GUSAU OIL MILL, GUSAU:
ARCHITECTURAL CONSIDERATIONS TO HYGIENE IN INDUSTRIES

BY

AKINSOLA ADESOLA

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DECLARATION

I, Akinsola Adesola of the Department of Architecture, Faculty of Environmental Design, Ahmadu Bello University hereby declare that this thesis work has been a personal academic undertaking under the supervision of Arc. Sagada of the Department of Architecture, Faculty of Environmental Design, Ahmadu Bello University, and that all quotations and other information utilized have been duly acknowledged by means of references.

A. Akinsola — 3/11/98.

Student's Signature — Date

CERTIFICATION

This thesis entitled Gusau Oil Mill, Gusau Nigeria (Giving architectural consideration to hygiene in Industries) meets the regulations governing the award of the degree of Master of Science in Architecture, (M.Sc. Architecture) of Ahmadu Bello University and is approved hereby, for its contribution to knowledge and literary presentation.

S.S. Tulpule — 02/11/98
Chairman, Supervisory Committee — Date

M.L. Sagada — 2/11/98
Member, Supervisory Committee — Date

M.H. MUKHTAR — 4/11/98
Member, Supervisory Committee — Date

Head of Department — Date

Dean, Postgraduate School — 22/07/99
Date

DEDICATION

This thesis research is dedicated to God Almighty, my beloved parents; Chief M.A. Akinsola and Mrs. E.A. Akinsola, my brothers and sisters and every member of my family.

ACKNOWLEDGEMENT

To God be the glory for all He has done for me. I thank God for everything.

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ABSTRACT

Nigeria produces cotton seed and groundnut in abundance, especially in the northern part. This project "Gusau Oil Mills" aims at designing a factory for processing these oil seeds. In the process of doing this, more products will be realized and wastage will be minimized. The sub topic is "Architectural considerations to hygiene in Industries". This has to do with ventilation, waste disposal and workers' welfare. A conducive environment promotes productivity as we11 as safety.

This research work touches industrial hygiene, sources of hygiene problems namely chemical, air, machines, micro-organisms, wastes and storage. Control principles are ventilation, substitution and Isolation. Other factors are industrial stress, first aid, waste disposal and industrial comfort.

For a better understanding of the problem, analysis of existing oil mill was carried out and attention was focused on hygiene considerations. The production processes are seed cleaning, delinting and decortication for cotton seeds, crushing of groundnut, solvent extraction, cooking or frying, pressing, refining and packaging.

Different units in oil mill are mentioned in this research work; they are main production hall, raw material and finished product stores, solvent extraction units, refinery, workers' facilities and administrative block. Also, the

economic survey of Gusau and site description are mentioned.

Finally, a full description of the main raw materials (cotton seed and groundnut) is given. This includes the seasons of harvesting and planting, diseases and pests, water, soil type, transportation, storage, and precautions.

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CHAPTER ONE

INTRODUCTION:

The Colonial era left Nigeria with few industries which were basically sheds for the primary processing of agricultural produce such as palm fruits, cotton and cotton seeds, cocoa and others. Full processing industries sprang up in 1975 when the oil boom started to have its impact on the economic development of this country.

Industrial set-up helps in developing the economy of any area. In this case, agricultural products are used up, refined, preserved and transformed into other useful things to avoid wastage due to lack of storage facilities. This project gives a special consideration to groundnut and cotton seeds. They are oil seeds.

The oil mill is proposed to press extract and refine cotton seeds and groundnut for domestic market and subsequently international market. Zamfara state, especially Gusau produces groundnut and cotton seeds in abundance. The proposed oil will take up these raw materials and then give consumable oil in returns, thus creating job opportunities and progress for the people within that area and nearby places.

Cotton seed which would have been used for the production of several items is eaten up by animals; the same way groundnut is eaten up by human beings. The mechanical vegetable oil production system helps in the production of

margarine, soap, animal feeds and oil.

The traditional women are trying their best to produce oil locally with groundnut but the compressive strength they are applying to squeeze oil out of the seeds is low. At the end of the day, oil and groundnut cake will be produced with no soap, no margarine and no animal feeds.

The subtopic is "Architectural considerations to hygiene". Hygiene has to do with well-being of workers in an industry, protection from hazards and injuries comfort and waste disposal. Hygiene design considerations are ventilation, zoning, facility design, storage, waste disposal, fire and safety and landscaping.

1.1 MOTIVATION

Nigeria is one of the largest producers of groundnut and cotton seed in the world. In Nigeria, Northern part is the major production zone. Zamfara State, Kaduna State, Katsina State, Sokoto State, Kebbi State Kano State are the major areas.

The following are the motivating factors:

The desire to get maximum benefit from cotton seed and groundnut to reduce local wastage.

To supplement the non-effective and non-hygienic traditional system with a very effective and hygienic mechanical system.

To encourage the production of other items like soap, margarine and animal feeds.

To support the agricultural and industrial development of this country.

1.2 AIM AND OBJECTIVES

To uncover the advantages of mechanical means of producing vegetable oil over the traditional method. In this case, more products will be realized.

To evolve physical structures that will house machines, human beings and materials comfortably.

To harmonize the industrial environment with the community and the natural setting.

To design architectural solution to hygiene problem and then identify the suitable architectural planning that will suit the purpose of hygiene as regards comfort, safety, good sanitary condition and waste disposal.

1.3 DESIGN SCOPE

The design work has three units. Administrative unit consists of staff offices, account section, marketing section and personnel department.

Production unit consists of the main production hall, extraction section refinery, storage and packaging.

Workers' facilities consist of changing section, cafeteria and clinic.

Engineering services consist of workshops and waste disposal facilities.

1.4 METHODOLOGY

For this research work, magazines, textbooks and related thesis work were consulted. Oil mills and ginneries were visited. The managing director, production manager, marketing manager and admin manager of oil mills were interviewed.

1.5 CONSTRAINTS

Photography and data collection were the main constraints of the research work. Staff and owners of these oil mills gave limitations on the level of information. Photography is fobbiden, some of them were not ready to release the site plan of their industry when the research was going on. To take the photographs of the rural women involved in the traditional method of product is not always easy.

CHAPTER TWO

LITERATURE REVIEW

2.1 SITE SELECTION

For every site, there is an ideal use and for every use, there is an ideal site.

J.O. Simonds (1961) says "if we as planners are concerned with wedding a proposed function to a site, let us first besure that the parties are compatible. We have all seen structures or group of structures that seem foreign to their site. No matter how excellent these structures or how well contrived their plan, the total result is disturbing and unpleasant". This shows that every site should have a well defined function. It would seem obviously foolish to site a shopping center without adequate parking space, a farm without a source of water, a new fabricating plant with no room for storage or expansion, a residential building within the industrial estate or a tannery within the residential area.

2.2 INDUSTRIAL PLANNING

Industrial planning has to do with the relationship between industrial area and human settlements and ways of protecting the environment from environmental problems like pollution and hazards.

Planning with respect to the shape, size, and height of industrial plants (machineries) is very important. This will help in the determination of areas to be reserved for industrial development unit by unit.

There is the assurance that a plant will not become obsolete too soon, since science and technology advance rapidly.

Harmonizing every structure and facility with good landscaping using plants and other landscaping elements is another factor. The word 'harmony' is very important.

Zoning plays a very important role in industrial planning. Example is to separate the noisy area from the quite area e.g. Administrative block should be separated from the production hall.

2.3 TYPES OF INDUSTRIES

i. Light duty industries

ii. Medium duty industries

iii. Heavy duty industries.

i. Light Duty Industries

These are small scale industries such as simple workshops like craft workshops, repair workshop, small shoe manufacturing workshops, machine workshops, bench workshop and others. Industrial buildings where operational demands place few demands on structural frame or floor.

ii. Medium Duty Industries

This has to do with batch production where process and supporting services imply some demands on design of building structure, shape and floor, allowing potential flexibility of production and layout. Examples are bottling company, large scale food processing industries, paper mills, textile industries and other.

iii. Heavy Duty Industries

This type of industry is concerned with large scale batch or mass production systems which have intensive demands for overhead production, environmental service, materials handling and floor of good strength with some heavy machineries. Examples of this type of industry are oil mills, automobile industries, iron and steel industries and so on. In this regard, heavy duty industries require machineries of high level of power demand.

So this project (Gusau oil mill) falls under heavy duty industries.

2.4 BASIC REQUIREMENTS OF INDUSTRIAL BUILDINGS

i. Different engineering approaches due to the use of large amount of water, heat consumption in some cases, noise and the release of corrosive substances like gas, smoke, dust and effluent.

ii. Industrial processes are complex, engineering services and material handling are the basic things that may influence the choice of layout and structural components as well.

iii. Health, safety and comfort of workers are to be considered in the conception, designing and erection of industrial buildings. Here, space allocation comes in. Each worker should have enough working and circulation space.

iv. Structural components of industrial buildings carry dynamic loads which may be imposed by materials, equipments like cranes and conveyors, pressing plants, power plants and others. Vibration may affect these material or may constitute a health hazard. So source of vibration should be isolated from the principal building components.

v. Lighting and ventilation are very important design elements.

2.5 HYGIENE

Hygiene goes beyond good sanitary condition. It covers some other areas like the well-being of workers, state of being free from contamination and hazards, comfort and safety.

The Advance learner's dictionary of current english by A.S. Horuby defines hygiene as the science of, rules for healthy living, cleanliness, free from disease germs.

W.R. Awen, D.M. Ellis and W.A. Hart (1976) define hygiene as health protection, well-being of people both in the place of work and in the community.

D.G. Clayton and E.F. Clayton (1991) define hygiene as an approach to the problems of occupational diseases and the health of industrial employee. So hygiene has to do with cleanliness, good sanitary condition, safety, comfort and carefulness.

An industry is the branch of trade or manufacture, contrasted with the distribution and commerce. Industrial hygiene has to do with good sanitary condition in an industry, prevention from chemical and physical hazards, comfort and total well-being of workers and the inhabitants around.

2.6 HISTORY OF INDUSTRIAL HYGIENE

The history can be said to begin with hippocrates who in the fourth century B.C. recognised and recorded the problem of lead toxicity in the moving industry.

About 500 years later, the elder plan commended on the hazards involved in handling lead and silver and then devised a crude face mask for persons working around large quantities of dust and lead fumes.

In the second century A.D., the Greek physician Galen wrote at length on occupational diseases, recognizing the dangers of acid mists to copper miners.

Ulrich Ellenboy (1473) published a pamphlet which discussed toxic fumes and vapors and ways of coping with them.

In the following century, Georgills Agricola's De Re Metabolical published a 12 part treatise which described ruling accidents, offered suggestions for mine ventilation and protective masks for miners and discussed silicosis, a lung disease caused by inhaling silicon dust.

Other note worthy treatises of the Renaissance and its immediate aftermath include those of parancelsus (1567) and Bernado (1700).

During the eighteenth and nine tenth centuries, industrial hygiene became of increasing interest.

2.7 THE COMBINED INDUSTRIAL HYGIENE AND MEDICAL SURVEY

W.P. Shepard (1977). The Combined industrial hygiene and medical survey is the most comprehensive of all industrial hygiene surveys. The kind of investigation includes studies of individual workmen by medical technicians and physicians. It may include bacteriological and parasitological studies as well as physical, X-ray and other physical medical examinations.

2.8 SOURCES OF HYGIENE PROBLEMS IN FOOD PROCESSING INDUSTRIES.

There are two main sources of hygiene problems

Natural sources

Artificial sources

i. Natural Sources

Air

Air is a natural phenomenon that is always in constant motion. In its natural state, it is not harmful but it could easily be contaminated and polluted, then it is harmful.

Air is polluted when poisonous gases like cartonmanoxide and smokes are released into the atmosphere.

Air borne contaminants are noise, heat stress, radiation produced by machineries, electric power generating plants, dry ovens, toasting ovens, associated with chestpain, cough, shortness of breadth, respiratory incitant, eye problem and soon.

Micro-organisms

Micro-organisms and biological contaminants include virus, fungi, moulds, bacteria, nematodes, and mites. In food processing industries, one will always find these contaminants in cool areas like the surrounding of cooling towers, damp-organic materials, plants, animals and insects.

ii. Artificial or Man-made Sources

Storage

Poor storage of any material could lead to hygiene problem. For example poor storage of fish can pollute the whole environment and poor storage of hexane, in the solvent extraction unit of the oil mill can lead to explosion resulting into fire hazards.

Chemicals

Some of the chemicals used and produced in food processing industries are hazardous, poisonous and highly flammable. So some of them are sources of hygiene problems.

Examples

(a) Hexane that is used in the solvent extraction unit of oil mill can burn the whole industry down if care is not taken

(b) Caustic soda (alkali) used in the neutralization of vegetable oil can harm the consumers if it is too much in the oil.

