Source: Department of Geography FUT, Minna

1.2 HISTORY OF SULEJA

The story of Suleja started when the Fulanis invaded Zaria in 1804. The then Zazzau rulers and Mohammadu Makau the 60th fled to what is today known as Suleja. Before entering Suleja they settled at Zuba.

In 1825, Makau defeated the Fulani at a battle, and became the ruler of the whole area. Though the control of most of the Northern Nigeria passed into the hands of the Fulanis, Suleja was never defeated. The title "Sarkin Zazzau" (Emir of Zazzau) which was the original title of Zazzau rulers was retained and is still the official title of Suleja Emirs today.

Following Makau's death at a battle in Lapai Emirate in 1883, the mantle of leadership fell on his brother, Jatau, nicknamed Abuja (i.e Abu the red) meaning the light complexioned Abu. The present Suleja was therefore knowned and called Abuja until the movement of the Federal Capital from Lagos when the Present Federal Capital was named Abuja and the former Abuja became known as Suleja.

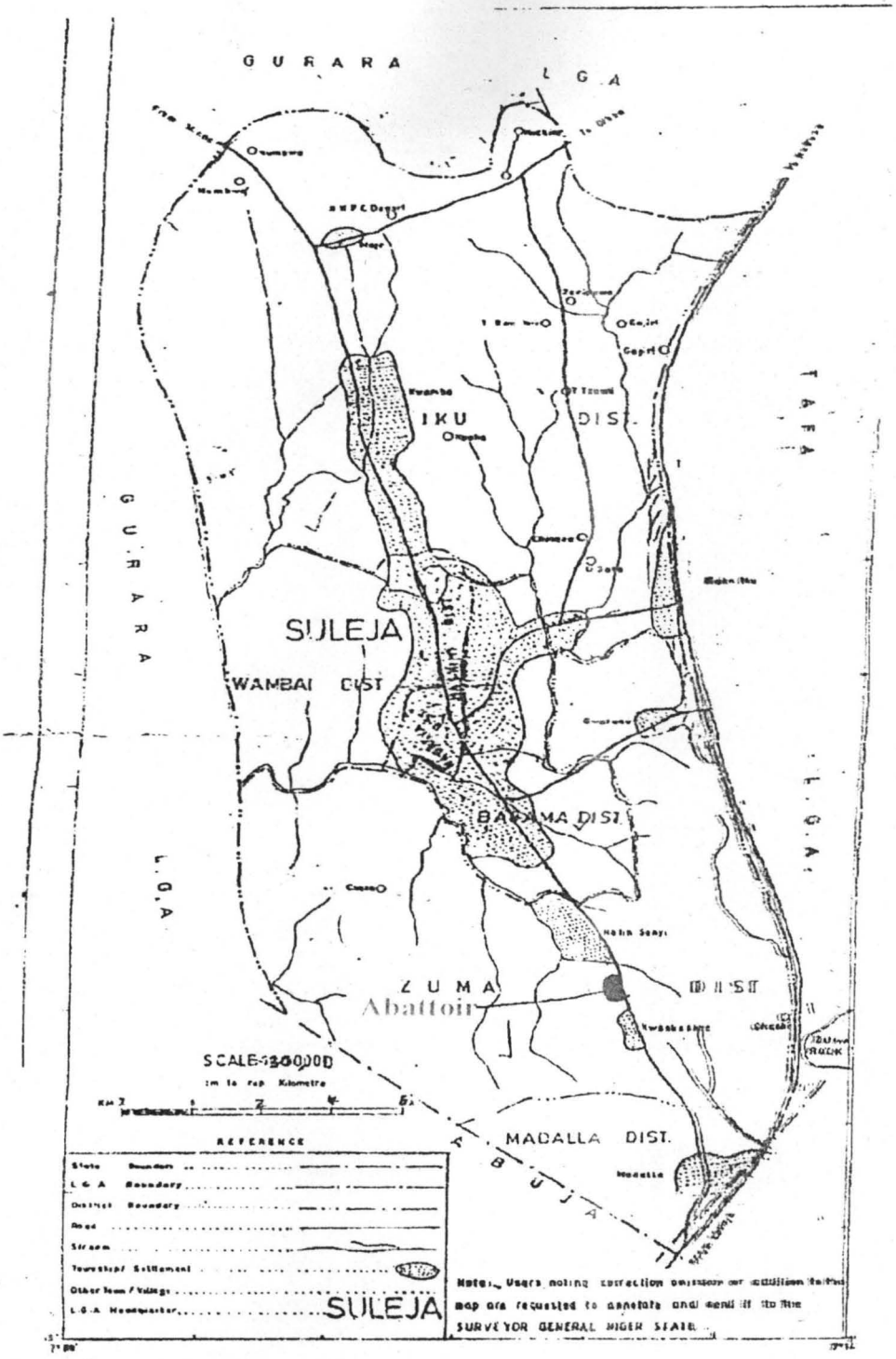

Fig 1.2 Map of Suleja Local Government Area showing the study area

Source: Town Planning Division, Minna, Niger State

1.3 HISTORY OF THE STUDY AREAS

1.3.1 MINNA ABATTOIR

The Minna slaughterhouse was what would be referred to as a slaughter slab because of its size and level of patronage. The Slaughterhouse was then situated near Bosso village. Despite the small size of the facility then, animal, environmental and meat inspections were still carried out by the joint Environmental Health Officers and Veterinary Officers.

The upsurge in human population brought about an increase in the number of animals slaughtered thereby creating congestion in the slaughterhouse. In recognition that the facility was becoming too small for comfortable operation, the present abattoir was built and commissioned on 24th January, 1990 by the then Military Governor of Niger State, Colonel Lawan Gwadabe. The abattoir is presently under the jurisdiction of the Chanchaga Local Government.

1.3.2 SULEJA ABATTOIR

The former abattoir was situated at Pangamu ward of Suleja. The abattoir was re-located to the present place in 2001 due to the fact that the old abattoir was gradually being swallowed up by expanding human population and residential houses. The expansion in human population and residential houses made it impossible to conveniently handle animals and the smell from the abattoir was increasingly becoming a source of nuisance to the populace. Finally, the abattoir itself was increasingly becoming smaller compared with the number of animals that are daily slaughtered.

1.4 CLIMATE

Like the rest of the west African sub –region, the climate of Minna and Suleja are influenced largely by two dormant air masses affecting the sub – region. They are the dry and dusty tropical continental air masses and the warm moist tropical moisture air masses. There is dynamism in the climatic conditions, which determines the nature of the rainfall regimes, temperature

and the wind. Suleja and Minna have a relatively high annual rainfall of 1640mm (64.5 inches) concentrated into three months of July, August and September.

The usually cloudless dry season has temperature with extreme maximum occurring in March/April (38oC).

1.5 STATEMENT OF PROBLEMS

A casual peep into Minna and Suleja Abattoirs, especially during the early morning hours will reveal that there are existing sanitation problems. It will be observed that the entire environment is pervaded with thick black cloud of smoke. There is also the possibility of perceiving stinky odour, bloodstains on the concrete pavements and fly infestation. All of the above conditions are not good for health. They can cause water contamination, respiratory diseases, intestinal diseases, environmental degradation and so on. As visible as these are, however, no study has, as yet, been conducted to document their causes and effect in Minna/Suleja and any other urban center in Niger State.

1.6 AIM AND OBJECTIVES OF THE STUDY

The aim of the study is to compare and analyse the problems of sanitation in Minna and Suleja abattoirs. This aim will be achieved by the following objectives: -

1.7 OBJECTIVES OF THE STUDY

i. To determine the extent and effects of poor sanitation in the two abattoirs.
ii. To determine the types of wastes generated in the two abattoirs.
iii. To assess the quantity of water required for sanitation in the two abattoirs.
iv. To assess the management system of wastes in the two abattoirs.
v. To carry out soil analysis in the two abattoirs in order to determine the level of pollution from abattoir wastes.

vi. Carry out water analysis, where necessary, to determine the level of water pollution from abattoir wastes.

1.8 JUSTIFICATION

The poor sanitary condition of most slaughterhouses in Nigeria today is largely due to ignorance and poverty on the part of the workers and those who patronize the meat products. The second is due to indifference and /or incompetence on the part of local governments whose duty it is to monitor the activities of the Slaughterhouses and also enforce the laws governing the operations of such premises.

The workers are mostly illiterates and therefore do not know the hazards they are exposed to when they work in sanitation deficient environment or contribute to the causation of nuisance of any kind. Since they do not know the dangers they are personally exposed to, they certainly will not appreciate the dangers of sending out contaminated meat for public consumption. Also because of ignorance and poverty on the part of people who buy the meat from the slaughterhouses, there is no complaint or protest against the filthy condition of the slaughterhouses.

There are also a lot of shortcomings on the part of the local government whose duty it is to properly manage the activities of the slaughterhouses under their jurisdiction. It is the constitutional responsibility of the local government to make laws that will ensure proper functioning and maintenance of slaughterhouses. What is actually happening is that either some governments, particularly those at the local levels do not have in existence such laws or such laws are not enforced at all either due to indifference, incompetence or both.

1.8 SCOPE AND LIMITATION

The study work is centered on Minna and Suleja abattoirs and strictly focused on the general sanitation conditions of the abattoirs. The study looks into the factors responsible for the poor sanitation and various negative effects of the nuisances identified.

CHAPTER TWO

LITERATURE REVIEW

A slaughterhouse is any place officially designated to be used for keeping and slaughtering of animals including taking necessary measures to ensure safety of the meat for public consumption.

"***Slaughterhouse includes an abattoir, slaughter poles or place set apart and approved by a local authority for slaughtering animal and birds, the meat of which is intended for sale or for human consumption***"-Nigeria Public Health Bill, Sec.104, (1999).

Before a slaughterhouse is built many factors must be put into consideration. Among the factors to be considered are nearness to the market where animals can be easily bought and the meat products sold, nearness to a reliable source of water supply, availability of convenient transport system, the climatic condition and so on. "***The main essentials of an abattoir site are that there should be available an ample supply of water (usage can be in excess of 1,000 gal) 1,000 Ib (4,545 litres/453.5kg) dressed carcass weight), adequate facilities for sewage disposal, an electricity supply and if possible or gas supply and good road facilities***"- Thornton ***et. al.*** (1978).

Slaughterhouses should also be sited away from human settlements to avoid noise and environmental pollution. The presence of animals, large number of workers and customers, the sound of vehicles and machines used can create noise nuisance to the neighbouhood of the slaughter houses. The presence of wastes from animals can also cause air, soil and water pollution to human settlement close to the slaughterhouses. The view is also reorganized by the FAO, (1985), when it said, "***The Slaughterhouses should be situated away from residential areas. Access for animal-either by road, rail and or stock route must be assured. The Slaughterhouses should be located in area where flooding is impossible.***".

The preparation for the construction of a slaughterhouse should also include the consideration for the topography of the land. A little sloppy site should be used to ensure easy clearing and draining of waste water. Also to be considered before construction is the number of animals to be slaughtered and needs for future expansion as overcrowding of facilities may give sanitation problem.

Also to be considered when planning to build a slaughterhouse is how to ensure enough light in all the areas of operation. This will allow for proper handling of the meat product, ease in cleaning, proper examination and avoidance of accident either by equipment or falling.

Murtle, (1997), emphasized that, "***sufficient lighting shall be provided to enable accuracy of operations and hygienic processing. Artificial lights shall be adequately provided to prevent contamination in the event of breaking***",

2.1 OPEN PREMISES

As soon as a slaughterhouse becomes operational adequate safeguards should be employed to rid the premises of all kinds of nuisance. A nuisance is any thing or place that is in such a condition as to be injurious to life or property. This includes high grown bushes, broken containers, refuse, excavated ditches, stagnant water and so on. The important thing to note here is that anything that is referred to as a nuisance is what is useless but possesses the potentialities of causing harm. Ademiluyi, (1986), pointed out that "A waste is the discharge of any material (gaseous, liquid or solid) which can cause a negative impact on the environment either routinely during normal operations or accidentally due to process up sets".

2.2 LAIRAGE

The lairage is a place designated for keeping animals preparatory to their slaughter. The intention is to offer the animals sufficient rest and recover on the physical impact of a probable long journey.

It is important to base the size of the lairage on many factors. Some of the most important factors to be considered is the number of the animals to be accommodated, the type of the animals, weather conditions and so on. ***"Sufficient space for lairage and tripe and hide treatment is required. The space required for lairage will often depend on local and even climatic conditions. In specific areas it will only be possible to transport the animals in the dry season while slaughtering may only be carried out in the rainy season because of waste requirements"***-FAO, (1985).

While the animals take their rest and shelter in the lairage, the veterinary doctor conducts ante-mortem examination on the animals with a view to identifying any sign of disease in the animals. ***"This most desirable practice is of great value, for it aids in the detection of animals suffering from scheduled or infectious diseases, particularly anthrax, rabies and glanders, which are communicable to man"***. - Thornton *et al*. (1978).

Animals must be in the lairage for at least 24 hours before slaughter. This allows for adequate rest for the animals and for a reliable result of ante-mortem examination. Thornton et. al. (1978), supports the above view in the following quotation- ***"The importance of suitable lairage accommodation for animals awaiting slaughter cannot be over estimated, for a period of rest of 24 hours before slaughter has a marked beneficial effect on the appearance and subsequent marketability if the carcass ".***

The existing condition of the lairage should be such that will not be harmful or uncomfortable to the animals kept there in. There should be adequate ventilation opening commensurate with the number of animals. The floor and wall of the lairage should be devoid of dampness. Facilities must also exist in the lairage for the veterinary doctors and other staff to clean their lands and equipment.

The lairage should be constructed in a way that clearing will be effected with ease. Depending on the population of the animals, there is always the

presence of dung and urine. These have to be cleared and floor washed at regular interval if the health and comfort of the animals kept will be guaranteed. All the cleanings with regard to the lairage itself, animals, lairage workers including veterinary workers and equipment depend on the availability of adequate water. ***"Lairage: there should be sufficient space and a sufficient water for drinking purpose. A spraying system where the animals can be cleaned before entering the slaughter hall is recommended, if sufficient water is available"***- FAO, (1985).

2.3 SLAUGHTER HALL

The slaughter hall is a place where the slaughtering of animals takes place. Any animals to be slaughtered are removed from the lairage straight to the slaughter hall. The hall should be so constructed and slaughtering so organized that no animal is allowed to see another animal being slaughtered. Whatever method is used for slaughtering should not subject the animal to unnecessary pains. Murtle, (1997), expressed his concern on this when he said, ***"There are rules about cruelty to animals such as no torturing or subjecting them to unnecessary pain and suffering and no keeping them in cages that there is not sufficient room to go with their measurements. One of the biggest issues is that the animals are not supposed to be exposed to their own kind getting slaughtered, but they are constantly having to watch their own kind getting dragged mercilessly to their brutal death".***

Slaughter hall may differ in type, size and equipment from one place to another depending on the types of animals to be slaughtered, culture and religion of the people.

In some places slaughtering procedures are conducted using machines, while in some places knives are used. Whichever slaughtering method is used, ***"The two essentials,"*** according to Thornton *et. al.* (1978), ***"in the slaughter of food animals are that they shall be dispatched without unnecessary suffering and the bleeding of the animals shall be as complete as possible".***

The cleanliness of a slaughter hall should be maintained always. Since blood is what is largely handled in this section efforts must be made to ensure that blood is not allowed to clot thereby staining the floor and blocking the drains. On this, FAO, (1985), pointed out that, ***"It is therefore recommended that the manager of the Slaughterhouses is responsible for maintenance of a hygienic standard. This team should do some clearing and cleaning during slaughtering hours or instruct the butchers and workers to do this during and after slaughtering. This team will be responsible for clearing and disinfections at the end of the working day and maintaining the hygiene standard".***

To ensure a high standard of cleanliness that is required in a slaughter hall, reliable sources(s) of water supply must be guaranteed by the management of every slaughterhouse. ***"A supply of potable water, with appropriate facilities for its storage, distribution and temperature control, shall be provided in sufficient volume and pressure for the hygienic operation of the premises"***-Murtle, (1997).

Blood from the slaughter hall can be subjected to various uses or treatment. Depending on the custom and religion of the people the blood can be collected and processed as animal feed, for human consumption or may be discarded as wastes. It is when blood is dealt with as a waste product and must be disposed off that the issue of sanitation arises. If it is possible to collect blood separately without allowing it to mix with waste water, this can be done so that blood does not block the drains. The so collected blood can be disposed off hygienically or transformed into edible products. ***"The blood from slaughtered animals will coagulate into a solid mass, which may block up both open and closed drains, it is therefore recommended that the blood is collected and used for human consumption, stock-feed production or fertilizers, if the religion and cultural traditions allow the use of blood".*** FAO, (1985).

If the drains are wide enough and dealing with blood alone is not possible then plenty water must be made available to wash the blood along the drains to existing pools, rivers or lakes. If this option is unavoidable then adequate precaution must be taken not to contaminate water sources for humans, domestic and wild animals or cause fly infestation and offensive smell.

2.4 DRESSING HALL

This is the hall from where the carcass is flayed and viscera brought out of the abdominal cavity. This section is very vital in meat inspection because it is from here that post-mortem inspection takes place. The muscles and the internal organs are closely examined in order to identify the existence of any pathogenic condition. The internal organs may also be subjected to dissection to have a deeper look into the organs. Any part of the carcass found to be locally diseased is condemned and must be properly disposed off. If the case of disease identified is generalized then the whole carcass must be condemned and in the like manner discarded to prevent it being used far human consumption. This view is expressed further by Davies, (1979), when he said, ***"A full examination of the carcass is made, including organs and glands. All serious membranes must be left on the animals for inspection. If there is generalized disease, the whole of the carcass may be seized and condemned, but if only part of the animals is affected, as indicated by diseased lymph glands, a portion only of the carcass may be condemned".***

While there is the need to maintain a high degree of cleanliness in the dressing hall, adequate precaution also needs to be taken to avoid contamination of meat parts through human contact. It is possible to have a disease free animals being slaughtered and dressed in disease free environment but the meat may be contaminated by a food handler carrying some pathogenic organisms.

To minimize the risk of contaminating meat products by food handlers it is important for the management of a slaughterhouse to have up to date medical record of the staff. They should also maintain high level of personal hygiene. The equipment like knives, cutlasses, axes and so on must also be clean and used carefully. ***"During the evisceration process care should be taken to minimize contamination. Special care must be taken to avoid damaging the intestines. Edible organs must be handled in a hygienic way (stored/removed in separate containers and so on) waste must be removed rapidly from the floor in the vicscreation room/area"***-FAO, (1978).

As a further precaution to prevent meat, contamination by meat handlers, Nigeria Public Health Bill, Sec. 8, (1999), added that, "A person cutting meat into the desired portions and where the use of bare or open hand is permitted shall ensure that the hands are clear and free from injury or cut and shall ensure no contamination or infection of the meat takes place".

In order to further reduce the risk of meat contamination, meat handlers need to be provided with special uniform, boots, head gears and hand gloves. This will go a long way in not only protecting the meat products but also as a means of protection to the workers themselves. This fact is supported by FAO, (1978), in the following recommendation: ***"Working clothes should ideally be supplied by the Slaughterhouses and a laundry services is recommended to ensure a certain level of hygiene. Working clothes should be comfortable and easy to wash. Their design should encourage good hygiene habits. Light coloured working cloth shows the need for cleaning earlier than dark coloured clothes".***

Dressing rooms/halls should be separated from slaughter halls. This standardized separation is seen where rules and regulations of slaughterhouse management are strictly adhered to. In most third world countries both slaughter and dressing of animal take place in the same place. This is contrary

to hygienic laws and exposes both the meat products and meat handlers to high degree of danger

2.5 MANAGING THE WASTES

The daily activities of the slaughterhouse bring about accumulation of various types of wastes that must be properly dealt with in order to avoid their harmful effects on the environment, human or animals.

The stomach and intestinal content of slaughtered animal are made up of faeces (dung) and undigested food particles. Since they are not edible they have to be appropriately disposed off. Poor handling of animal dung brings about fly infestation, offensive smell, rodent infestation, soil contamination and so on. If the animal dung is to be used for manure it should be appropriately kept in such a way that it does not pose any danger. The dung can be buried but with adequate care not to contaminate underground source of water supply. In Slaughterhouses with modern facilities the dung can be pulverized in a disposal unit before final treatment.

2.6 BONES

Bones are other types of wastes seen in slaughterhouses. Bones are animal by-products that can be converted into several edible substances for man and animals. They can be processed to produce materials for use. ***"Fresh bones are processed in bacon curing work, sausage factories and in modern abattoirs to yield a valuable edible fat, but bones prepared from dead or condemned animals are unfit for the production of edible products***"- Thornton ***et. al*** (1978). The bones can also be burnt or roasted and used for animal feed or for manufacture of pottery materials. If bones must be roasted adequate measures must be taken to prevent air pollution and smell around the vicinity of the exercise.

2.7 HORNES AND HOOVES

These may also be converted to useful materials of high economic value if facilities are available to do that. In developed countries almost every animal

waste is recycled for other uses. Thornton *et. al.* (1978), pointed out that, "Horns are sawn from the skull, graded and used for manufacture of combs, hair pins, other hair ornaments, bottons and knife handle if of low grade, as a fertilizer". Where facilities to recycle them do not exist they can equally be burnt but again mindful of the environmental hazards.