(c) Lactic acid produced in the milk industry is injurious.

Waste Products

The dumping of hazardous wastes has been a threat to environmental quality and to human and wild life. this happens through direct contact with the materials either

ground subrace run off or by leaching of the waste into drinking water.

Wet waste products like the waste from fruit juice processing industry, vegetable oil industry, canned food industries can produce micro-organisms and biological contaminants like virus, fungi moulds and lactorrhea. These contaminants can easily spread diseases. Any solid or liquid particles dispersed in the atmosphere in the form of waste such as dust, and ash can yield a toxic effect.

Machines

Food processing industries make use of different machineries like the vegetable oil industry has refinery plant, solvent extraction plant, pressing plant, effluent treatment plant, cocker and so on. These machineries have heating and cooling systems. Some of them produce heat that is too high for human beings to withstand without proper ventilation. Without proper ventilation, this could cause skin rashes, eye problem, respiratory and mucous membrane irritation, objectionable headaches, sore throat and so on. This is not so serious in the admin area.

Some food processing industries use electric power generating plants, drying ovens, roasting ovens and boilers. Hygiene problems like chestpain, cough, shortness of Breath, respiratory irritant and eye problem are associated with the machines that are mentioned above.

Design Elements

i. Poor or wrong location

ii. Lack of ventilation

iii. Poor drainage system (acid-resistant drains)

iv. Inconvenient access and passages

v. Poor fire and safety considerations

vi. Poor space allocation and planning

vii. Poor facility design.

All these can add to hygiene problems.

2.9 INDUSTRIAL ACCIDENTS

F.H. Tyrer and K. Lee (1985) have defined accident as an unexpected, unexplained occurrence which may involve injury.

The types of accident are fatal accident, major injury accident, dangerous occurrences and others. Fatal accidents should be reported if they arise out of or in connection with work whether the person who dies is employed or not. A major injury involves fracture of the skull, spine or pelvis, fracture of any bone, amputation of a hand or foot, loss of sight and any other injury which results in the person injured being admitted in the hospital for more than 24 hours, unless that person is detained only for observation. The data that shows the percentage of industrial accident says that handling takes 27%, machinery 17.5%, persons falling 19.7%, striking against objects 9.0%,

transport 8.2%, struck by falling objects 7.2%, hand tools 7% and others 9.3%.

To prevent accident, everybody should understand that man is fallible and machinery can go wrong; it is better to recognize the inevitability of these weaknesses and attack them than to regard accidents as inexplicable arrangements of fate. So, engineers should have some basic training in industrial hygiene. Certain tasks may need certain abilities or standards of fitness and appropriate medical selection is needed. Safety performance will be improved by training and job experience, it will be improved by training and job experience, it will be impaired by fatigue, illness and alcoholism. Slower working pace at night in shift work gives greater freedom of movement and diminished danger from transport.

2.10 INDUSTRIAL STRESS

Industrial or occupational stress could be caused by physical and mental demands, but physical factors such as heat or physical work load are related to well understood physical stresses. In industries, stress may be made evident directly as illness of indirecting as absenttecism, accidents, conflicts and misjudegements. Stress may particularly occur at times of change when there is a need to adapt to new conditions. Large number of workers can be involved with major industrial changes and closures.

Stress could arise from over-stretching with too many demands either in quality or quantity, under-stretching and frustration, boring work, deprivation of work satisfaction or changes at work. F.H. Tyrer and K. Lee (1985).

2.11 CONTROL PRINCIPLES

1. Substitution Method: Replacing hazardous substances with less hazardous ones.

- Replacing a hazardous mechanical ventilation system with a non-hazardous machine or with the one that has a lower degree of hazard associated with it
- The disadvantage of this method is that one hazard can be replaced by another one, but equipments may be modified
- Replacing safety gloves or aprons with garments made of materials more impervious to chemicals being handled
- Replacing unguarded equipments with properly guarded machines.
- Substitution is an immediate response to an obvious problem and it is very effective

2. Isolation:- Installation of a physical barrier between a hazardous operation and the workers. e.g The use of air flow- to provide heating or cooling, to remove a contaminated air near its source of release to the environment. To dilute the concentration contamination

to acceptable levels, to remove the air exhausted from an enclosure, for the control of heat and humidity primarily for comfort reasons, prevention of fire and explosion maintenance of concentrations of airborne contaminants at acceptable levels in the work place.

3. Ventilation:- Provision of enough openings for fresh air to come in and used air to go out. This involves window and roof openings in the industrial buildings.

4. Design Elements

- Proper location
- Good drainage system
- Convenient access and passages
- Good fire and safety considerations
- Good facility design

5. Provision should be made for waste disposal

6. Good storage facilities should be provided

7. Workers should not fail to wear protective equipment where necessary.

2.12 INDUSTRIAL COMFORT

If a man has to learn and perform certain tasks successfully, his resources of adaptation should not be stressed by an unfavourable environment.

In 1922, vernon showed that in a group of munition workers, the accident rate was least when the temperature was 19.5°C (67°F). There was a 30 percent increase in the accident rate when the temperature was raised by 5°C (10°F).

Ventilation, lighting, working posture, instrument displays, communications, rest, meal breaks and good space allocation and outdoor elements should all be designed to reduce fatigue.

F.F. Tyrer and K.Lee (1985) "Good conditions will improve productivity as well as safety".

2.13 FIRST AID

This aspect takes into account the wide variation in hazards, work and location. The employer is required to provide adequate first aid facilities and suitable trained people to supervise them. The employed first aider should know how to control bleeding and treat unconscious patient. He should know the treatment of shock, dressing and immobilization of injured parts, contents of first aid boxes, treatment of injuries, burns and scalds and simple record keeping. He must be familiar with personal hygiene, safety and general hygiene, poisons and control of hazards and contamination. Instructors must be doctors or nurses with knowledge of first aid.

For any industry, first aid room should be made available. First aid boxes are also important.

Description of First Aid Room.

This room should be well ventilated, readily made, functional and not used for any other purpose, give easy access to transport, manited and cleaned daily with removal of all refuse. The room should be large enough for proper circulation of any type that has to do with health of workers. The room should be well designed and the needed facilities like sink, drawers cabinets, refuse- containers and others should be planned and provided.

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CHAPTER THREE

CASE STUDIES

INTRODUCTION

Case studies were carried out to study production processes;construction of buildings and the nature of oil mills. About nine oil mills were visited together with ginneries. Every unit of these oil mills was visited for a proper observation and understanding.

The following questions were forwarded to the senior staff of each oil mill.

3.1 QUESTIONS

1. When was the factory established?
2. (a) What are the main raw materials?
   (b) How do you get your raw materials quantity per day?
3. How many workers have you in your industry?
4. How many shifts have you?
5. What are the factors to be considered when an industry like this is to be located in x place?
6. What are the advantages and disadvantages of setting up an industry like this?
7. What are the sources of energy for the machines?
8. What is the production capacity of your industry?
9. How do you market your products?
10. How do you handle your effluent?

11. Storage

12. Hygiene consideration.

3.2 SUN SEED OIL MILLS, ZARIA

3.2 Locations This oil mill is located along Jos road, Zaria, Kaduna State.

3.2.3 Sources of Raw Materials

Procurement officers are at various states and local government areas that grow cotton seeds and groundnut. they are to buy these materials from farmers. These areas are Kano State, Katsina State Zamfara State Kaduna State and Jos.

3.2.4 Marketing

Positioning their products based on the available oil in the market

Availability of competing products will determine their own price.

Bulk sales only, based on market situation finished products are sold in Zaria and nearby areas.

Some are taken to Maiduguri and Kano

Some are exported to South Africa and India.

3.2.5 Structures

The administrative block, laboratory, clinic and by-products ware house are made of concrete blocks. But the production areas are made of concrete, steel, stanchion and administrative roofing sheet. The production area has tall buildings.

There are circulation spaces all over for trucks to move conveniently.

3.2.6 Units Within the Oil Mill

Administrative unit, production unit and services. Production unit consists of main production hall, extraction unit and refinery.

Services covers workshops of all kinds.

Administrative unit constitutes all administrative works. Some of the senior staff are the general manager, works manager, administrative manager, production manager, purchasing manager, marketing manager.

3.2.7 Hygiene Considerations

i. Good Sanitary condition in some areas but the production area is not well kept.

ii. Good sanitary fittings

iii. Fair landscaping around the administrative block for comfort and pleasure

iv. Fire control materials like fire extinguisher are available.

v. Recycling method for wash water, not just to be released anyhow.

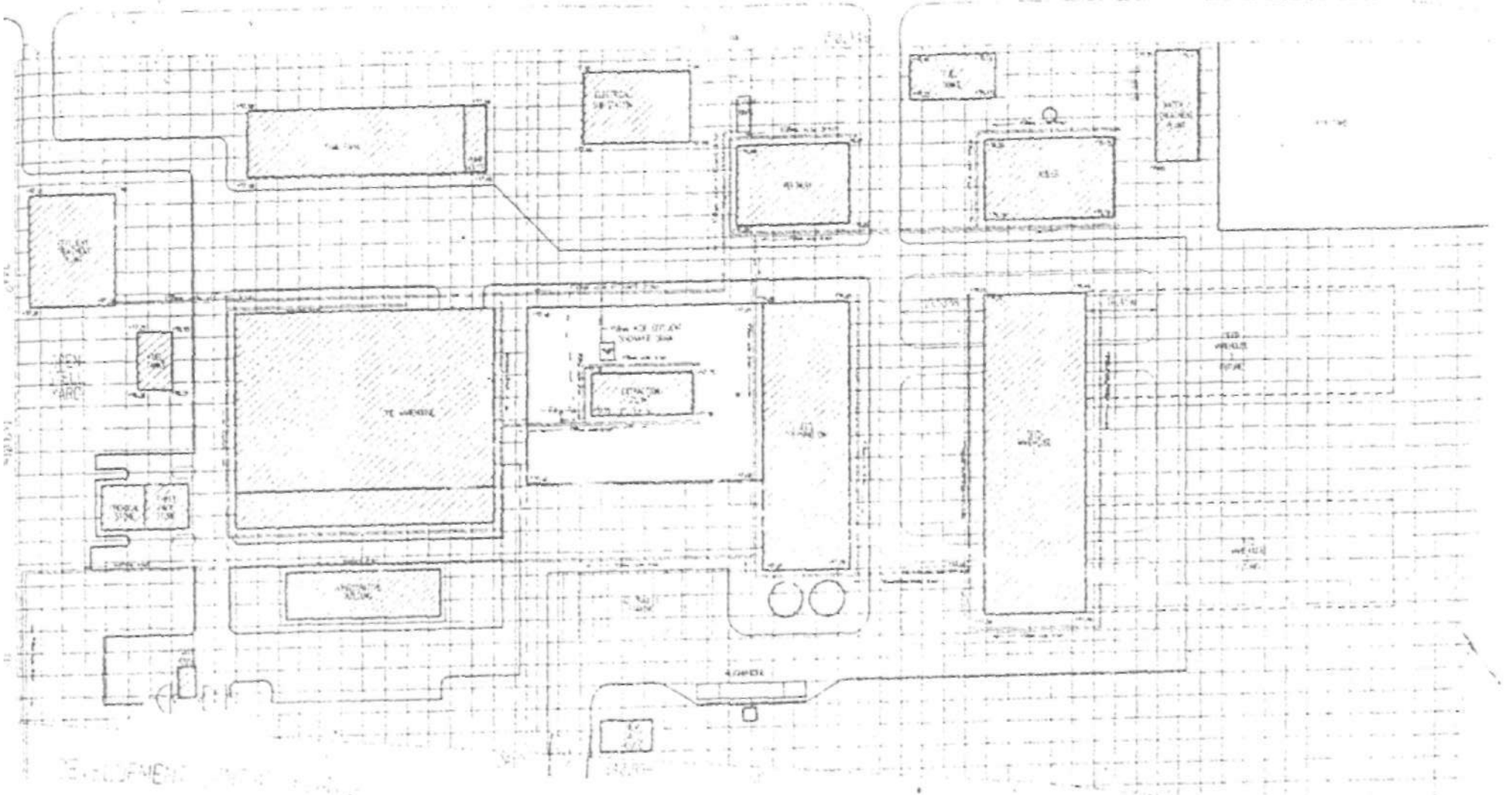
3.2.8 Merits

1. Good planning (flexible design)
2. Security and future expansion
3. Fair landscaping for comfort and pleasure
4. Ventilation and highting are okay for the purpose of hygiene
5. Fire control measures are considered in the system of planning and activities
6. Drainage is well done
7. Pipe line connection is made to protect the oil from insects and impurities
8. Clinic and laboratory are provided for hygiene and quality control
9. Provision of a standard effluent treatment unit and disposal of solid wastes.