2.8 HIDES AND SKIN

Hides and skins are of good economic purpose for tanneries. In advanced societies where tanneries are of high standard, hides and skins are used to make varieties of lather products. In less advanced societies hides and skins are also used to produce some local lather products or converted to edible products. Whatever hides and skin are intended for, they should not be kept in such a way that they will become smelly and attractive to flies.

2.9 BLOOD

Blood is another waste material of the slaughterhouse which must be handled in line with sanitary needs. As indicated earlier when dealing with slaughter hall, blood, depending on religion and culture, can be gathered up and converted into edible products for animal or human consumption. When blood is to be converted to edible products it must be processed quickly. ***"Fresh blood must be processed at the earliest possible moment, as otherwise it decomposes rapidly with an appreciable loss in its nitrogen content".*** Thornton *et. al.* (1978). If blood must be washed away together with waste water and directed into a pool, pit or lake and so on care must be taken not to allow fly infestation, offensive smell, contamination of surface and under ground sources of water supply.

2.10 CONDEMNED ANIMAL/MEAT

Whenever a whole animal or part of it is condemned by reasons of disease, it should not be eaten as food and must therefore be properly discarded. It can be burnt or buried. If the burning is to be used, it should be so thorough that nothing remains. If burying is chosen over burning the meat can

be treated with chemical before burial so that it can not be dug secretly and eaten.

2.11 TRANSPORTION OF MEAT PRODUCTS FROM THE SLAUGTHER HOUSE

At the end of the post – mortem examination meat products that are certified fit for human consumption are moved to points of sale. It is important to use a reliably hygienic means of transportation to convey meat products to the market. This is necessary to prevent contamination. In recognition of this necessity Nigeria Public Health Bill, Sec.5, (1999), Stated that ***"Meat meant for sale or for human consumption at a charge or free of charge shall be conveyed in a truck especially designed for the purpose of conveying in a hygienic manner or conveyed in a closed vehicle approved by an environmental health officer or such other authorized officer"***

The way and manner meat products are carried from the Slaughterhouses to the markets in Nigeria is disheartening. Vehicles that are rickety, dirty, uncovered, smoky and almost off road are used to convey meat. To worsen the matter, butchers are always seen on the same vehicle and having direct body contacts with the meat. Some times motor–cycles with the same structural descriptions like the vehicles above are also used to convey meat. Here, the clothes of the motorcyclists look bloody, an indication of body contact with the meat products. On this, the Nigeria Public Health Bill, Sec.6, (1999), went further-***"Persons carrying, transporting or conveying meat intended for human consumption whether from a slaughterhouse, vehicle, conveyacer, store room or such other place or thing shall wear or put on clothes or articles that will prevent contact between the person and the meat and such clothes or articles shall be in accordance with the health and hygienic requirements or as may be approved by an environmental health officer or such authorized officer."***

2.12 DRAINAGE SYSTEM

The whole premises of a slaughterhouse should be properly drained to avoid stagnation of water and to allow liquid content waste products to be properly washed away. The drainage should be properly slopped during construction to ensure free flow of their contents. The drains should always be cleared of solid materials that may obstruct water movement. Faulty drainages expose the slaughterhouse to mosquito breeding and offensive odour. ***"There shall be a drainage and sewerage system that effectively removes solid and liquid waste and which does not jeopardize the hygienic processing of products"***, Thornton ***et. al.,*** (1978).

2.13 FIRST-AID SERVICES

There is a need for the existence of a first aid facility in a slaughterhouse. The fact that it is animals and sharp working materials that are handled, to that extent, there exist the possibilities of injuries to the workers. The administration of first-aid treatment will prevent the condition from becoming worse until a substantive medical attention will be given in case of injury. Thornton ***et. al.*** (1978), shares this view when he wrote, ***"It is essential, especially in the large establishment to have a well equipped first-aid room with a qualified nurse. Besides catering for the usual injuries and ailments to which all workers are prone, an industrial nurse can make a significant contribution to the standard of hygiene in a meat plant".***

2.14 TOILET AND WASH HAND BASIN FACILITIES

To further heighten the sanitation standards of a slaughterhouse, there should be adequate number of toilet facilities commensurate to the population of the workers and customers. Such facilities should equally be in acceptable sanitary and functional condition. ***"Sanitary facilities must also include a sufficient number of toilets/latrines and arrangement for hand-washing or even possibilities for bathing (showering). These facilities must be kept clean and well maintained."*** FAO, (1978).

The wash-hand basins are essential to maintain good personal hygiene among the workers. Workers whose schedule it is to be in contact with live animals, meat, wastes and so on must have wash-hand facilities close to their areas of operation. FAO, (1978), also made the following observation- ***"Basically there should be two sites room where the staff can wash their hands-the rest room and the working area where sufficient hand washing facilities must be placed close to the working places. If the hand-washing facilities are situated at particular areas from working places, there is a great risk that they will not be used."***

2.15 WATER SUPPLY

A slaughterhouse requires plenty water to be able to smoothly run its services and maintain its premises in high standard of sanitation. Infact, any slaughterhouse without a reliable source of pure and adequate water supply does not possess the competence to operate. The issue of water supply should be treated with every seriousness because every activity of a slaughterhouse revolves around availability of water. ***"If sufficient water of drinking quantity is available, it will be possible to plan processing and cleaning procedure in a way which assures hygienic products. The water supply may be from the premises own well or from the community supply. Working routines should be planned to economize the consumption of water because of waste water disposals"***. FAO, (1978)

2.16 FENCING

A strong fence surrounding a slaughterhouse is important for security and sanitary reasons. The properties of the slaughterhouse are safe from theft if there is a fence around it. The presence of fence will also prevent people from outside coming to defaecate within the premises or bring in some thing harmful or contaminating. FAO, (1978), ***"To prevent access of unauthorized persons, the public, dogs and other animals fencing must be erected around the slaughterhouse areas. The fencing should have contact with the ground***

at the lowest edge and should be high enough to prevent access to the grounds".

CHAPTER THREE

MATERIALS AND METHODS

3.1 INTRODUCTION

This chapter describes and makes a presentation of the procedures used in carrying out the study. The research is essentially a normative methodology where many variables have been observed and their relationships used in drawing conclusions. The following are the sub-headings: -

Research Design

Research Tools

Data Collection

Data Analysis

3.2 RESEARCH DESIGN

The design for this study involves a survey of the abattoirs in both Minna and Suleja. The survey deals with the mode of operations, quantity and types of wastes generated and their possible impact on health and environment. The management strategies of the waste from the two abattoirs were also examined.

3.3 RESEARCH TOOLS

Questionnaires were prepared and distributed among the staff of the two abattoirs. The questions on the questionnaires dealt with: -

a) Waste Removal

b) Funding

c) Personnel

d) Materials/Equipments

e) Number of animals slaughtered

3.4 METHOD OF DATA COLLECTION

1. One hundred copies of questionnaires were distributed to each of the abattoirs in Minna and Suleja. The questionnaires were filled and

returned. The response of recipients to each of the questions in the questionnaires form the data for analysis.

2. Physical assessment and personal interview with the personnel of the abattoirs and the butchers were also carried out. What were seen during the physical assessment and the responses given during the interviews helped to enhance the data for analysis.

3. Soil analysis of the two abattoirs were also carried out to establish the quantity of certain animal dung chemical elements that are contained in the soil. The quantity of the chemical elements was expressed in terms of possible harmful effects to human health.

3.5 DATA ANALYSIS

1. Responses from the questionnaires gave clues to the nature of problems in connection with the removal of wastes, funding of the abattoirs, personnel and equipment. The responses are presented in tabular and graphical forms to suggest drawn conclusions.
2. The personal physical assessment of the abattoirs and responses to interviews with the staff and butchers helped in revealing further problems related to the operational status of the abattoirs.
3. The soil analysis of the two abattoirs was carried out with a view to assessing the level of chemical elements of animal wastes origin.
4. Water analysis of the stream behind Suleja abattoir was also carried out with a view to identifying possible pollution.

CHAPTER FOUR

RESULTS

4.1 INTRODUCTION

The Result of the study include table 4.1 and 4.2 below that indicate the questionnaire responses from the study areas. The questionnaire was essentially aimed at identifying unknown problems relating to the management aspect of the abattoirs in both Minna and Suleja. One Hundred questionnaire samples were distributed to each of the abattoirs. Eighty and Ninety completed questionnaire copies were returned from Suleja and Minna abattoirs respectively. Also indicated in the results in the graphic presentation of questionnaire responses.

Plate I shows the slaughter and dressing hall of Suleja abattoir, plate II shows how a cow is being dressed on bare floor in Minna abattoir and plate III shows one of the shallow wells in Suleja abattoir. Plate IV shows a drainage full of dung in Suleja abattoir, plate V indicates a collection of animal dung in Suleja abattoir, plate VI shows drums of collected blood in Suleja abattoir, plate VII shows a collection bones in Minna abattoir, plate VIII shows a collection of horns in Minna abattoir and finally plate IX shows a decomposing carcass in Minna abattoir.

TABLE 4.1: RESPONSES TO QUESTIONNAIRE FROM SULEJA ABATTOIR

NO	QUESTIONNAIRE	RESPONSES TO THE QUESTIONNAIRES		
		RESPONSES OPTIONS	NO. OF RESPONSES	%
	Please indicate who is responsible for the removal of waste from the abattoir	a. Local Gov't	56	70
		b. Non Governmental Organisation	24	30
		c. Community members	-	-

		d. Hired Labourers	-	-
2	How are the wastes removed	a. By refuse vehicles	8	10
		b. By using wheelbarrows	-	-
		c. By dumping anywhere	72	90
		d. By burying them	-	-
3	How often are the wastes removed?	a. Everyday	40	50
		b. Twice every week	16	20
		c. Once every two days	-	-
		d. Once every month	24	30
4	Depending on your answer above, is it enough to keep the abattoir clean?	a. It is very enough	16	20
		b. It is enough	40	50
		c. It is slightly enough	8	10
		d. It is not enough	16	20
5	Is it possible to improve on level of performance?	a. It is very possible	32	40
		b. It is possible	40	50
		c. It may be possible	8	10
		d. It is not possible	-	-