Demerits

1. Parking spaces are not fully defined
2. No standard workers facilities like canteen and changing unit
3. No display unit for the finished products

SUNSEED OIL MILL



4. No standard mechanical and spare parts workshop

5. Production area is not so clean.

3.3 SHARADA OIL MILL, KANO

3.3.1 Location:- Located in Sharada Industrial Estate, phase III, Kano

3.3.2 Units

1. Administrative Zone: Constitutes a block of building with a caravan, gate house and parking area. Here, the administrative and management works take place
2. Crushing and refining areas: The crushing and refining areas are together to form another zone. At the same time, the seed storage facility, silo, together with open space storage (Pyramids of seeds) is very close to the crushing and refining hill.
3. The packaging is a separate building well located at the entrance of the oil mill. This makes loading of finished product easy.

3.3.3 Landscaping

There are few plants there but the landscape is not really encouraging. There is a tree opposite the gate house but grasses are all over the ground surface. The factory is well fenced.

3.3.4 Circulation

The factory has only one entrance or route. It serves the trunks, cars and even pedestrians. It's like transportation of goods are done manually. In the production halls, conveyors and elevators are used for the transportation of materials under processing.

3.3.5 Existing Structures

The existing buildings are gate house, caravan used as part of the offices, refinery, generator house, production hall, oil tanks, office block and fuel tanks.

3.3.6 Demerits

1. The factory is poorly planned
2. Landscaping is poor
3. Laboratory (for quality control) is too far to the production hall.
4. One access serves trucks, cars and pedestrians

Merits

1. Generator plant is well located at the extreme end of the site so as to reduce noise reaching the office block (hygiene consideration)
2. The industry has a good location
   (a) Accessibility
   (b) Within the industrial estate

3. There is room for expansion

3.4 BEREJI OIL MILL, KANO

3.4.1 Location

The oil mill is located along Magauda Road, Kano. It was established in the year 1972. The surface of the ground slopes towards the entrance, this will help in the drainage system.

3.4.2 Zoning

i. Administrative Area:- The administrative block takes the front part of the industry with covered parking space. The administrative block has a large reception area with a receptionist. Inside are offices for the manager production manager, marketing manager purchasing manager and production manager. The block takes a linear form.

ii. Production Area:- The production area constitutes different halls for different functions and the buildings are arranged. The decorticating area, pressing area extraction area, pelletisation area, fumigating area and refinery are all parts of the production area.

iii. Workers facilities:- The factory has time office, clinic, canteen and toilet blocks and changing unit (for workers).

3.4.3 Auxiliaries And Services With Storage

Workshops, storage facilities, Boiler house, water tank, cooling tower diesel generator house and other facilities are set up within the same area.

3.4.4 Structural Aspect

Walling Hollow blocks are used for the construction of ware houses (to a length of 2.1m from the ground level). Steel stanchion are used with aluminum cladding to the roof cave level. The clinic, admin block, canteen and laboratory walls are made of hollow blocks.

Flooring

The floors are made of concrete but the thickness depends on the activity that is taking place in each place. The concrete flooring for the production area has to be thicker than that of canteen or clinic.

3.4.5 Merits

1. Workers facilities like canteen changing rooms and clinic are highly considered. So hygiene, consideration could be seen here

2. The industry is well planned not just anyhow
3. The oil mill has good circulation and ventilation
4. Transportation and transfer of goods are highly considered
5. There are fire extinguishers for fire control (hygiene consideration)
6. Exits are well defined
7. The environment is clean (good sanitary condition)
8. Solid wastes are well kept for disposal

Demerits

1. Laboratory is located very far from the production area.
2. Staff and visitors' car parks are outside the factory
3. Poor landscaping

3.5 FUNTUA COTTON SEED CRUSHING COMPANY

3.5.1 Location

It is located within the industrial area, Katsina road, Funtua, Katsina State.

3.5.2 Zoning

The factory layout is in three zones

(a) Administrative Zone:- The off loading area separates the administrative block from the ware houses. Administrative block is mainly for administration. The

admin block takes linear form. There is a covered parking space in front of it.

(b) Production area and workshop: These two areas constitute another zone. A part from the refiners, the production area takes a big hall and that is all. The production areas and the workshop are together.

(c) Storage: Seed store is very close to the entrance of the factory, this makes off-loading easy. The entrance doors are 3m wide and 6m high, the seed store is the next to the production hall, taking the form of production sequence. The boiler house is closed to the production hall roofed with corrugated aluminium sheets.

3.5.3 Administration

The constituents of the administrative block are the personnel department which is responsible for the management of the company such as organisation and welfare of workers and the accounts dept for the purpose of purchasing raw materials and equipments sales of refined oil and bye-products

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3.5.4 Landscaping

The landscaping aspect is not so encouraging but there are trees and shrubs around. But the beauty of the word landscaping is not seen within the environment.

3.5.5 Transportation/Movement of Goods

The two main transportation systems are road and railway. They are for transporting raw materials and finished products as the case may be.

Fork lifts are used in the seed store for the arrangement of cotton seeds and groundnut. they are also used for carrying these raw materials in bags to cleaning room for processing.

3.5.6 Production, Storage and Marketing

The space allocated for production is separated from that of storage. The oil mill produces about 100 tones of oil per day and they market the oil through distributors. There is retail outlets for people of lower capacities.

3.5.7 Technical Services and Other Facilities

Mechanical workshop, spare part store, boiler room and generator room are within the production hall. There is no clinic within the premises and no special consideration is given to workers facilities. The refinery houses its own machineries together with the laboratory and despatch room. Outside the refinery are four tanks. One for crude-oil, two are, for semi-refined out and the fourth one is for the fully refined and de-coloured oil.

3.5.8 Hygiene Considerations

Zoning is fairly done, landscaping is not so encouraging, sanitary fittings are not so pronounced, no clinic within the premises but cyclone is there for sucking cotton dusts so that people will not be affected. Also process lines are always kept clean. Fire extinguisher are provided for fire control. The factory is doing her best to improve structurally and in the area of production and environmental development.

3.5.9 Demerits

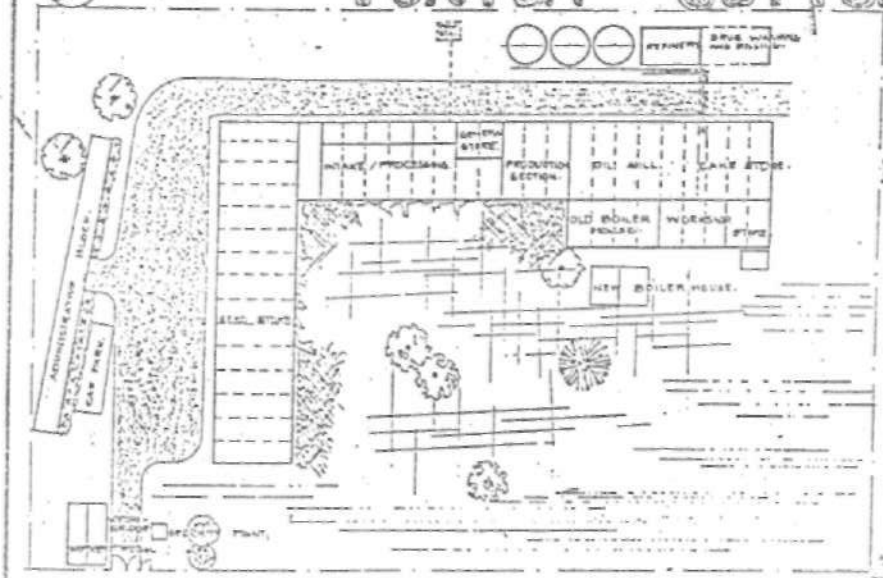
1. Poor lighting and ventilation in the production area
2. Landscaping is not so encouraging
3. No clinic and workers changing area are not well considered
4. No land for future expansion
5. Single unit for production processes except the refinery that is separated
6. No cafeteria for workers.

Merit

1. Simplicity
2. Accessibility
3. Seed store is accessible from the road (easy off-loading)

FUNTUA COTTON SEED CRUSHING CO.

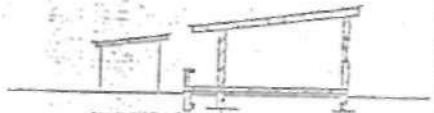
FIGURE 4



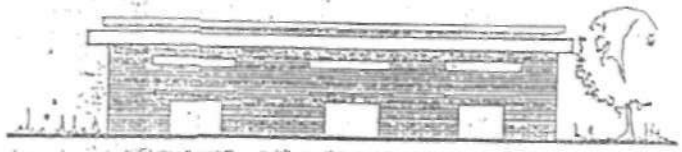
SITE PLAN.



NORTH ELEVATION.



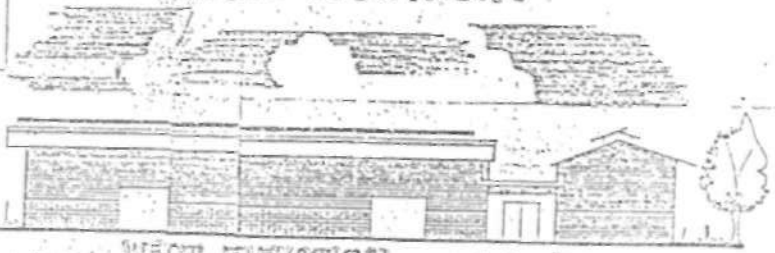
SECTION THRO. ADMIN. BL



SOUTH ELEVATION.



SECTION THRO. WAREHOUSE



WEST ELEVATION.

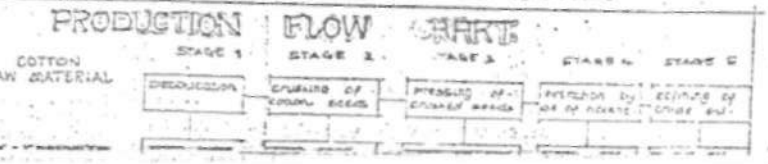


SECTION THRO. PRODUCTION BL

FIGURE 3



ELEVATION OF OIL TANKS.





SECTION THRO. REFINERY

4.6.5 Services

The workshop for mechanical work is attached to the main production hall with spare parts.

4.6.6 Refinery

The refinery is directly opposite the main production hall, at the same time the laboratory for quality control is at the back. the refinery has about three floors. It contains different refining machineries for neutralization, de-odourisation, decolouring, bleaching and water washing.

4.6.7 Hygiene Considerations

For fire protection, all the connections in the form of tubes or metals are lagged with insulator (To protect workers- too much heat).

Fire extinguisher, hose reel and air hoses are available everywhere.

Building materials used (Concrete and steel) have the ability to resist fire to an extent.

3.6.6 (a) Merit

1. Accessibility
2. Simplicity and functionality
3. Availability of standard machines
4. Maintenance workshop
5. Buildings are not scattered

6. Fire control measures are considered

7. Sufficient ventilation and lighting

8. Machines lagged with insulators to protect workers

9. Laboratory (quality control)

10. Security

(b) Demerits

1. Planning is not so excellent

2. No room for future expansion

3. No landscaping

4. External circulation is poor

5. No provision for parking spaces

6. No standard workers facilities like canteen and changing unit

7. Treatment plant, loading and off loading areas are not defined.

3.7 P.S. MANDRIDES PLC

3.7.1 Location: It is located along Murtala Mohammed Way, Kano. The oil mill is about 50 years old.

3.7.2 Zoning

The oil mill constitutes the administrative block, the production area and service unit. It has a scattered arrangement. Different units on different sites.

The administrative block has a ground floor and a upper floor. Only administrative works are carried out there.

Production area covers the refinery, Crushing and pressing units and seed cooking unit.

Services include workshops and other areas where familiar activates take place.

3.7.3 Production

This oil mill crushes about 300 tons of groundnut per day.

3.7.4 Marketing

(a) Distributors buy tins of oil and sell

(b) Distributors by in tankers and sell

(c) Sell directly to customers who want small quantities

(d) Depots: Maiduguri, Lagos, Portharcourt

3.7.5 Management

i. Senior Staff :- 8

ii. Junior Staff:- 70

iii. Casual workers:- 40

3.7.6 Hygiene Considerations

1. Nose and mouth protective(for workers)

2. Cotton dust control (people around the oil mill)

3. Goodsanitary condition (proper cleaning)

4. Fire extinguisher (fire control)

5. Quality control (to test the oil quality before it is despatched).

3.7.7 Construction (Materials(

The main structural materials are concrete and steel

3.7.8 (a) Merits

1. Clean environment

2. The front of the administrative block has a very beautiful plant collection

3. Fire extinguishes for fire control

4. Building materials a strong and durable (concrete and steel)

5. Effluent treatment plant is provided

(b) Demerits

1. Poor parking space

2. Scattered buildings (not in one place)

3.8 NIGERIAN OIL MILL

3.8.1 Location : Tafawa Balewa Road, Kano

3.8.2 Description

The industry constitutes milling and pressing units, refinery packaging, can preparation and so on. The industry is not sited in a place. The buildings are all over Tafawa Balewa area. This industry crushes groundnut, cotton seed, sun flower seeds soya beans and so on.

3.8.3 Milling Building

The milling building is just a covered space but not enclosed, just like a shed with a large area. The building roof is raised with steel stanchion and aluminum roofing sheet as roof covering. Cleaning plant, a big silo, pressing plant and pacing plant are kept within this milling area.

3.8.4 Administrative Block

The Administrative block is a story building takes the form of a residential house. Senior staff have their offices there.

3.8.5 Landscaping

The industry lacks landscaping. The environment is not so appealing, except the administrative block that has a good look but landscaping is zero.

3.8.6 Circulation

The administrative block lacks parking space. The design is rigid, no appreciable circulation space outside. Staff have no space for parking their cars. Pedestrian and vehicular ways are well defined.

3.8.7 Hygiene Consideration

i. Poor workers' facilities like changing area and canteen

ii. Landscaping that will make the environment more comfortable and appreciable is lacking

iii. Solid waste disposal is cared for but water treatment is lacking

iv. Administrative area is clean but milling area is not given so much priority. Heat and fire considerations are addressed (enough ventilation).

CHAPTER FOUR

SITE SELECTION

4.1 SITE

The proposed site is within the industrial estate, along Dansadau road, Gusau, Zamfara State. There are so many able towns but Gusau has special qualities that will favour this proposal. The following are the special considerations.

4.1.1 (i) Availability of Raw Materials

In Nigeria, the major production zone for cotton is the Northern part. Northern part of Nigerian produces about 60-650% of the whole cotton products. Gusau, Funtua, Malumfashi, Kano and others are well known. The case of groundnut production is like that of cotton. Zamfara State, Kano, Katsina, Sokoto and Kaduna States are all involved. Neighbouring towns are sources of blessings to Gusau in terms of groundnut and cotton production.(information:- Dr. Echekwu Department of Plant Science, Institute of agricultural research, (IAR), Samaru, Zaria.)

4.1.2 (ii) Accessibility

To transport the raw materials from the farm to the proposed industry or from the neighbouring towns to the industry is not a problem. The same way, distribution of

finished products can never be a problem. Road transport system and railway are on within Gusau town and all side so, transportation is very easy.

(Source:- Ministry of works and transport, Yahaya Gusau Secretariat, Gusau).

4.1.3 Marketing

The factor that makes every producer happy is the clearing of the store. If goods are produced, the thing that will encourage the producer is that the good should be bought within a short time. Research has uncovered the market situation of Gusau town. This could be related to the growing population. People move in everyday, they buy and sell, there are schools, hospitals, commercial areas that are occupied by people. Presently, there are two small regetable oil industries there and they have not been able to meet up with the demands of people. So, to have another one will help in meeting people's demand, creating job opportunities and supporting population growth and marketing will never be a problem. When commodities are produced in large quantities, the price comes down for people to enjoy.

4.1.4 Availability of Land

Gusau has enough land for residential, commercial and industrial purposes.

Source:- ZUREP, (canteen area, Gusau)

4.1.5 Power, Services and Other Facilities

Schools, government set-up, gainers, health centre, other industries, water work, relaxation centres and commercial areas are all available.

4.2 MERITS AND DEMERITS OF THE SITE

(a) Merits

i. Site is accessible, transportation of raw materials and finished products will not be a problem.

ii. This site is within the industrial estate, so, it is an ideal site for the proposed oil mill.

iii. The site is not hidden. There are people all over to see what is happening. So, marketing is easy

iv. Site is surrounded by ginneries, getting the seed from seed cotton will not be a problem.

v. The site has a gentle slope, so surface drainage will be easy.

(b) Demerits

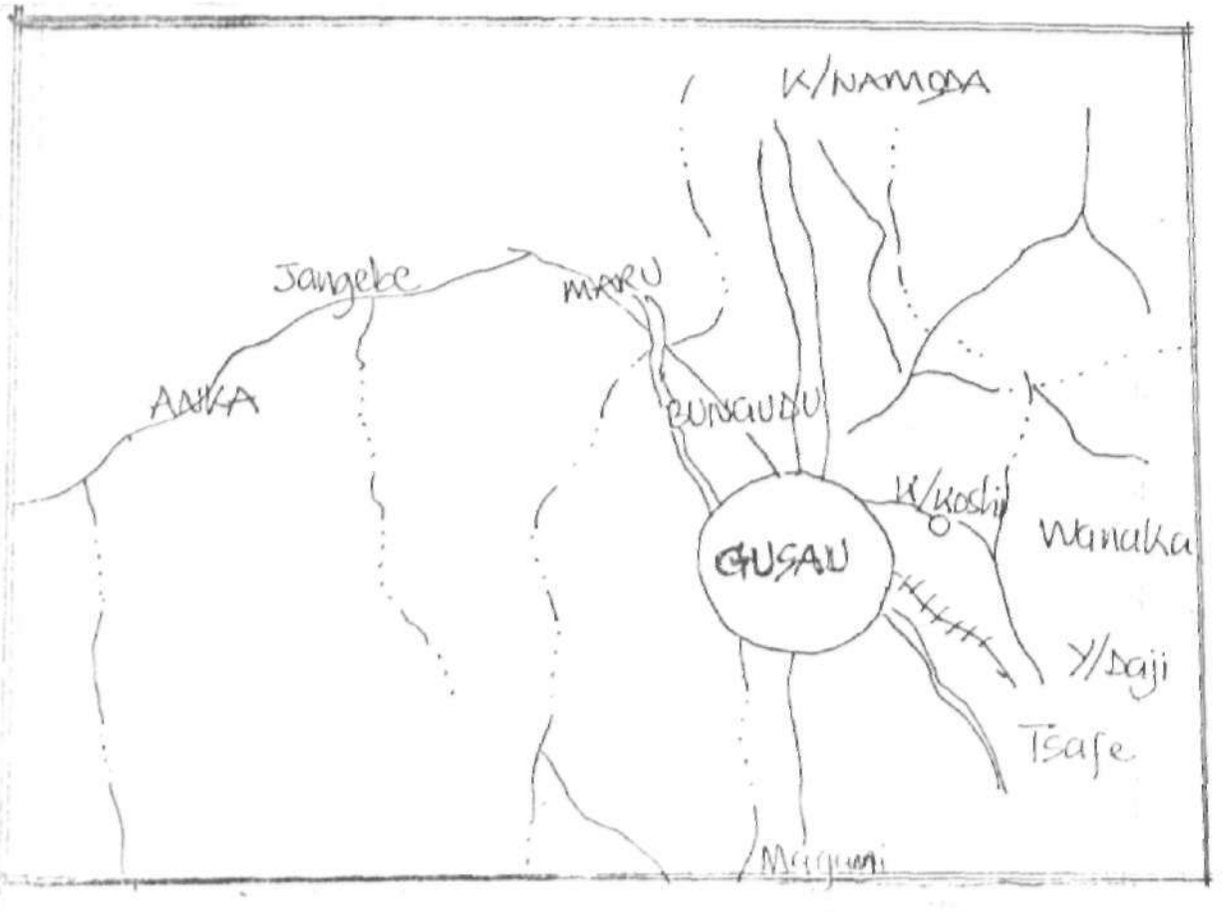
i. The concentration of industries in a particular area promotes environmental pollution.

CHAPTER FIVE

SOCIO-ECONOMIC SURVEY
GUSAU, ZAMFARA STATE

5.1 LOCATION

Gusua, a town in Zamfara, State is located between latitude 6° 38' to 6° 42E and longitude 12° 9' to 12° 12' N. This town is surrounded by many towns and villages like Kaura Namoda, Sokoto, Bungudu, Nahuche, Maru, Tsafe, Magami among the order ones.



5.2 Population

The following figures were obtained from the national population commission (N.P.C.), canteen area, Gusau.

No	Year	Males	Females	Both Sexes
1.	1991	71,180	63,149	134,329
2.	1992	73,194	64,936	138,131
3.	1993	75,266	66,774	142,040
4.	1994	77,396	68,664	155,058
5.	1995	79,586	70,607	159,446
6.	1996	NOT-GIVEN	NOT GIVEN	163,958
7.	1997	"	"	146,060
8.	1998	"	"	150,194

Initially, the figures for 1991 were males:- 70206, Females:- 62,185, both sexes 132,391.

But the same year Anguwar Giraza was attached to Gusau. The population of that village was as follows:- Males:- 974, Females:- 964 and both sexes 1938. When these figures were added together, Gusau had a new set of figures for 1991. (Males: 71180, Females:- 6314, both sexes:- 134,329.

5.3 AGRICULTURE

5.3.1 Sites

The land to be used for agricultural purpose must be accessible and the soil type must be determined. Most of the inhabitants of Gusau are farmers.

Most of the time, they will clear the land, plough it, the next is harrowing. Harrowing is a method of breaking the soil into smaller particles. Ridging follows harrowing and the next is planting. Most of the people in Zamfara State practice subsistence farming. When seeds have started growing, there is the first weeding, followed by second weeding and then the third one.

Zamfara State is good in cotton and groundnut production.

5.3.2 Farm Inputs

They are spraying chemicals, fertilizer, seeds, labour (weeding) and money.

5.3.3 Farm Institutes

i. Zamfara Agricultural Development project (ZADP), Zaria Road, Gusau.

ii. National Agricultural land Development Authority (NALDA) Zaria Road, Gusau

iii. Zamfara Agricultural supply Company (ZASCO). Zaria Road, Gusau.

iv. Zamfara livestock project Division, Kreal, near Government house, Gusau

v. Forestry II project, opp. ZADP, Zaria Road Gusau.

vi. Ministry of Agriculture, Zaria Road, Gusau.

5.3.4 Irrigation Projects

i. Bakura irrigation scheme 40 (ha)

ii. Yunfafiya irrigation scheme 40 (ha)

iii. Bukkuyum " " 100 (ha)

iv. Shinkafi " " 100 (ha) to be established.

v. Bakori irrigation project, Talata Mafara, Sokoto Road, Gusau River.

vi. Lake Natu at Bakura (another irrigation Project).

Bakori irrigation scheme was commissioned in 1979. It is of two components (Dam/Reseavori). The total area is about 23,000 (ha) divided as follows:- 15,000 (ha) sprinkler irrigation and 8,000 (ha) for surface irrigation. About 20,000 people are benefiting from 23,000(ha) irrigation system. It has increased in income to about =N8.284 billion per annum. Farmers pay (It is a source of income for government).

There are local irrigation projects within Gusau town.There are two types of irrigation systems based on the season.

i. Dry season irrigation system (main)

ii. Wet season irrigation system (supplementary).

Source:- Zamfara Agriculture Development project (ZADP), Zaria road, Gusua).

5.3.5 Land

For land to be acquired the purpose or what the land will be used for must be identified or defined. Land cannot be allocated to people anyhow; there are rules regulations and format that should be followed.

i. For residential buildings, a bank draft of =N500 development charge has to be presented and =N100 for receipt.

ii. For commercial, it is a bank draft of =N3,000 that will be presented.

iii. For industrial buildings, a bank draft of =N15,000 has to be presented.

A letter of grant will be issued to show that the land has been allocated.

(Source:- F.Z.U.R.E.P.R., Canteen area, Gusau).

5.3.6 Waste Disposal (Dump Site Method).

Within a catchment area, there are collection points 2m x 3m or 2m x 2m. These collections points are in form of refuse bunkers.

Refuse is collected from various bunkers to a distance far away from the town. The place is called the 'dump site'.

The dump site is about 10 -18kms away from the town. It is a very buy ditch of about 0.3kms by 0.3kms area and so many meters deep. The ditch will be covered with sand when it is filled up and the are will be so rich for agricultural purposes.

(Source:- Z.U. RE.P.B., Canteen area, Gusau).

5.3.7 Transportation

The main transportation systems over road, railway and air.

There are good roads for transportation system. There is a local air port along Kaura-Namoda road, very close to Government Girls Secondary School. Local aeroplane make use of the place. (It is not international). Railway station is along canteen road. This is another method of transportation for people and industries.

Source:- Ministry of works and transport, Yahaya Gusau Secretariat, Gusau).

5.4 ARCHITECTURE AND PLANNING

Gusau is divided into divisions. The residential area, commercial area, industrial layout and institutional area.