	If there is possibility for improvement. how?	a. Increase the number of evacuations	-	-
		b. Increase in number of labourers	8	10
		c. Acquire more sophisticated equipment	40	50
		d. Increase more vehicle	32	40
	Are the cleaners making any impact on the cleaning of the abattoirs?	a. Very high impact	40	50
		b. Making some impact	8	10
		c. Only a little impact	32	40
		d. No impact at all	-	-
	If you think that they are not making impact what may be the reason	a. They are inadequate in number	-	-
		b. They are not skilled enough	8	10
		c. They are not motivated	32	40
		d. Inadequate materials for work	-	-
	Can you suggest any of the following for boosting the cleaners' morale?	a. Increased Salary	24	30
		b. Improved safety measures	16	20
		c. Procurement of modern Equipment	32	40
		d. Need for more training	8	10
	How adequate is the money available for cleaning activities?	a. Very adequate	8	10
		b. Adequate	56	70
		c. Inadequate	16	20
		d. Grossly Inadequate	-	-
	How regular does the funding take place?	a. Very regular	8	10
		b. Regular	64	80

		c. Irregular	8	10
		d. Grossly irregular	-	-
12	Are you sure that adequate and regular funding can ensure abattoir cleanliness?	a. Very sure	24	30
		b. Sure	48	60
		c. Not sure	8	10
		d. Not likely	-	-
13	If funding is not regular make suggestion for improvement?	a. Once every week	-	-
		b. Once every month	-	-
		c. Once every two weeks	8	10
		d. Once every two months	-	-
14	Where is the source of funding for cleaning?	a. Local Government	56	70
		b. Non Governmental Organisations	16	20
		c. Individual Philanthropists	-	-
		d. Community contributions	8	10
15	Are equipment/ materials for cleaning available?	a. Adequately available	8	10
		b. Available	56	70
		c. Manageably available	-	-
		d. Not available	16	20
16	If the materials for cleaning are available are they sufficient?	a. Very sufficient	8	10
		b. Not sufficient	56	70
		c. Insufficient	16	20
		d. Grossly insufficient	-	-
17	How effective are the equipment?	a. Very effective	8	10
		b. Effective	-	-
		c. Not effective enough	72	90
		d. Grossly ineffective	-	-
18	If equipment/material are	a. They are not appropriate	56	70

	ineffective can you give reasons why?	b. They are old c. They are not properly maintained d. They are obsolete	24 - -	30 - -
	Indicate how many cows are slaughtered daily in the abattoir.	a. 10 - 30 b. 30 - 40 c. 40 - 60 d. 60 and above	- - 8 72	- - 10 90
	How many goats are slaughtered daily in the abattoir?	a. 10 - 20 b. 20 - 30 c. 30 - 40 d. 40 and above	16 - 64 -	20 - 80 -

TABLE 4.2: RESPONSES TO QUESTIONNAIRE FROM MINNA ABATTOIR

No	QUESTIONNAIRE	RESPONSES TO THE QUESTIONNAIRES		
		RESPONSES OPTIONS	NO. OF RESPONSES	%
	Please indicate who is responsible for the removal of waste from the abattoir	a. Local Gov't	90	100
		b. Non Governmental Organisations	-	-
		c. Community members	-	-
		d. Hired Labourers	-	-
	How are the wastes removed	a. By refuse vehicles	-	-
		b. By using wheelbarrows	90	100
		c. By dumping anywhere	-	-
		d. By burying them	-	-
	How often are the wastes removed?	a. Everyday	90	100
		b. Twice every week	-	-
		c. Once every two days	-	-
		d. Once every month	-	-
	Depending on your answer above, is it enough to keep the abattoir clean?	a. It is very enough	54	60
		b. It is enough	36	40
		c. It is slightly enough	-	-
		d. It is not enough	-	-
	Is it possible to improve on level of performance?	a. It is very possible	27	30
		b. It is possible	63	70
		c. It may be possible	-	-
		d. It is not possible	-	-
	If there is possibility for	a. Increase the number of		

	improvement. how?	evacuations	18	20
		b. Increase in number of labourers	-	-
		c. Acquire more sophisticated equipment	18	20
		d. Increase more vehicle	-	-
7	Are the cleaners making any impact on the cleaning of the abattoirs?	a. Very high impact	27	30
		b. Making some impact	63	70
		c. Only a little impact	-	-
		d. No impact at all	-	-
8	If you think that they are not making impact what may be the reason	a. They are inadequate in number	-	-
		b. They are not skilled enough	-	-
		c. They are not motivated	45	50
		d. Inadequate materials for work	45	50
9	Can you suggest any of the following for boosting the cleaners' morale?	a. Increased Salary	63	70
		b. Improved safety measures	9	10
		c. Procurement of modern equipment	18	20
		d. Need for more training	-	-
10	How adequate is the money available for cleaning activities?	a. Very adequate	-	-
		b. Adequate	9	10
		c. Inadequate	36	40
		d. Grossly Inadequate	45	50
11	How regular does the funding take place?	a. Very regular	-	-
		b. Regular	9	10
		c. Irregular	18	20
		d. Grossly irregular	63	70
12	Are you sure that adequate and regular funding can ensure	a. Very sure	63	70
		b. Sure	27	30
		c. Not sure	-	-

	abattoir cleanliness?	d. Not likely	-	-
3	If funding is not regular make suggestion for improvement.	a. Once every week	63	70
		b. Once every month	27	30
		c. Once every two weeks	-	-
		d. Once every two months	-	-
4	Where is the source of funding for cleaning?	a. Local Government	90	100
		b. Non Governmental Organisations	-	-
		c. Individual Philanthropists	-	-
		d. Community contributions	-	-
5	Are equipment/ materials for cleaning available?	a. Adequately available	-	-
		b. Available	-	-
		c. Manageably available	27	30
		d. Not available	63	70
6	If the materials for cleaning are available are they sufficient?	a. Very sufficient	9	10
		b. Not sufficient	27	30
		c. Insufficient	9	10
		d. Grossly insufficient	45	50
7	How effective are the equipment?	a. Very effective	-	-
		b. Effective	18	20
		c. Not effective enough	27	30
		d. Grossly ineffective	45	50
8	If equipment/material are ineffective can you give reasons why?	a. They are not appropriate	18	20
		b. They are old	-	-
		c. They are not properly maintained	18	20
		d. They are obsolete	54	60
9	Indicate how many cows are slaughtered daily in	a. 10 - 30	-	-
		b. 30 - 40	36	40

	the abattoir.	c. 40 - 60	54	60
		d. 60 and above	-	-
	How many goats are slaughtered daily in the abattoir?	a. 10 – 20	54	60
		b. 20 – 30	-	-
		c. 30 – 40	16	80
		d. 40 and above	-	-

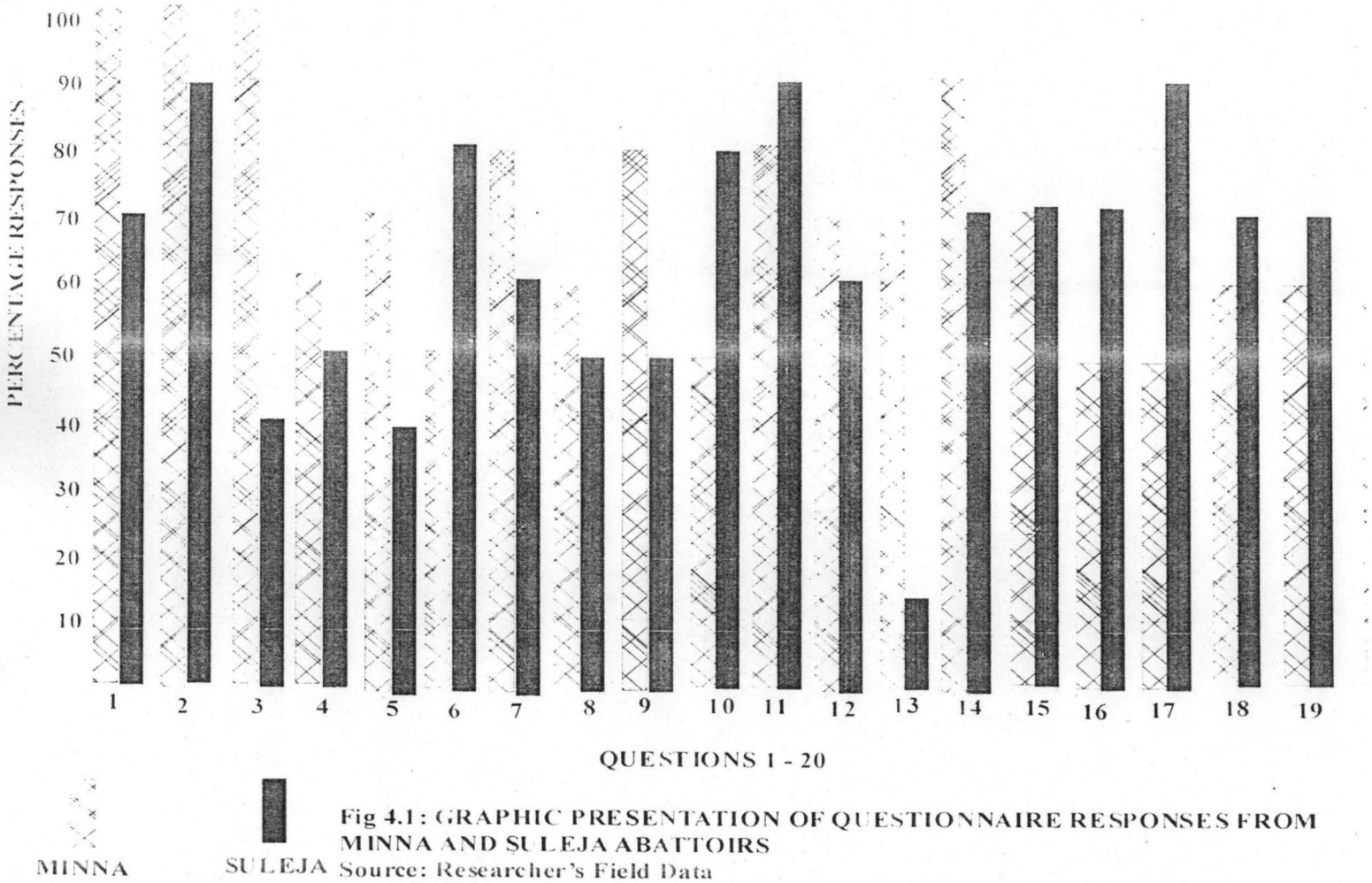

Fig 4.1: GRAPHIC PRESENTATION OF QUESTIONNAIRE RESPONSES FROM MINNA AND SULEJA ABATTOIRS
Source: Researcher's Field Data

4.3 RESULTS OF PERSONAL INTERVIEWS AND PHYSICAL ASSESSMENT OF MINNA AND SULEJA ABATTOIRS.

Minna Abattoir is located on a hilly topography North – East of the town. The abattoir premises slopes from North to South. There is a boundary wall demarcating the Eastern to Western slope of the premises while the Northern part of the premises is surrounded by a strand so onh of hill. Minna abattoir is situated in the town while Suleja abattoir is situated about 3 killometres on the Suleja – Madalla Road. Unlike Minna abattoir, the Suleja abattoir is neater since it was commissioned only in 2001. The whole surrounding of the abattoir premises is walled with a large interior land space.

4.3.1. INTERNAL OPEN PREMISES

The largest space inside the Minna abattoir premises is used for farming activities. The farm crop grown on the farms is mainly Maize which is further encouraged by abundant existence of heaps of animal dung. The animal dung is applied to the Maize farms as manure.