The residential buildings take the form of both traditional and modern buildings. This means that same are made of mud while some are built with blocks. Most of the industries take the form of industrial buildings. Building

materials are concrete, steel stanchion and aluminum roofing sheet. Most of the commercial and institutional buildings are modern buildings.

Source:- Ministry of Works, Yahaya Gusau Secretariat, Gusau)

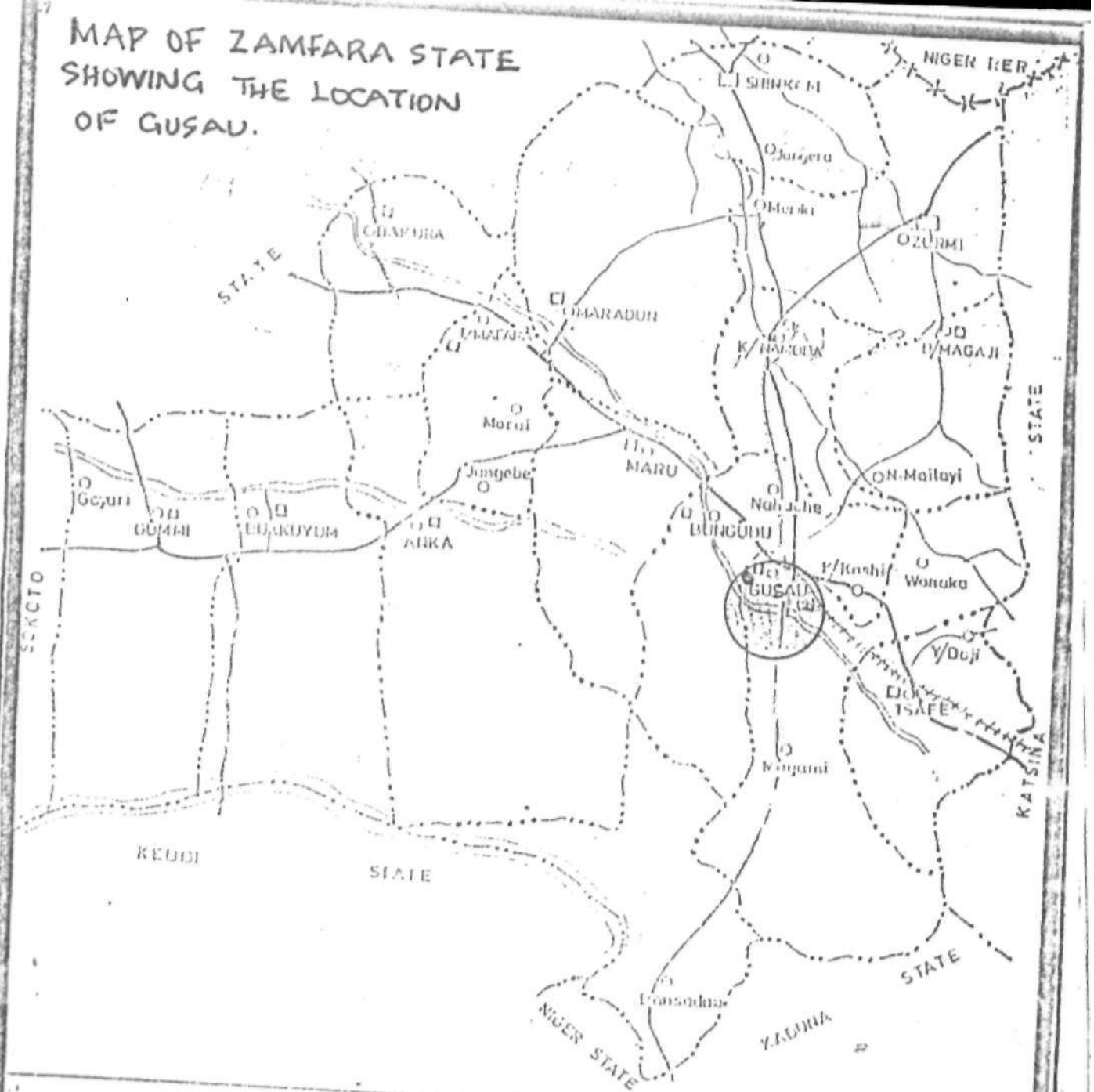
5.5 FACILITIES

Gusau is blessed with necessary facilities and institutions that help in the development of these facilities. Ministry of Health takes care of everything that has to do with health. There are hospitals for this purpose. Ministry of education takes care of schools. Waterboard takes care of water supply, NEPA takes care of electricity supply. Commercial activities and communication system are well kept.



LAND USE
MAP OF GUSAU.

MAP OF ZAMFARA STATE SHOWING THE LOCATION OF GUSAU.



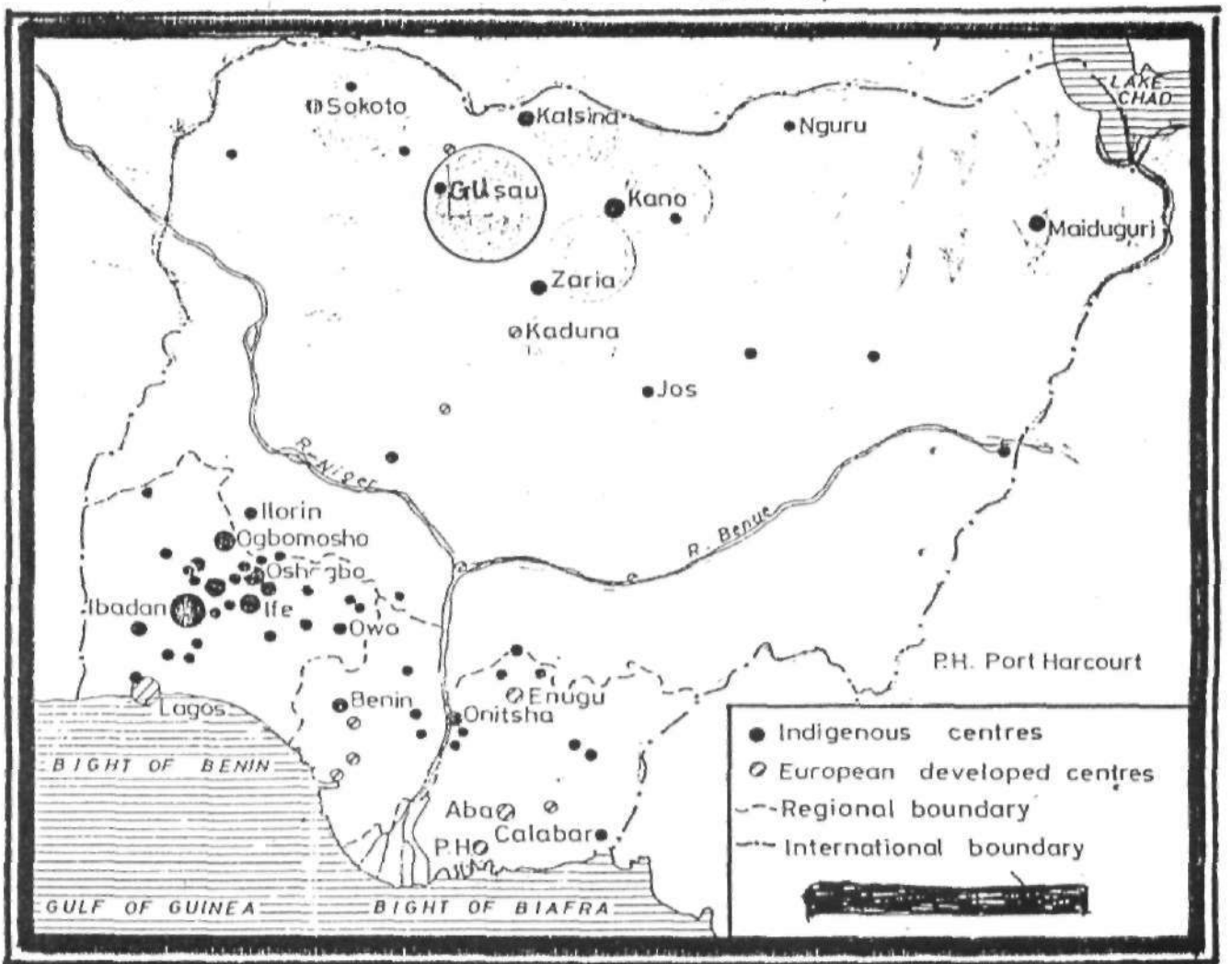
KEY

INTERNATIONAL BOUNDARY
STATE BOUNDARY
LOCAL GOV'T BOUNDARY
STATE H.Q
LOCAL GOV'T H.Q
DISTRICT H.Q
MAIN ROADS
SECONDARY ROADS
RAILWAY LINE
RIVERS AND STREAMS

SOURCE:- ZAMFARA STATE AGRICULTURAL DEVELOPMENT PROJECT, ZARIA ROAD, GUSAU.

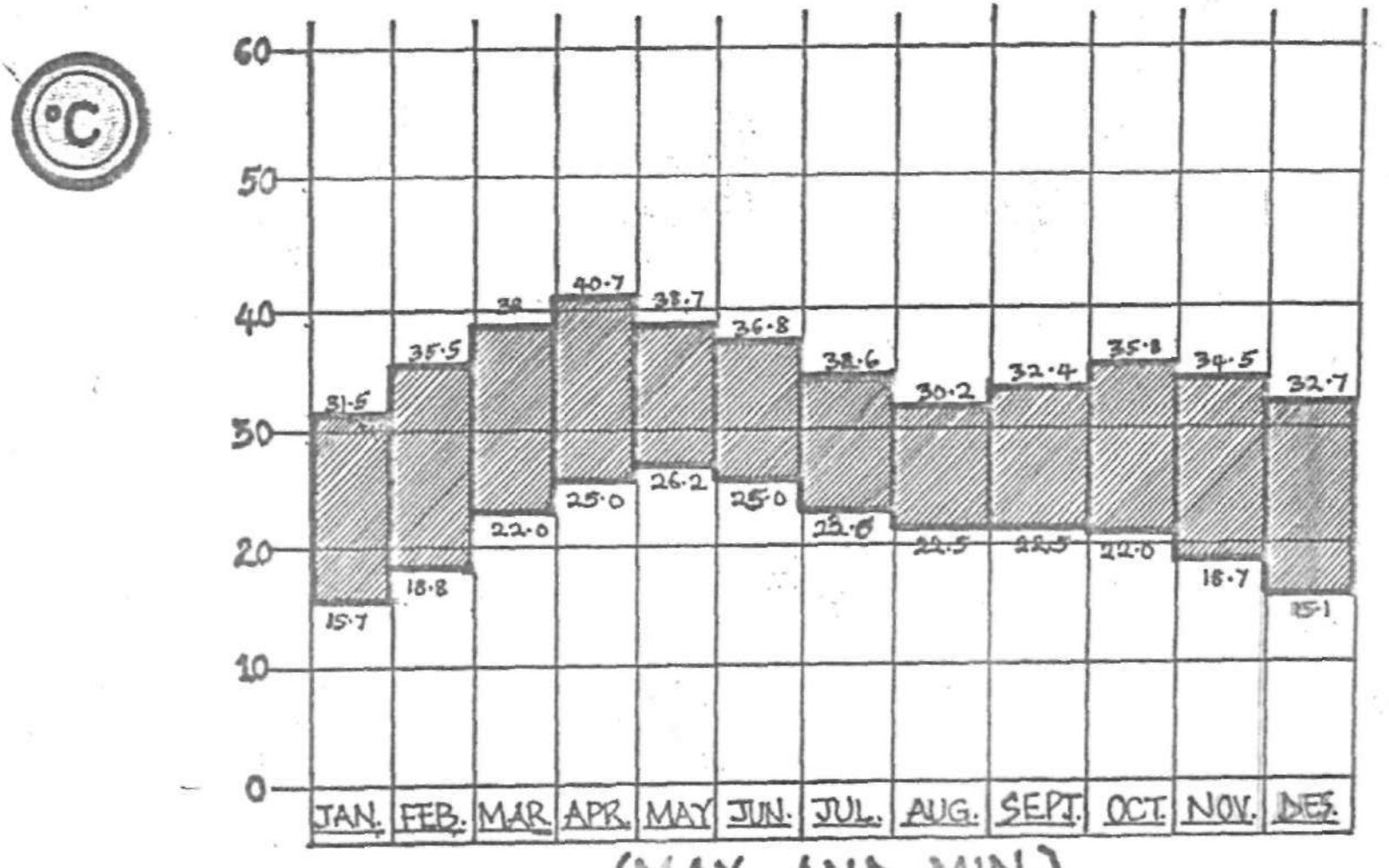
MAP OF NIGERIA

(SHOWING THE LOCATION OF GUSAU)