The remaining spaces that are not suitable for farming are left in very bushy condition and littered with all kinds of nuisance of solid wastes contrary to section 2(h) of Niger State Public Health (Amendment) law of 1984 which describes nuisance as ***"Any accumulation or deposit of rubbish of any kind whatever, or any decaying animal or vegetable matter, whether in the form of refuse, manure, decaying or tainted food, or in any form whatever"***. In the case of Suleja abattoir however, the first striking difference between Minna and Suleja abattoirs is that there are no farming activities within the abattoir. The only noticeable thing is that the premises was dirty, littered with variety of solid wastes including remnants of animal feeds.

4.3.2 LAIRAGE

This is a place where animals are kept for a period of at least 24 hours before slaughter. This place in Minna abattoir, based on the condition during

this study, does not qualify to be a lairage. It is simply a tiny open space where cows are tethered to some fixed iron bars. The ground surrounding the lairage appear very dirty due to the presence of both solid and liquid animal dung. Since the animals lie in this pool of dung prior to their slaughter there is the danger of transferring pathogenic micro-organisms into the slaughter hall and contaminating meat. The lairage in Suleja abattoir, compared with that of Minna abattoir, is more decent. It is a small space but roofed and well floored for the comfort of the animals that are kept there before slaughter.

4.3.3 GOAT ROASTING

Within the abattoir premises also is a section where slaughtered goats are roasted. What is disturbing here is not the roasting act itself but the type of combustible materials used to make fire. Old motor tyres are set on fire and then used to roast goats. During the process of roasting there is always a huge cloud of black smoke that envelops the abattoir atmosphere.

This smoke could be very injurious, first of all to the youths who carryout the roasting exercise, because of their proximity to the fire. By extension everyone within the abattoir premises including people living within the vicinity of the abattoir can suffer from the effects of the smoke. The effects could be in form of eye and respiratory tract irritation that may lead to very serious eyes and lung disease. The smoke can also contribute to the causes of global warming. The powder tyre debris which has accumulated in heaps can also be washed away by rain into water source thereby causing water pollution. The wires in the tyres have also accumulated in heaps after many years of tyre burning. The wires can also be a source of physical injury to the people

In Suleja abattoir the practice of using old tyres as combustible materials for making fire is the same like what happens in Minna abattoir. All the negative consequences inherent in this practice as pointed out earlier when discussing Minna abattoir are also relevant here. The only noticeable

difference is that the burning of tyres in Suleja abattoir takes place outside the abattoir wall.

4.3.4 FLOWING FOUL WATER

In Minna abattoir, it was observed that huge volume of foul water containing dung, blood, fats and other suspended meat debris was flowing freely from the slaughtering hall through a major drainage. This foul water is supposed to flow into a covered cesspool. Since the cesspool has collapsed and no longer in use this foul water flows out of the abattoir premises and into vast residential areas contrary to section 18, sub-section (1a and b) of Niger State Edict No.2 of 1984 which makes it an offence for any person to: -

(a) ***"Throw or lay on any street or tenement whether occupied or not or on any open space (except at such places as may be set apart by the proper authority for such purpose) any rubbish or any offensive or unwholesome matter; or***

(b) Commit any nuisance in any street or in any open space or in any place being an appurtenance of or adjoining a dwelling house shall for each offence in addition to any liability for damage at the suit of any person angered be liable to a fine of fifty Naira".

The fine above is too inadequate to serve as a deterrent to people who commit environmental sanitation offences. There is therefore the need for a review upward of this and other similar fines so that it will serve the purpose for which they are enacted.

Another serious concern about the flowing foul water through residential areas is the possibility of contamination of surface and underground sources of water supply along the route of the flow which is contrary to section 7 of Niger State Environmental Protection Agency of 1996 and intended to ***"prevent any act of omission or commission which consequences are likely to adversely affect the environment and to generally deal with any discharge, solid, liquid or gaseous matter, deposited willfully or other wise in***

the environment and to deal generally with any violation which the Agency may decide hazardous to the environment and the ecosystem and in particular to: -

i. Monitor the whole or any of such discharges.

ii. Cause the responsible party to stop or remove such discharge at the expense of the defaulting party.

iii. Remove or cause penalty to be paid for such violation and to negotiate appropriate compensation to be paid to the victims of such discharge.

iv. Reinstate, rehabilitate or cause the affected environment to be restored to its original state at the expense of the defaulting party".

As for Suleja abattoir, the flowing foul water originates from the slaughter hall and contains the same components of waste as that of Minna abattoir. Although the Suleja abattoir is newer than that of Minna, the cesspool designed to receive the foul water is not functional. During field visit to the abattoir the cesspool is filled up but not evacuated. The decomposition of the contents of the cesspool releases a lot of offensive smell, which permeates the whole abattoir premises. There is also a noticeable crowd of flies around the open cesspool.

Since the cesspool is filled up and can not take more wastes, the wastes are now washed through some drains and escape through boundary wall of the abattoir (see Plate IV). There is a stream towards which the ground outside the abattoir slopes. There is therefore the danger of pollution in this stream which is contrary to section 13 sub-section 1 of Niger State Edict No. 2 of 1984 which says ***"Whoever by any act or default causes or suffers to be brought or to flow in to any well, river, stream, tank, reservoir, aqueduct or pond or intended for supplying water to men or beasts or into any conduit communicating therewith any deleterious substance or does any act whereby such water is or may be fouled shall be liable to a fine of Three***

Hundred Naira (₦300) every day during which the offence continued after conviction".

4.3.5 SLAUGHTER AND DRESSING HALL

This is the hall where animals are slaughtered and skinned. In Minna abattoir there is an iron device (***Gravity Rail System***) on which the slaughtered animals used to be hoisted for skinning and post mortem examination. The device has ceased functioning for a long time because, as the researcher was told, the butchers see its use as a waste of time and the abattoir management has not done anything about it

Slaughtered animals are now instead skinned on bare floor (see Plate II) there by increasing the possibility of meat contamination. At the time of the visit there were many animals that were being skinned on the bare floor and with the butchers wearing their shoes and slippers. Another visit to the hall after the day's work revealed that no serious attention is given to the cleanliness of the hall because there were blood and dung stains all over the expanse of the floor. What obtains inside is exactly what exists at the concrete pavement surrounding the slaughter hall.

In the case of Suleja abattoir, the slaughtering and skinning of animals also take place on bare floor. In comparison with the size of the hall however, Suleja abattoir has a much larger slaughtering and skinning hall.

PLATE I: Slaughter and Dressing hall in Suleja abattoir
Source: Researcher's Field Data

PLATE II: Dressing a Cow in Minna abattoir
Source: Researcher's Field Data

4.3.6 WATER SUPPLY

There is virtually no pipe borne water supply to Minna abattoir. This is because there is a long standing debt which the Local Government has not paid to the Water Board. The researcher is however told that efforts are being made to settle the debt so that pipe borne water supply can resume again.

In the mean time there are two functional boreholes in the abattoir from where water is drawn for sanitary uses. Despite the existence of the two boreholes however, water is still not enough for use in the abattoir. This is because of the burden involved in drawing water from the boreholes manually. The quantity of water required in the abattoir is very high if one considers the various uses to which water is put in terms of body, equipment and environmental cleanliness. Several methods are available for use to estimate the total water needs of an abattoir. The one chosen for this study is based on the following quoted statement – ***".....and the water supply of an abattoir should be estimated on the bases of 150 gallons (681.8 litres) per beast slaughtered"*** Thornton ***et, al.*** (1978).

With the questionnaire response estimating 40 – 60 cows slaughtered daily in Minna abattoir, the daily water needs can be put at 40, 908 litres. This quantity estimation is based on 60 cows. Considering the much smaller size and number of goats slaughtered the above general estimate based on the highest possible number of cows may seem relevant. The quantity of water drawn from the two boreholes at the abattoir fall far behind the quantity needed for good sanitation, body and equipment cleanliness.

As for Suleja abattoir, there is no pipe borne water supply there. There are about four shallow wells outside the abattoir wall where water is drawn for use in the abattoir (see Plate III). The water output from the wells is grossly inadequate for the abattoir needs especially during the dry season. There is a borehole within the abattoir premises but not working. A major source of water supply to the abattoir is from an electrical powered borehole from

outside the abattoir wall which supplies water through a hose into the concrete reservoir within the abattoir premises. The questionnaire response indicate that more than 60 cows are slaughtered everyday. Going by Thornton's estimation of water needs of an abattoir based on the number of beasts slaughtered, Suleja abattoir requires up to 50,000 litres of water per day.

PLATE III: A shallow well in Suleja abattoir
Source: Researcher's Field Data

4.3.7. ANIMAL DUNG

In Minna abattoir, the solid animal dung is deposited in groups all over the premises surrounding the slaughter hall while the liquid part of the dung is washed down the drainage across the abattoir fence. ***"An average cow produces 6.8kg of dung while a goat produces 0.9kg"*** according to Thornton ***et al*** (1978). With the estimated 60 cows and 40 goats slaughtered each day in the abattoir the volume of dung generated per day will be 408kg and 36kg respectively.

The accumulation of the dung results in its decay causing offensive smell, flies infestation and filthiness of the environment. In the rainy season

when farming activities are in progress within the abattoir a large part of the dung is used as manure, helping to reduce the volume of the dung. There are also some farmers who come from outside the abattoir to take some dung for their farming activities.

Unlike the Minna abattoir situation, the animal dung in Suleja abattoir is deposited outside the abattoir wall (see Plate V). The liquid part of the dung is washed through the drainage and pushed across the abattoir wall. This washed dung is supposed to be drained into a cesspool. At the time of the visit the cesspool is found filled-up without evacuation. Because of this situation there is a lot of smell and flies infestation due to the decay of the dung in the cesspool. It is estimated that the volume of cow dung per day is higher than 408kg while the goats dung is as high as 36kg per month based on the standard estimates.

The animal dung from Suleja abattoir is widely used by the farmers who troop in during the rainy season to remove the dung for use as manure. The place used outside the fence to dump the dung is close to a river and there is the danger of leaching of the dung into the river resulting in pollution.

PLATE IV: Drainage full of animal dung in Suleja abattoir
Source: Researcher's Field Data

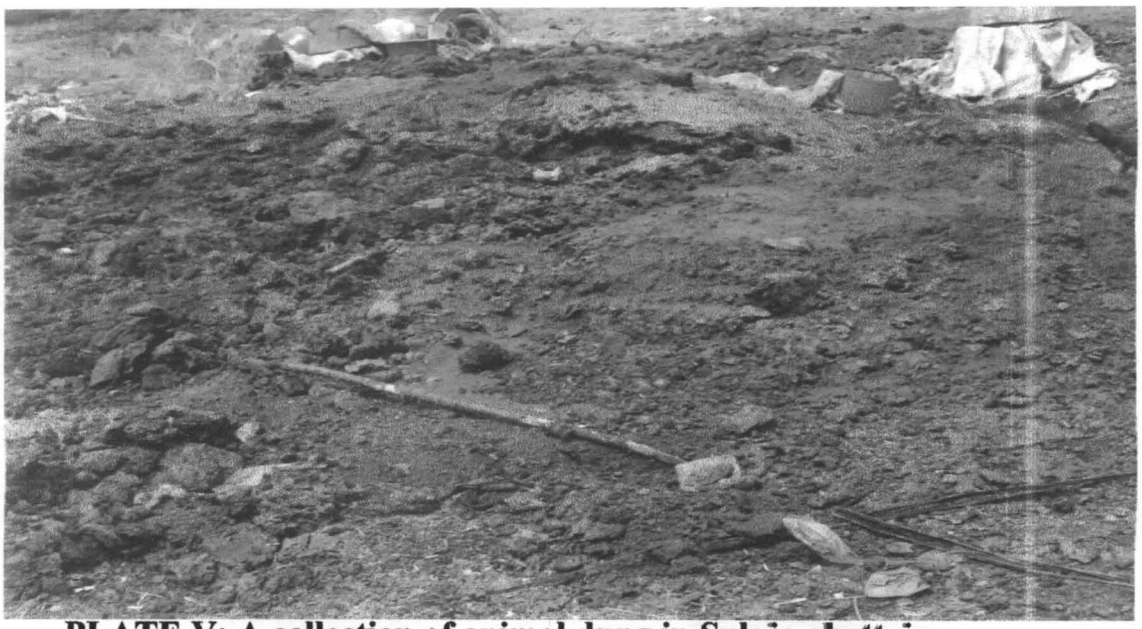

PLATE V: A collection of animal dung in Suleja abattoir
Source: Researcher's Field Data

4.3.8 BLOOD

In Minna abattoir, since there is no collection of blood for animal feed as practiced in Suleja abattoir, the largest liquid part of the blood is washed through the drainage across the fence while the dried part is swept and gathered up together with dung. ***"An average cow is known to produce up to 13.6kg of blood while a goat produces 2.2kg"*** – Thornton ***et al*** (1978). This estimation shows that there is a daily blood volume of 816kg from cows slaughtered and 88kg from slaughtered goats in the abattoir. The blood washed away should have been directed into a cesspool from where sanitary removal and disposal will take place. Allowing blood to flow freely across the wall into residential areas is dangerous because as a biological element, it encourages bacterial growth which may include pathogenic types that may be sources of disease occurrence.

In Suleja abattoir, blood flowing from the slaughter hall is washed into the drainage and together with the liquid part of the dung and other wastes

water flow across the abattoir wall. During the researcher's visit it is observed that some drums are filled with collected blood (see Plate VI) which are used as part of animal feed after boiling. Although the practice of blood collection before removal attracts flies, it helps in reducing the volume of blood which is more than 816kg for cows and 88kg for goats per day.

As in Minna abattoir, the biological nature of blood can encourage the growth of bacteria, some of which may be pathogenic and which may flow into the nearby river.

PLATE VI: Drums of collected blood in Suleja abattoir
Source: Researcher's Field Data

4.3.9 ANIMAL BONES, HORNS AND HOOVES.

Within the internal premises of Minna abattoir are groups of heaps of bones, horns and hooves that are collected as animal wastes (see Plate VII and VIII). The researcher was told that bones are bought by poultry farmers but that the demand has fallen since the outbreak of bird flu. All the bones, horns and hooves can be converted to some useful products if the facilities to do that are in existence. There is also the practice of setting the wastes on fire to

reduce the volume. This practice produces very disturbingly huge cloud of smelly smoke that posses a nuisance to the neighbourhood of the abattoir. Added to this is the danger of the accumulated wastes becoming hideout for rodents and dangerous reptiles like snakes.

Like in Minna abattoir, the above animal by-products are gathered up within the Suleja abattoir premises. But unlike in Minna abattoir, the volume of the by-products is smaller because, as the researcher was told, the by-products are bought from time to time by ceramic companies who recycle them into other useful products.

PLATE VII: A collection of bones in Minna abattoir
Source: Researcher's Field Data

PLATE VIII: A collection of horns in Minna abattoir
Source: Researcher's Field Data

4.3.10 TOILET FACILITY

When Minna abattoir was commissioned in 1990 there were in existence a number of water system toilets. The toilets have now ceased working because of system collapse. The workers and butchers now have to resort to going into the nearby bush to defaecate. This practice is inimical to hygienic rules because it attracts flies that may contaminate meat in abattoir and also produce offensive smell around the abattoir premises.

In Suleja abattoir, there is a provision for water system toilets but not functioning smoothly due to constant shortage of water.

4.3.11 CONDEMNED ANIMAL/MEAT

During the physical on-the-spot assessment of Minna abattoir a place designated for handling condemned animal/meat was identified. There is a decaying carcass, which is not properly burnt as a means of disposing off the condemned carcass (see Plate IX). There is fly infestation and offensive smell due to the presence of the decomposing carcass.

PLATE IX: Decomposing carcass in Minna Abattoir
Source: Researcher's Field Data

4.4 SOIL ANALYSIS

Since all the various types of animal wastes in abattoirs are dumped in and around the abattoirs, the soil is the first to be affected by the negative effects of the wastes before, by extension, human beings, food and water sources become affected. For a limitation, the researcher picked for study, through soil analysis, the nature of relationship between the animal dung and the soil and the consequences of this relationship to human beings.

Naturally, there are several chemical elements like Nitrogen, Potassium, Calcium, Magnesium, Sulfur, Phosphorus and so on in the soil that serve as nutrients to plants for their growth and ability to yield fruits or grains. In animal dung, some of these chemical elements are also found and also serve as nutrients to plants. The safety of the nutrients to human beings how ever depends on the quantity in the soil and the quantity required for a particular plant's needs. If the quantity of an element is quite higher than the plant's needs then there is the danger of excess accumulation of the element in the fruits, grains or tubers which can be consumed with some negative health effects to human beings.

The soil analysis of both Minna and Suleja abattoirs were carried out with a view to estimating the soil content of Nitrogen, Phosphorus and potassium. Some of these elements, although necessary for plants growth, could pose a health hazard to human beings if too high quantity of them is deposited into the soil through the animal dung.

Before going into the soil analysis let us study the usefulness of the three elements to plants.

a. **Nitrogen**

This element is important for producing rich green colour that is characteristic of a healthy plant. It also influences the quality of the plant's fruit and increases the fruit's protein content.

b. Phosphorus

It is necessary for the transfer of energy in plants and production of roots and seeds.

c. Potassium

This is important in offsetting the harmful effect of excessive nitrogen and also counteract the delay in ripening process of fruits.

As useful as these elements are to plants' growth and yield, they can also be injurious if too high in the soil and transferred into the fruit or grain.

4.4.1 SOIL ANALYSIS IN MINNA ABATTOIR

As pointed out earlier on, large quantity of animal dung is deposited in heaps within the abattoir premises. The largest land space within the abattoir is used for cultivating maize using animal dung as manure. The soil analysis is therefore carried out to estimate the soil content of nitrogen, phosphorus and potassium from the land used for maize cultivation. The intention of the soil test is also to determine the harmful effects of the elements if they are too high in the soil.

TABLE 4.3: SOIL ANALYSIS OF MINNA ABATTOIR

S/NO	ELEMENT	VALUE	REQUIRED QUANTITY
1	Nitrogen	97 Ibs/Acre	20 – 30 Ibs/Acre
2	Phosphorus	60 Ibs/Acre	20 – 30 Ibs/Acre
3	Potassium	145 Ibs/Acre	100 - 110 Ibs/Acre

Source: Researcher's Field Analysis

TABLE 4.4: SOIL ANALYSIS OF SULEJA ABATTOIR

S/NO	ELEMENT	VALUE	REQUIRED QUANTITY
1	Nitrogen	60 Ibs/Acre	20 – 30 Ibs/Acre
2	Phosphorus	46 Ibs/Acre	20 – 30 Ibs/Acre
3	Potassium	125 Ibs/Acre	100 - 110 Ibs/Acre

Source: Researcher's Field Analysis

TABLE 4.5: WATER ANALYSIS OF THE RIVER BEHIND SULEJA ABATTOIR

S/NO	ELEMENT	VALUE	WHO STANDARD
1	Nitrate	64.5 mg/L	50 mg/L
2	Phosphorus	11.3 mg/L	6.5 mg/L
3	Potassium	-	-
4	Coliform count	19 /L	0 /L

Source: Researcher's Field Analysis

CHAPTER FIVE

5.0 DISCUSSION, SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION.

The intention of this study is mainly to identify and compare the sanitation problems of Minna and Suleja Abattoirs including the dangers posed by such problems to man and environment and prescribing measures necessary to deal with the problems.

Chapter five deals with the discussion of results, draws up the summary of the research work, the conclusions based on the findings and recommendations made also on the findings, to deal with the situation.

5.2 DISCUSSION

As stated earlier, One Hundred copies of questionnaires each containing twenty questions were distributed to each of the abattoirs in Suleja and Minna. A total of Eighty questionnaires were completed and returned from Suleja abattoir while Ninety completed copies of questionnaire were returned from Minna abattoir. The responses to the questionnaires from the two abattoirs including the soil and water analysis from the two abattoirs are interpreted and discussed here under: -

5.3 QUESTIONNAIRE RESPONSES

5.3.1: Responses to which organization is responsible for wastes removal

The responsibility of removing wastes from abattoirs is primarily that of the Local Government that establishes the abattoir, 70% of respondents from Suleja abattoir have however indicated that both the Suleja Local Government and Non Governmental Organizations are involved in the removal of wastes. While 100% of respondents from Minna abattoir have indicated that it is only Minna Local Government that bears the burden of removing wastes from the abattoir. The responses may be the reason why Suleja abattoir appears neater

than Minna abattoir. This may also be because there are businesses that transform the wastes in to other useful products in Suleja.

5.3.2: Responses to methods of wastes removal

Wastes removal from Suleja abattoir is physically carried out using wheelbarrows according to 90% of respondents. While 100% of the respondents from Minna abattoir have made a similar declaration. The fact that wheelbarrows are mainly used for the removal of wastes from the two abattoirs, may be held as the reason for the poor sanitation in both abattoirs due to ineffectiveness.

The investigation carried out by the researcher indicates that apart from the crude Equipment in use the Local Governments are also grappling with the problem of inadequate qualified Environmental Health Officers.

5.3.3: Responses to frequency of wastes removal

The regularity of wastes removal from the abattoir contributes in the improvement of sanitation in abattoirs. 40% respondents from Suleja abattoir have indicated that wastes are removed on daily bases from Minna Abattoir. While 50% from Suleja abattoir also indicated the same. Considering the claims of daily wastes removals from the two abattoirs there should be very minimal sanitation problems. The continuous existence of sanitation problems may therefore be due to other factors that may relate to management problems.