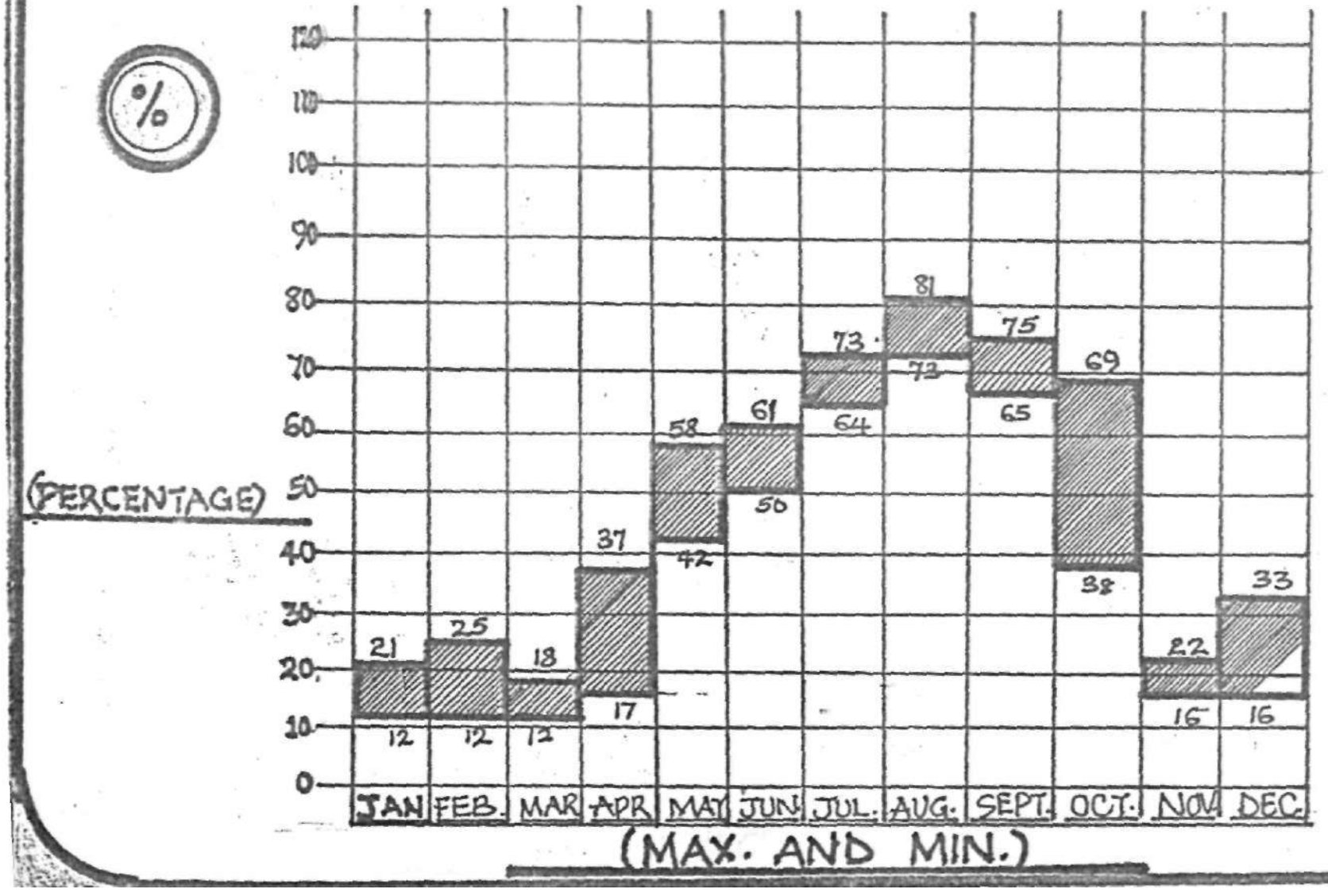
SOURCE:- REUBEN K.UDO (1970), GEOGRAPHICAL REGIONS OF NIGERIA, HEINMAN, NAIROBI / IBADAN.

AVERAGE MONTHLY TEMPERATURE.



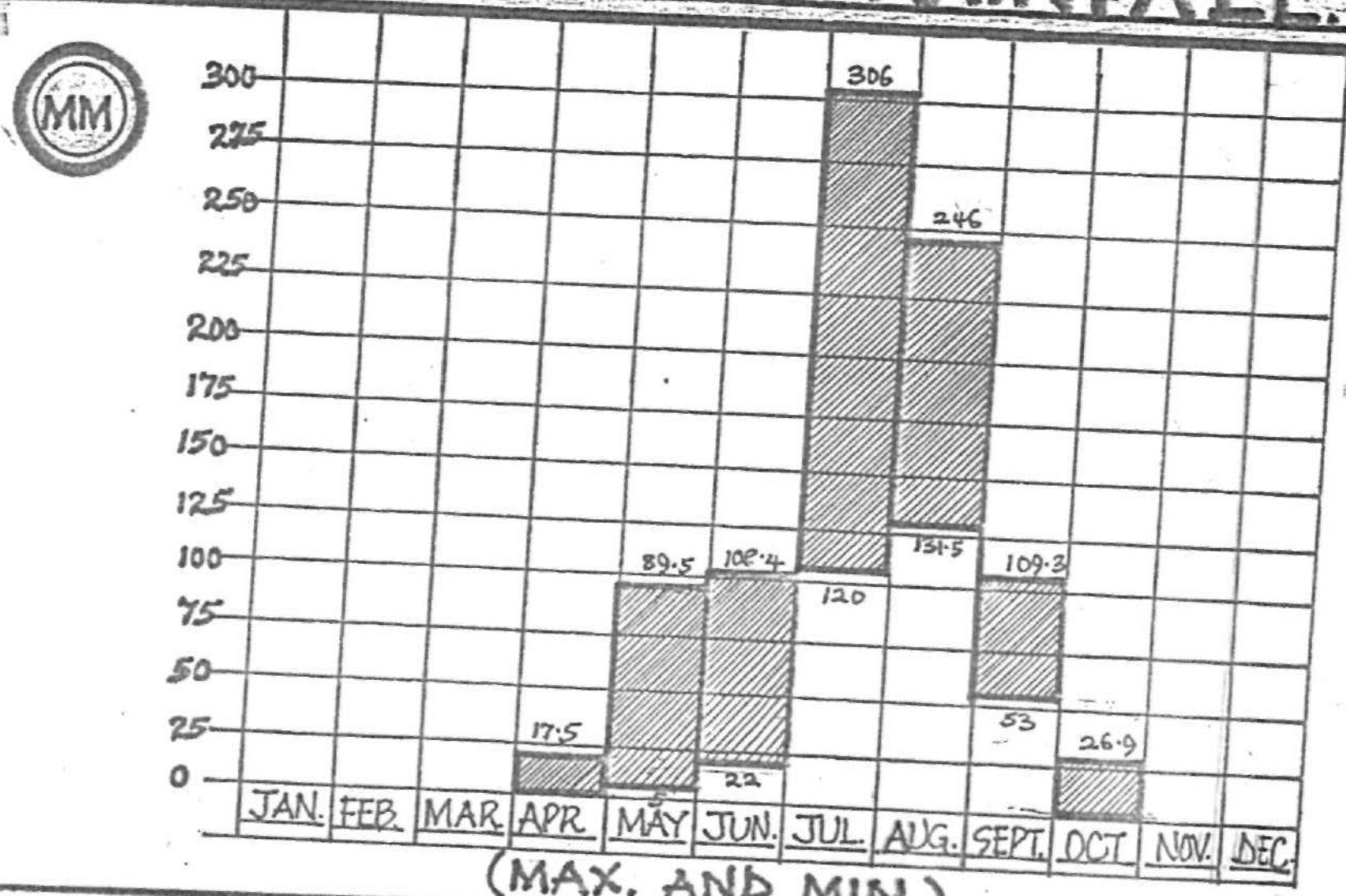
(MAX. AND MIN.)

AVERAGE MONTHLY RELATIVE HUMIDITY.



(MAX. AND MIN.)

AVERAGE MONTHLY RAINFALL.



(MAX. AND MIN.)

CHAPTER SIX

RAW MATERIALS AND PRODUCTION PROCESSES

Introduction

Vegetable oil production involves different processes. They are seed cleaning, dehunting, decortication, crushing, cooking, pressing, solvent extraction, refining and packaging.

For the proposed oil mill, the raw materials are groundnut and cotton seed. The norther part of Nigeria produces these raw materials in abundance, for this reason, oil mill is proposed for the area.

6.1 Cotton Seed

6.1.1 Varieties

Samcot-8; Use commercially in Eastern cotton production zone of Nigeria.

Samcot-9 Found in the northern zone of Niger

Samcot -10: Found in the southern zone of Nigeria.

Planting: Early June to August. Dabbling method is used. (The use of hoe and hand).

Harvesting: September ending. Hand picking method is used. Some are taken to gingery.

Water: It needs water moderately (120cm rainfall.)

Soil: Best in loamy soil, also performs in day loam.

Storage:- To be packed in jute bags. Being kept away from the house to avoid fire problems.

Diseases: Bacteria light, alternaria leaf spot

Pest:- Ball worms, leaf roller and cotton stainer.

Precautions: Clearing and burning of bush seed dressing, spraying with chemicals.

Transportation: Donkeys, camels vehicles and railway.

Source:- Zamfara state agriculture development, Gusau, Institute of agriculture, plants science department, Samaru, Zaria.

6.1.2 COTTON SEED PREPARATION

Delinting: Removal of lint from cotton seed.

Decortication: To break the seed in order to separate cotton meat from husk.

Lint is about one-third of seed cotton. Husk is the seed coat that has to be removed before oil production. Ginning is done in the gingery but delinting and decortication take place in the vegetable oil industry.

6.2 GROUNDNUT

Planting: May (just like cotton)

Harvesting: August ending to September. Harvesting is done by digging.

Water: Does not need too much water (100cm rainfall).

Stage:- Can be stored throughout the year using bags or heaps inside rubus.

Diseases:- Groundnut rosatter.

Pests:- Aphids

Precautions:- Good land preparation seed treatment and proper management.

Transportation:- Donkeys, camels, vehicles (Road) and railway.

Source:- Zamfara State agriculture development, Gusau.

6.3 PRODUCTION PROCESSES

(i) Seed Cleaning:- Seed is prepared for production. In this case, stones, dried leaves, dust, sticks have to be removed.

(ii) Delinting: After ginning, residual lints will be removed from the seed. Lint makes the seed not to be properly pressed. This process is meant for cotton seed preparation.

(iii) Decortication:- The final seed cutting. In this case, cotton seed is broken and then separated from the husk. Shakers would separate cotton meat from the husk.

(iv) Cooking:- Cooker is used to cook the seed before pressing.

Pressing:- Pressing plant is used to squeeze oil out of seeds.

(v) Solvent Extraction: This is a system used in removing residual oil from cake. Hexane is mixed up with the cake to remove oil from the it. Hexane is then separated from oil. Solvent extraction involves toasting (Heat is applied and the residual hexane in the cake is removed),

distillation, condensation, absorption (moisture in the cake is absorbed) and humidification. Final products are residual crude oil and de oiled cake.

(vi) Refining

Refining plant does the work. Refining involves the following process.

Alkali Neutralization: The addition of caustic soda to remove free fatty acid from oil.