5.3.4: Responses to whether the wastes removal method can ensure cleanliness

In Suleja abattoir 50% of respondents agreed that daily wastes removal is enough to ensure a clean environment while 60% of respondents from Minna abattoir have the belief that daily wastes removal is to ensure clean abattoir. Daily wastes removal should make the abattoirs clean. Many other factors therefore have to be considered in determining the cause of the sanitation problems in the abattoirs.

5.3.5: Responses on how to improve wastes removals

The suggestions on how to improve the effectiveness of cleaning from the two abattoirs are nearly the same. The 40% of responses from Suleja abattoir and 72% of responses from Minna abattoir are of the opinion that acquisition of more sophisticated Equipment will improve the cleaning efforts of the abattoirs. The similarities of responses here only indicate that the use of wheelbarrows are not enough in dealing with the removal of increasing volumes of wastes.

5.3.6: Responses on the improvement of wastes removal method

The possibility of having an improvement on the present wastes removal is supported by 50% of respondents from Suleja abattoir while 70% of respondents from Minna abattoir have also indicated the same. These responses are probably showing that having improvements in other factors other than daily removal of wastes may create an improvement in the cleanliness of the abattoirs.

5.3.7: Responses on the impact of cleaners

The impact of the cleaners on cleaning activities was assessed in the questionnaire. While 50% of respondents from Suleja abattoir are of the view that the cleaners are making very high impact 70% respondents from Minna abattoir agreed that the cleaners are only making some impacts. The differences in responses here may indicate the reason why general environmental cleanliness is better in Suleja abattoir than what obtains in Minna abattoir.

5.3.8: Responses to why there may be low impact from cleaners

The reason for low cleaners' impact in cleaning was seen by 40% respondents from Suleja abattoir to be due to lack of motivation of the cleaners while 50% of respondents from Minna abattoir also cited motivation reasons. The fact that half of the respondents from each abattoir have given lack of motivation on the part of the cleaners as the reason for low impact among the

cleaners, it is clear that low cleaners' performance may be due to lack of motivation which is contributive to the poor sanitary condition of the two abattoirs.

5.3.9: Responses to how to boost the cleaners' morale

The questionnaire responses regarding suggestions on how the cleaners' morale could be boosted show that 40% of the respondents, which is the highest from Suleja abattoir, indicated that procurement of modern equipment can boost the cleaners' morale while 70% of respondents from Minna abattoir indicated that increased salary to the cleaners can boost their morale. These responses show that salary increment may really boost the cleaners' morale because 30% of respondents from Suleja abattoir also support the view of salary increment to the cleaners as a morale booster.

5.3.10: Responses to adequacy of money for cleaning

Funding is one of the factors that ensures cleanliness in the abattoirs. But while 70% of respondents from Suleja abattoir say that funding is adequate, 40% of respondents from Minna abattoir say that funding is inadequate. Considering the fact that both the Suleja Local Government and Non Governmental Organizations are involved in the cleaning activities of Suleja abattoir, it would not be surprising to have more funding there compared with Minna abattoir where only Local Government, which is also not serious with the abattoir's cleanliness, is involved.

5.3.11: Responses to regularity of funding

On how regular funding takes place in the two abattoirs, the responses indicating the regularity of funding from Suleja abattoir are 80% while 70% respondents from Minna abattoir are of the opinion that funding is grossly irregular. The responses to the adequacy of funds as analysed in the above question (5.3.10) the should not be surprising. The regularity and irregularity of funds in Suleja and Minna abattoirs respectively can then be considered as

the reasons for a better cleanliness in Suleja abattoir and a dirtier condition in Minna abattoir.

5.3.12: Responses on whether regular funding can ensure cleanliness

Adequate and regularity of funds are not the only factors that ensure cleanliness in abattoirs. 60% of the respondents from Suleja abattoir believe that adequacy and regularity of funds can ensure abattoir cleanliness while 70% of respondents from Minna abattoir supported this too. The close similarities in the responses from the two abattoirs go to show that adequate and regular funding backed by proper utilization can ensure cleanliness in abattoirs.

5.3.13: Responses to how funding may be regularized

Suggestions were requested as to how to regularize funding where it is found to be irregular. From Suleja abattoir only 11% responses were received suggesting that funding be once every two weeks while 70% of responses from Minna abattoir suggest funding once every week. The responses above may be considered appropriate because a large percentage of respondents from Suleja abattoir had earlier indicated that funding is regular. So if only 10% of respondents are suggesting that funding be made once every two weeks it should not be a thing of concern. The 70% responses from Minna abattoir calling for weekly funding is also not surprising if one considers the earlier responses that funding is grossly irregular in Minna abattoir.

5.3.14: Responses to source of finding

The source of finding, according to 70% of respondents from Suleja abattoir is from the Local Government and Non Governmental Organizations while 90% of respondents from Minna abattoir have however indicated that funding only comes from the Local Government. The two responses can not be faulted if one considers the general better cleanliness of Suleja abattoir in comparison with the general dirty condition of Minna abattoir.

5.3.15: Responses to availability of equipment for cleaning

It is one thing for funding to be adequate and regular and it is clearly another thing to also have materials/equipment available for cleanliness. Suleja abattoir has 70% of respondents who agree that materials/equipment for use are available while a corresponding 70% of respondents from Minna abattoir are of the belief that the equipment/materials for work are not available. Although the earlier analysed responses have shown that wheelbarrows are widely used in the two abattoirs, it is possible that wheelbarrows are negligibly few in Minna abattoir.

5.3.16: Responses to sufficiency of available equipment

The following reactions were also recorded as. 70% respondents from Suleja abattoir believe that the materials are not sufficient while 50% respondents from Minna abattoir indicate that the materials are grossly insufficient. The fact that sanitation problems exist in Suleja abattoir. justifies the claim by the respondents that the materials are not sufficient even though the environment is better than that of Minna abattoir. The responses from Minna abattoir that the materials are grossly insufficient is also justified if one considers the worst environmental condition of the abattoir.

5.3.17: Responses to the effectiveness of equipment

There should not only be sufficient materials for use in the abattoir but such materials should equally be effective. In reaction to the aspect of the questionnaire 90% of respondents from Suleja abattoir indicate that materials are not effective enough while 50% of respondents from Minna abattoir agree that the materials are grossly ineffective. The percentages of responses from the two abattoirs are almost the same in number and opinion. The similarities may therefore account for the existing poor sanitation in the two abattoirs among other possible reasons.

5.3.18: Responses to why the equipment may be ineffective

The questionnaire went further to find out why the materials are ineffective. In responses to this the following percentages of responses were

recorded 70% of respondents from Suleja abattoir show that the materials are ineffective because they are not appropriate materials while 60% of respondents from Minna abattoir indicate that the materials are obsolete. The overwhelming responses from the two abattoirs are almost the same in both percentage and opinion. 70% and 60% are very close measurements, inappropriate and obsolete materials call for the same solution-procure new materials/equipment that will serve time and purpose.

5.3.19: Responses to the number of Cows slaughtered

The number of cows slaughtered daily is higher in Suleja abattoir with 90% respondents indicating that over sixty cows are slaughtered daily while 60% of respondents from Minna abattoir indicate that between 40 and 60 cows are slaughtered daily. The implication of these variables are that more water will be required for cleaning purposes in Suleja abattoir than Minna abattoir. More personnel for cleaning and cleaning materials/equipment will be needed more in Suleja abattoir than in Minna abattoir. In addition, the variables also indicate that if not for the removal of certain types of wastes by manufacturing companies and local farmers, the volume of existing wastes in Suleja abattoir will be much higher than that of Minna abattoir.

The number of animals slaughtered is confirmed by the records of daily slaughters kept by the veterinary officers.

5.3.20: Responses to the number of goats slaughtered

Suleja abattoir also records the higher number of goats slaughtered daily with 80% of respondents indicating between 30 and 40 slaughters daily compared with 60% respondents from Minna abattoir that indicate between 10 and 20 slaughters daily. The two variables in the number of cows and goats slaughtered daily, among other benefits, also show the differences in the volume of various types of waste daily generated.

5.4: RESULT OF SOIL ANALYSIS FROM MINNA ABATTOIR

The soil analysis results from Minna abattoir (see Table 4.3) indicate that nitrogen, which represents the final product of the biochemical oxidation of ammonia, is in high quantity. This may be a direct result of the application of animal dung on the land as a fertilizing agent. The hazard here is that excess nitrogen will be stored in the maize grain, the process known as ***biomagnification*** D.B Botkin et. al. (1997). The consumption of maize with such high concentration of nitrogen causes ***Methemoglobinaemia*** or ***"Blue Babies"*** Salvato, (1982).

The results also indicate soil increases of both phosphorus and potassium. These increases may also be linked to the heavy use of animal dung as manure on the maize farm. Even though high levels of phosphorus and potassium have the potential effects of lowering the negative effects of excess nitrogen, the measured soil content of the three elements are too high for maize requirement. This is because, ***"For an average yield in maize cultivation per acre, the nutrients removed by crops are nitrogen 32 Ibs/acre, phosphorus 18 Ibs/acre and potassium 35 Ibs/acre".*** (International Institute of Tropical Agriculture, Ibadan, Nigeria, Manual Series No. 1.)

5.5: RESULT OF SOIL ANALYSIS FROM SULEJA ABATTOIR

Just like in Table 4.3, the Soil analysis from Suleja abattoir (see Table 4.4) also indicate increases in the soil content of all the three elements. The difference is only that the increases in Table 4.4 are lower than those of Table 4. 3. The reasons for the difference may be because:

a. The land behind the Suleja abattoir wall where the animal dung is deposited slopes towards a river as has been pointed out earlier. The sloping nature of the land may have increased the leaching of the elements from the soil towards the river. The surface run-off of rain water is another factor that is likely to increase the flow of the elements towards the river.

b. While the nature of soil in Minna abattoir is loamy, the nature of soil in Suleja abattoir is sandy. This type of sand usually always allow easy flow of nutrient from one part of the soil to the others.

c. The fact that farmers come to the abattoir to collect the animal dung of their farms as manure, this prevents the high accumulation of the dung in Suleja abattoir unlike that of Minna. This may also lead to smaller quantity of the elements in the soil.

If the quantity of the chemical elements flowing into the river through leaching or surface run-off is high there is likely to be some danger to human health and the environment. The stream water was therefore subjected to some analysis with the results shown here under: -

5.6 RESULT OF WATER ANALYSIS FROM SULEJA ABATTOIR

The results of the water analysis from the river behind Suleja abattoir (see Table 4.5) indicate a high presence of Nitrate and phosphorus in the water. Potassium is not reflected in the analysis because there is no current WHO Standard and its effect on health is very negligible.

The consumption of water with such high content of Nitrate can cause ***Methemoglobinaemia*** "***Blue Babies***". In addition, and as physically observed the high content can combine with Nitrate to cause the ***Eutrophication*** of the stream Botkin ***et. al.*** (1997).