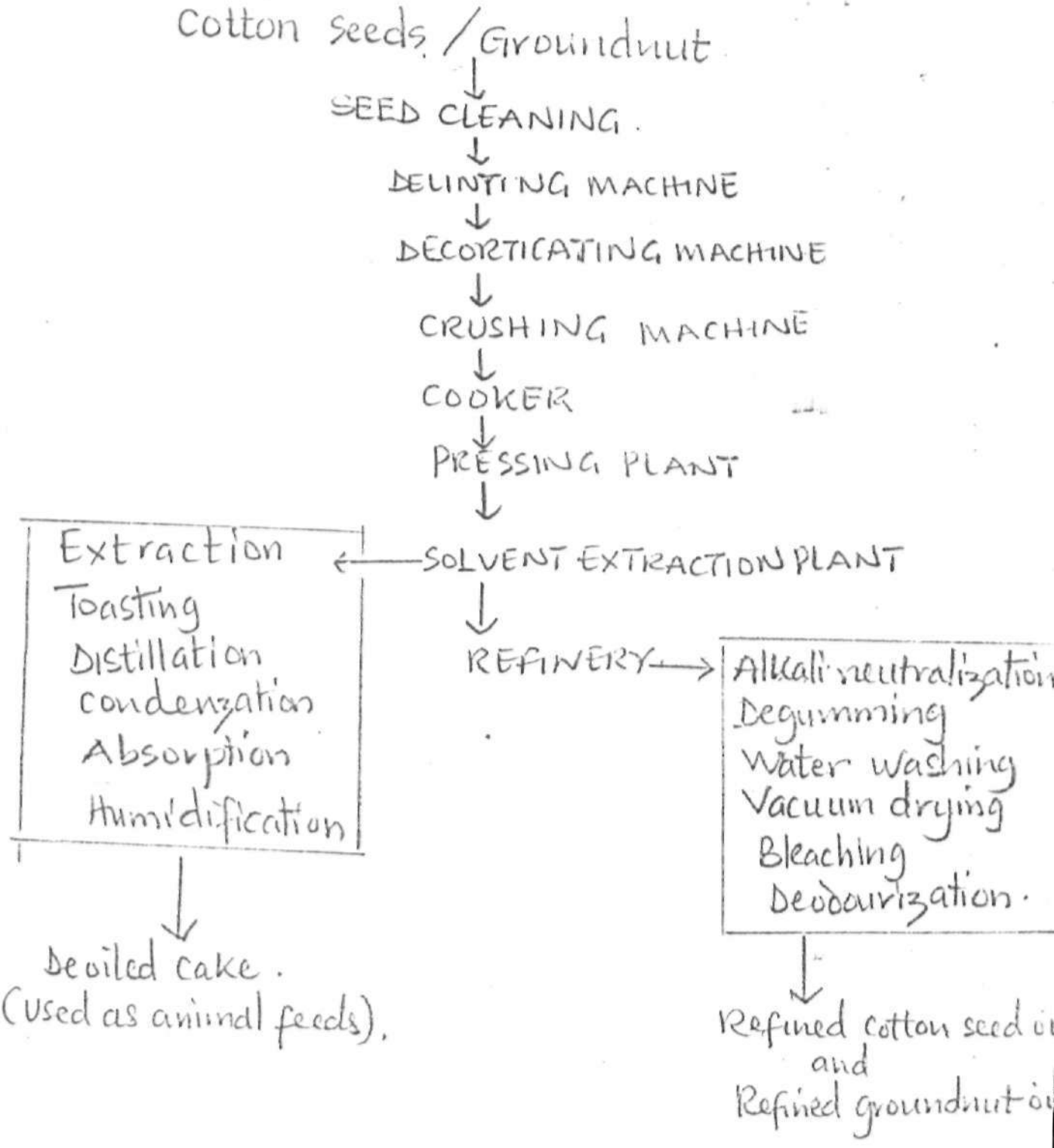
Degumming: The removal of gum from oil.

Water washing:- To wash excess caustic soda away from oil using water washing separator and other equipments connected together.

Vacuum drying: The removal of moisture from oil by using a vacuum drier.

Bleaching:- Removal of colour.

Deodourization: Removal of odur.


Cotton seeds / Groundnut
SEED CLEANING.
DELINTING MACHINE
DECORTICATING MACHINE
CRUSHING MACHINE
COOKER
PRESSING PLANT
SOLVENT EXTRACTION PLANT
Extraction
Toasting
Distillation
condenzation
Absorption
Humidification
REFINERY
Alkali neutralization
Degumming
Water washing
Vacuum drying
Bleaching
Deodourization.
Deoiled cake.
(Used as animal feeds).
Refined cotton seed oi
and
Refined groundnut oi

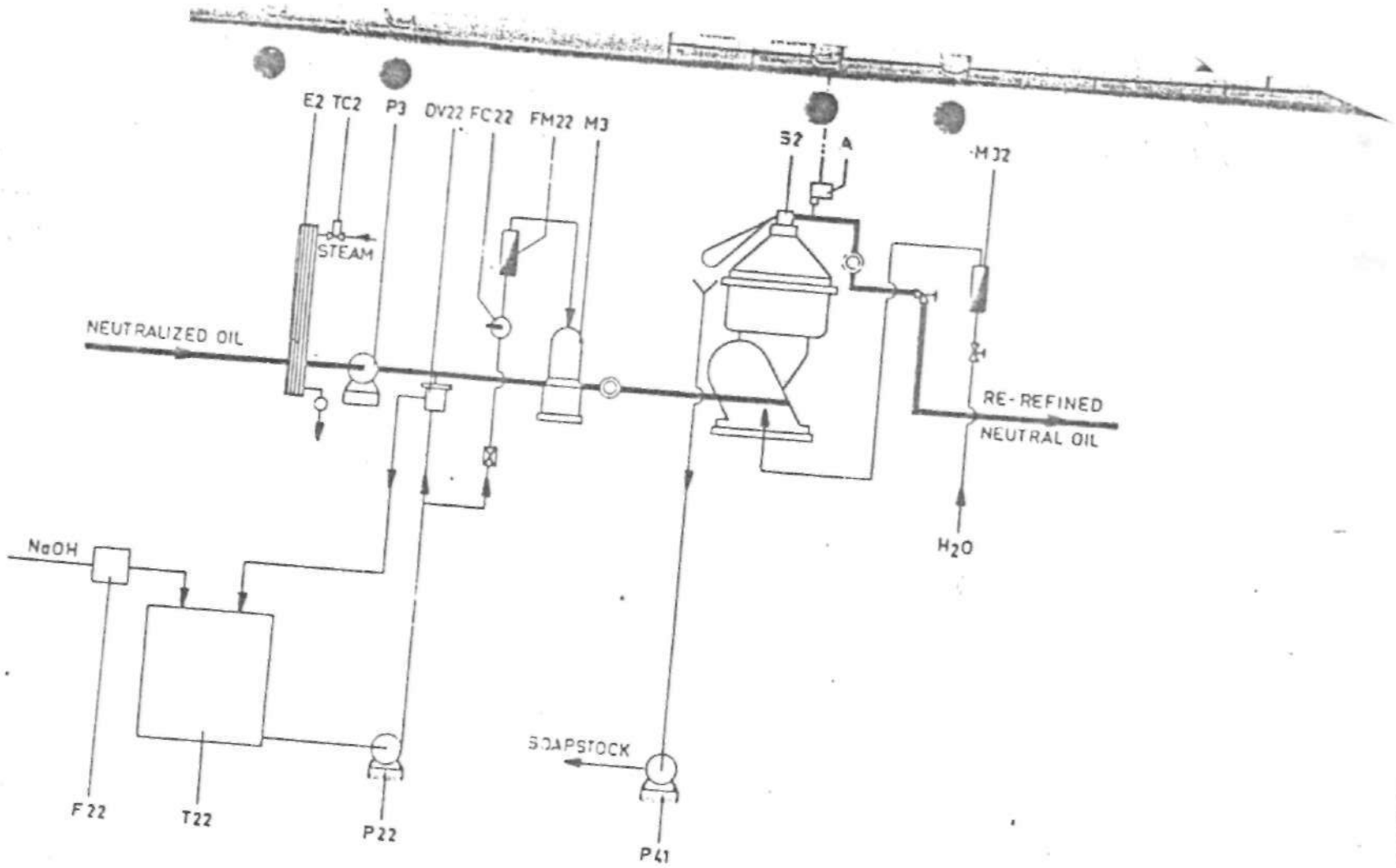


Fig. 15

CENTRIFUGAL SEPARATOR:
S2 HERMETIC SEPARATOR

PUMPS:
P3 OIL FEED PUMP
P22 LYE PUMP
P41 SOAPSTOCK PUMP

HEAT EXCHANGER:
E2 OIL HEATER

MIXER:
M3 RE-REFINING MIXER

STRAINER:
F22 LYE STRAINER

CONTROLLERS:
DV22 LYE-DOSING RATIO CONTROLLER
FC22 LYE-FLOW CONTROL VALVE
TC2 OIL TEMERATURE CONTROLLER
A ALARM SYSTEM

FLOW METERS:
FM22 LYE FLOW METER
FM32 WATER FLOW METER

TANK:
T22 LYE TANK

REFINING STAGE.