Eutrophication is a situation in which the presence of nitrogen and phosphorus in a river cause heavy growth of algae and bacteria thereby reducing the oxygen content of the water needed for survival by other aquatic lives. This condition leads to the death of aquatic lives including fishes.

The result also indicate a high rise of coliform count. Coliform is a pathological micro-organism found in the intestines of both animals and human beings. A high coliform count in water is an indication of feacal contamination of human or animal source. The high coliform count here is probably due to the flow

animal dung in to the stream from the abattoir through leaching and run-off of ain water.

5.7 IDENTIFIED EFFECTS OF ABATTOIR WASTES ON THE PEOPLE

Although the effects of Nitrate (which was discovered in the soil analysis of both abattoirs) in form of methemoglobinaemia or "Blue babies" was not identified physically or through clinical records from both abattoirs, medical records from a Government Basic Health Clinic near the Suleja abattoir however indicated an earlier epidemic of Gastro-enteritis in 2003 which was suspectedly traced to the contamination of the stream near the abattoir.

The epidemic of Gastro-enteritis is a wide spread disease characterized by severe abdominal pains, diarrhoea, vomitting and general malaise. The medical records indicated that the disease occurred in the months of August to September, 2003. This was the period when there was acute shortage of pipe borne water in this community of Suleja. Many people in this community had to resort to the use of stream water for both drinking and other domestic uses.

The months of August and September are rainy season period which might have encouraged the washing of animal dung containing probably higher volume of coliform micro-organisms in to the stream. The medical records examined indicated that 27 adults, both male and female and 43 children also of both sexes were affected by the epidemic. The difference in the age morbidity of the out break may be due to the higher body resistance to disease by the elderly than the children.

Although no analysis of the stream water was carried out to confirm that the 2003 epidemic of Gastro-enteritis was as a result of the contamination of the stream water by the abattoir wastes, high number of the coliform count recorded in this project analysis goes to reveal the possibility of the existence of a long term contamination of the stream water by coliform organisms.

5.8 SUMMARY

The study was carried out by drawing up questionnaires with twenty questions. One Hundred copies of the questionnaires were sent to each of the two abattoirs. The researcher also embarked on physical on-the-spot assessment of the two abattoirs and in addition had personal interviews with the employees, butchers and animal owners in the abattoirs. The responses to the questionnaires, personal interviews and the physical assessment revealed the nature of the problems, the causes of the problems and likely dangers of the problems. These revelations also offered the researcher the opportunity of suggesting measures necessary to deal with the situation.

5.9 MAJOR FINDINGS OF THE STUDY.

The major findings of the study include:-

1. A display of lack of seriousness on the part of the Local Governments whose duty it is to maintain the two abattoirs. This fact is relevant considering the questionnaire responses and the few number of environmental health personnel available to the two Local Governments. All the efforts of the researcher to have audience with the chairmen of the two Local Governments was not possible.
2. Modern sanitation implements and equipment that are necessary to ease sanitation work are lacking.
3. Adequate water, which is one of the main requirements of an operational abattoir, is not guaranteed in the two abattoirs.
4. The butchers who make fire with old tyres for roasting goats in the two abattoirs are not aware of the health hazards of the black cloud of smoke that permeate the whole abattoir environment.
5. The two abattoirs are also badly funded leading to ineffectiveness in most of the activities dealing with sanitation.
6. Abattoir wastes of different types and hazards are carelessly deposited every where in and around the two abattoirs.

5.10 CONTRIBUTION OF THE STUDY TO KNOWLEDGE

The outcome of the study has revealed that nitrogen contained in animal dung is deposited in excess quantity on the soil used for farming. The study has also shown that the high quantity of nitrogen flowing into a river has potentially damaging effects on the water and aquatic life of the river.

5.11 IMPLICATIONS OF THE MAJOR FINDINGS

The findings of this study imply that as human population increases, need for increased different foods also increases, creating increased problems of different wastes that must be eliminated. A concerned, honest, focused political leadership and an enlightened followership need to be entrenched to ensure an environment that is supportive to living.

5.12 CONCLUSION

The study has indicated that the two Abattoirs have sanitation problems with environmental and health implications. The study further revealed that certain necessary measures and policy decisions have to be adequately taken to ensure that the existing problems are dealt with and further occurrence is minimized, if not forestalled all together.

5.13 RECOMMENDATIONS

i. Composting of abattoir wastes

Where facilities and labour are available abattoir wastes can be turned into safe product to be used as manure after a few weeks of composting. Wastes are usually gathered up and solid parts like bones are sorted out. The wastes are then dumped into a pit or pits and allowed to decay under anaerobic bacterial action.

The wastes are later removed from the pit after some weeks. At this time the wastes have reduced in weight, dried, less smell and harmless. The transformed wastes are now ready for use as fertilizer. The bulk of the manure will depend on the volume of wastes generated at the abattoir and the size/number of existing composting facilities.

This method of dealing with abattoir wastes is also suggested by Pittaway, (2001). He suggested that up to 3 pits, the size of which will depend on volume of the wastes should be excavated. A layer 30cm of sawdust should be laid on the bottom floor of the first pit and covered with a layer of wastes. The sawdust will act as both liquid and odour absorber. In this manner the sawdust and wastes are arranged in the pit on daily bases. An estimated $33m^3$ of wastes was added to one pit with the final volume (including sand dust) only about $27m^3$ after about 8 – 10 weeks after the last waste is added. Delaying 8 to 10 weeks after the last waste is added before emptying the bay, should ensure that all waste is at the dry-decay stage (no fluid, minimal odour). Since the pits will be filled at different time and each pit taking up to 10 weeks before evacuation the pit will continue to be used one after the other.

When using composting pits in handling abattoir wastes adequate measures should be taken to avoid fly infestation and contamination of surrounding water sources. The people to physically handle the work should be provided with safety wears like hand gloves, face mask, boots and overral.

ii. **Waste water management**

Abattoirs need large quantities of water with which to operate and this in turn results in large volumes of nutrient-rich effluent being produced. This effluent is supposed to be collected into cesspools within the abattoirs and constantly evacuated. To avoid the dangers of the effluent to health and to the environment considering the lack of permanence in the function of cesspools in our abattoirs, the effluent needs to be handled in waste water treatment ponds. There are many industries that use waste water treatment ponds where anaerobic fermentation of waste water takes place. This water can be used to irrigate the land. The main problem here is that the technology is difficult to

maintain and costly to construct and in addition the effluent contains a high quantity of nitrogen and phosphorus which are hazardous to land.

Alternatively, a new technology introduced by Goopy, (2004) in dealing with waste water from abattoir can be used. The new technology uses biological methods to improve the quality of effluent discharged from abattoirs. The method involves the use of natural or man-made shallow lagoon. systems that utilize aquatic plants to "capture" nutrients and producing high quality water from effluent. Such systems are said to have been employed for cleaning treated and untreated domestic sewage in the United States and around the world. An added advantage of this technology is that the plants which are responsible for much of the nutrient being recovered, can be harvested to provide a valuable service of animal food. But like the waste water treatment plant, this technology also has the problem of ability to deal with effluents with very high nutrients and other pollutants such as fats and suspended solids which are present in animal production systems.

iii THE NEED FOR PUBLIC – PRIVATE PARTNERSHIP

Depending on size, the management of an abattoir is not a small and easy enterprise. In Nigeria, local governments are mostly vested with the responsibility of managing the abattoirs. Since every local government has wide areas of responsibilities to the people the financial and managerial burden of managing the abattoirs become unbearable to the local governments. This brings about the existence of abattoirs with dilapidated infrastructures, disgusting sanitary conditions, poor environmental safety and very low level of guarantee for the wholesomeness of meat products.

One of the options in ensuring a standardised management of abattoirs is to engage in Public – Private Partnership. In this arrangement the local government can enter into a mutual business agreement with a company or a group of companies for profit making partnership. Most of the animal wastes generated from abattoirs can be transformed into economically useful

materials. The companies to be invited for partnership may be engaged in handling animal dung, blood, skin, hooves, horns and so on and converting them to some other uses or act as intermediaries in selling the materials to the industries that convert them to other uses. One of the companies may also engage in the general cleanings of the abattoir.

The local government will provide the land. And all the remaining requirements like skilled and unskilled man power, training, finance, equipment, transport and so on will be provided based on mutual agreement and percentage of profit to be derived by each of the stakeholders. Each stakeholder's profit will be determined by the level and technicality of contribution. When an enterprise is managed by a group of organizations with profit interest in mind there is every possibility of success in the operations of the enterprise.

Public – Private Partnership was used in Agra, India, in 2001. A new modern abattoir was built by the Agra Municipal Council. Much of the investment in land, plant and machinery was made by the Agra Municipal Council with little monetary contribution from Indian government. At the completion of the project the Agra Municipal Council realized that the knowledge and skill required for successful operation and maintenance of such a sophisticated facility were not available in-house. The existing Municipal workers are trained for delivering public health and sanitary services and not for running an industry on profitable lines. Moreover, the plant capacity was found to be much higher than the requirement of the local market.

It then downed on the Agra Municipal Council that to run the abattoir complex well there must be veterinary doctors, labourers, butchers, operators, supervisors, electricians, mechanics and so on Other requirements include Maularis (priests) to perform religious rights and putting in place a managerial out fit that would ensure the running of the entire abattoir complex in accordance with the rules and regulations.

Realizing the inability of the council to provide all the requirements, bids were invited for leasing out the plant for 10 years. The winning bid came from M/S Frigorifico Allana Ltd of Mumbai which is one of the leading meat exporters in the country. Based on the agreement 30% of the plant capacity was given to small scale butchers/meat traders for meeting local requirement of the city. The local small scale traders would be allowed to bring their own animal and get them slaughtered on payment of a certain agreed fee.

iv **CREATING HEALTH AND LEGAL RIGHT AWARENESS**

There should be a means of creating awareness among the butchers, abattoir employees and the general population particularly those close to the abattoir about the dangers of various types of animal wastes within the abattoir premises and liquid wastes flowing out of the abattoir premises. There should also be a provision in our penal code that will give a right of protest or show of grievances in form of civil action by people affected by the negative effects of abattoir wastes. This legal option can be pursued by the concerned people until they receive justice.

This type of civil action, as reported by Nema, (1997) was once taken by the people in Agra, India, when Yamuna river was severely polluted due to the combined discharges of sewage and effluents from industrial and trade activities from the cities of Delhi, Faridabad and Mathura. The civil action was pursued by the people up to the India's Supreme Court where directive was given to the Agra Municipal Corporation to take all the necessary steps to prevent the pollution.

v. The laws dealing with environmental sanitation should be updated and fines charged to be increased as to be commensurate with the severity of the offences committed. Environmental Health Officers should also receive adequate training to enhance their professional capability.

ONS FOR FURTHER STUDY

i. The chemical components of burnt tyre smoke and debris and their effects on health.

ii. Abattoir sanitation in Nigeria, the role and limitations of Environmental Health Officers.

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