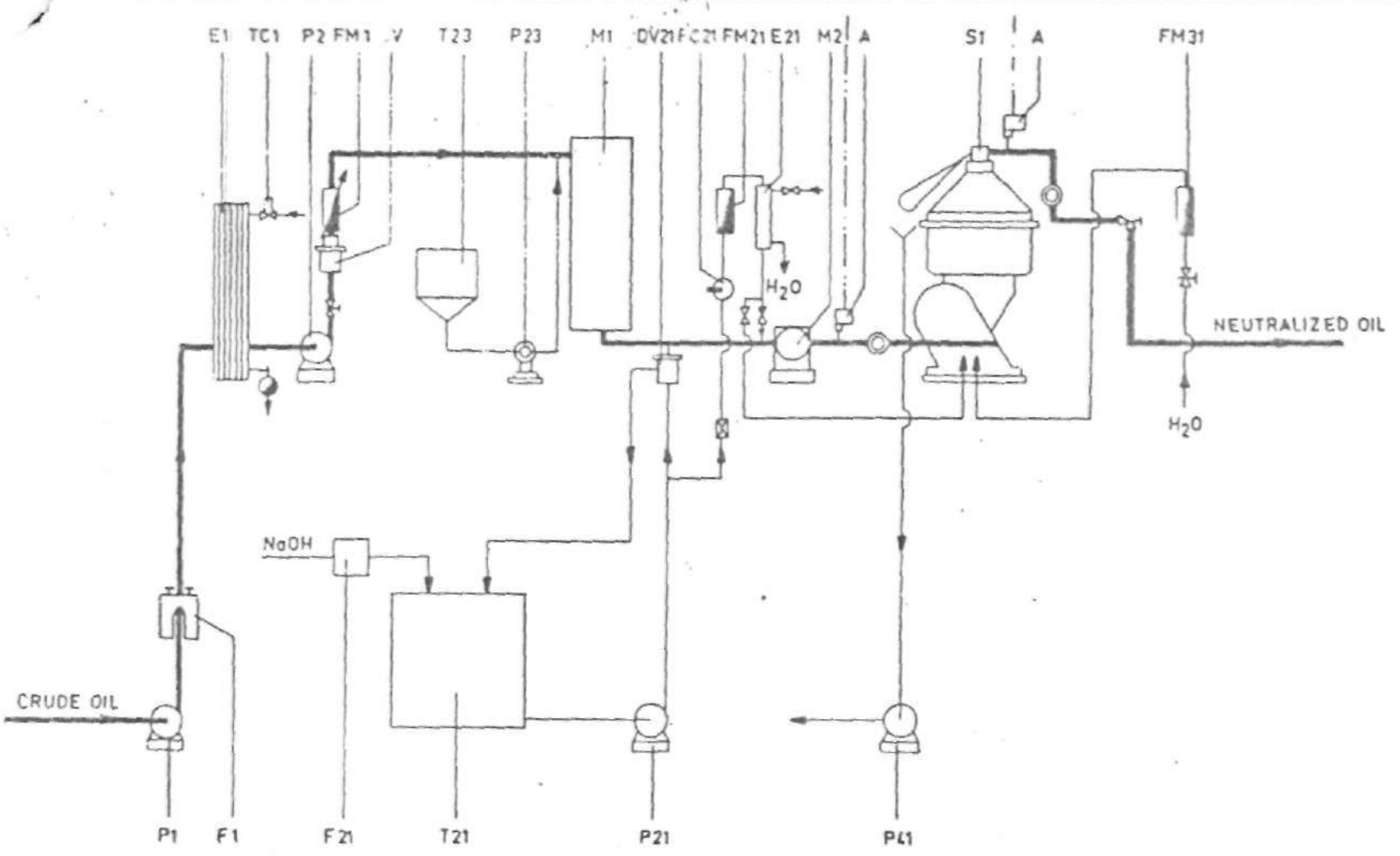


Fig. 14

CENRIFUGAL SEPARATOR
S1 HERMETIC SEPARATOR

PUMPS:
P1 CRUDE OIL PUMP
P2 OIL FEED PUMP
P21 LYE PUMP
P23 PHOSPHORIC ACID PUMP
P41 SOAPSTOCK PUMP

HEAT EXCHANGERS:
E1 OIL HEATER
E21 LYE HEATER

MIXERS:
M1 DEGUMMING MIXER
M2 NEUTRALIZING MIXER

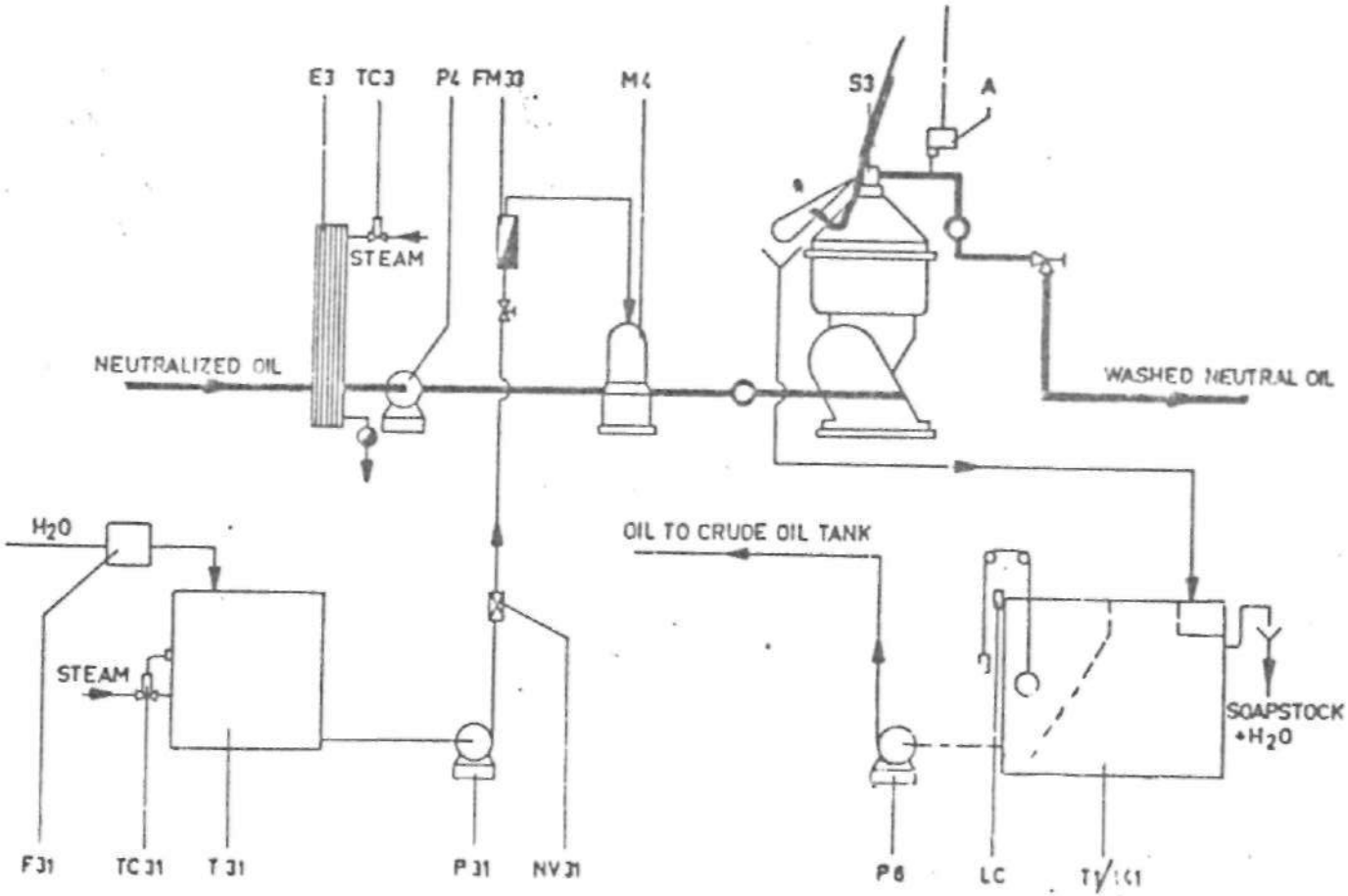
STRAINERS:
F1 CRUDE OIL STRAINER
F21 LYE STRAINER

CONTROLLERS:
CV CONSTANT OIL-FLOW CONTROLLER
DV21 LYE-DOSING RATIO CONTROLLER
FC21 LYE-FLOW CONTROL VALVE
TC1 OIL TEMPERATURE CONTROLLER
A ALARM SYSTEM

FLOW METERS:
FM1 OIL FLOW METER
FM21 LYE FLOW METER
FM31 WATER FLOW METER

TANKS:
T21 LYE TANK
T23 PHOSPHORIC ACID TANK

ALKALI NEUTRALIZATION



CENTRIFUGAL SEPARATOR:
S3 HERMETIC SEPARATOR

PUMPS:
P4 OIL FEED PUMP
P6 SLOP OIL PUMP
P31 WATER PUMP

HEAT EXCHANGER:
E3 OIL HEATER

MIXER:
M4 WATER-WASHING MIXER

STRAINER:
F31 WATER STRAINER

CONTROLLERS:
LC OIL LEVEL CONTROLLER
TC3 OIL TEMPERATURE CONTROLLER
TC31 WATER TEMPERATURE CONTROLLER
NV31 NON-RETURN VALVE FOR WATER
A ALARM SYSTEM

FLOW METER:
FM33 WATER FLOW METER

TANKS:
T31 WATER TANK
T1/T41 SLOP TANK/CATCH BASIN

WATER WASHING STAGE

Fig. 16

CHAPTER SEVEN

ARCHITECTURE OF OIL MILL

INTRODUCTION

Oil mill consists of different units and these units have different design considerations for hygiene purposes. The units are main production section, solvent extraction unit, refinery, raw material store, finished product store workers facilities, administrative block, auxiliaries, quality control unit and waste disposal unit.

7.1 Main Production Section

Usually, the architecture of production area is always affected by the following factors.

(i) Required headroom

(ii) Production flow

(iii) Ventilation

(iv) Disposal and piping

Walling, flooring roofing systems should be designed to suit the purpose. Durable and suitable materials should be specified for a good result. Steel and concrete are the main building construction materials in this area.

7.2 Solvent Extraction Unit

In the solvent extraction unit, hexane (a highly flammable solvent) is used. underground storage should be planned with the design to avoid fire hazard (hygiene consideration).

7.3 Refinery

In the refinery, high connections of machineries and equipments are made. So, provision should be made for enough headroom in the design. Machineries produce heat, so, provision should be made for enough ventilation for workers to survive. Circulation space is also impertant for free movement and safety. Pipe connections could be lagged with insulators for fire prevention.

7.4 Raw Material Store

Large opening is needed. Off-loading takes place through this large opening. There is a feeding point (a pit) for silos in the store. Bucket elevator takes up seeds and silos are fed by screw coveyors

7.5 Finished Product Store

This store should have a considerable height. Oil tanks are kept there with piping systems. Refined oil is conveyed

down to the finished product store for packaging.

Packaging

i. Glass bottles

ii. Tinned cans

iii. Plastic containers

iv. Drums.

7.6 Workers' Facilities

Workers facilities consist of clinic or first aid room, changing unit and cafeteria.

7.6.1 Clinic:-

In any industrial set up, first aid should be highly considered. To have a clinic is good. An injured worker may need a very urgent attention because an injury that involves bleeding can easily take a precious life a way if immediate attention is not given.

7.6.2 Changing Area

Workers have to change before they start their work and after. Some of them may like to take a shower and change. For the sake of convinience and encouraging productivity, necessary sanitary facilities should be provided.

7.6.3 Cafeteria

For recreational purposes, cafeteria should be planned with an industry.

7.7 Quality Control

Laboratory takes care of quality control. Laboratory should be closed to the raw material store, main production hall solvent extraction unit and refinery. Before production, raw materials will be tested for oil contents, moisture contents and protein contents, cake will be tested for oil contents, moisture and protein contents after extraction and the finished product will be tested for moisture content, free fatty acid percentage, soap, peroxide value, saponification-value, iodine value, relative density and odour and taste. All these are part of hygiene considerations.

7.8 Auxilliaries

These are workshops, boiler house and generator house. These buildings should be located far away from the administrative block and other quiet areas because of noise and heat. Strong and durable materials like concrete and steel are to be used.

7.9 Waste Disposal Unit

There are two types of wastes

i. Solid dwastes

ii. Liquid wastes

7.9.1 Solid wastes

These are in the form of stones, dried leaves and stick, pieces of paper and other unwanted particles picked from oil seeds. A suitable open but covered space should be provided. These untanted materials will be collected there and later, they will be packed to the dump site. The same design could be made for the husk yard.

7.9.2 Liquid Wasters

Liquid wastes take the form of impure water. It will be conveyed to the effluent treatment unit where it will be treated and recycled. Effluent treatment unit building can also be designed just like the other waste disposal units.

7.1.0 Hygiene In Oil Mill

Hygiene can be defined as good sanitary condition, well being of workers comfort, convinience, pleasure, satisfaction, a way of being free disease germs, pollution, and injury (safety).

The following are design considerations for hygiene in oil mill

i. Waste disposal/effluent treatment

ii. Ventilation, landscaping, harmony

iii. Good circulation space

iv. Drainage

v. Storage

vi. Facilities, clinic, cafeteria, changing area

vii. Fire control/prevention and safety

viii. Dust control (provision fo cyclone)

ix. Zoning

x. Building materials (good strength for safety and durability)

CHAPTER EIGHT

DESIGN REPORT

8.1. DESIGN CONCEPT

This design concept is based on one of the control principles of hygiene problems. Control principles of hygiene problems are ventilation, substitution, facility design and isolation. So, the concept is based on the word 'Isolation' i.e. to separate noisy area from less noisy area and to separate hazardous area from less hazardous area.

In the concept, administrative block, workers facilities and finished product store are separated from the refinery, extraction unit, main production hall, boiler house, generator house because of noise, fire, heat and raw material dust. Noisy units are on one side and the less noisy units are kept on one side for the purpose of hygiene. The problem of one area should be solved but not to be carried over to other parts.

(a) Raw material store is close to the main production hall.

(b) Loading bay and off-loading bay are very accessible.

(c) Administrative block is not too far to the workers facilities

(d) There is a fair consideration of future expansion.

8 2. DESIGN CONSIDERATIONS

Units within this industry are identified provision is made for storage facilities where necessary. The very sensitive units are refinery, solvent extraction unit and main production hall. Main work is done in those units.

Sanitary fittings are provided for workers convinience. Cafeteria and laboratory are provided for certain functions. There is a waste disposal unit and effluent treatment unit:

Ventilation, circulation and zoning are all considered.

Structurally, the following factors are considered.

i. Production processes and size of machines

ii. Roof height for machines in the production hall

iii. Durbale and fire resistant building materials.

iv. Structures should be able to withstand climatic conditions

v. The choice of a suitable roofing system e.g. portal frame, steel trusses

Portal frame is used for the production halls and steel trusses for the auxilliaries. In some cases, portal frames are embedded in concrete for durability, strength, for resistance and chemical resistance.

vi. Foundation is designed to support not only the structure and the machines but also the load of raw materials, finished products and material handling equipments like forklifts and bucket conveyor and screw conveyor.

8.3 LIGHTING AND VENTILATION

Production areas are well ventilated and lighting is sufficient to avoid idustrial hazard and accident. There are more window openings on the south and north sides to allow cool air to come in. There are few window openings on the east and west sides to reduce heat. Natural ventilation:-

(a) By providing openings on the walls

(b) By providing openable roof lighting windows.

8.4 FIRE PROTECTION

In industries, fire protection is a very important factor. Rate of occurence depends on the nature of production so, the architect should chose a concept and structure that will prevent spread of fire and cladding system should also aid fire protection.

Reduction of fire hazards

(a) Compartmentation of units

(b) Location of boiler house and fuel storage

(c) Fire resisting doors

(d) Site accessibility

(e) Maximum headroom heights.

LIQUID WASTES/SURFACE DRAINAGE

Liquid waste in form of effluent conveyed to the effleunt treatment unit for treatment. It is then recycled back to the cooling tower. Rain water from roofs, roads and paved areas is drained through gutters.

8·5 PRODUCTION BRIEF

Quantity of seeds to be processed per day:- 500 tonnes

Quantity of oil to be processed per day: 150 tonnes

No of shifts :- 2 shifts

Capacity of each silo :- 2000 tonnes of oil seeds

Capacity of each oil tank: 1,500 tonnes

No of female workers :- 20

No of male workers :- 80

Total no of staff= 113

Casual workers = 500

8·6 SCHEDULE OF ACCOMMODATION

ADMINISTRATION

OFFICE	TOTAL AREA
Managing director	36m²
Secretary (M.D.)	24m²
Assist. Man. director	33.75m²
Public relation officer	20.25m²
Works manager	20.25m²
Admin. Manager	20.25m²
Accountant	20.25m²
Purchasing Manager	20.25m²
Marketing Manager	20.25m²
Chief Sec. Officer	20.25m²
Boardroom	54m²
Reception	40.5m²
Display area	33.75m²

Toilet	2m²
Production manager	30m²
2 Supervisors	29.25m²
WORKERS' FACILITIES	
OFFICE	TOTAL AREA
CLINIC	
Pharmacy	15m²
Waiting	67.5m²
Emergency	13.5m²
Firstaide	13.5m²
Treatmentroom	13.5m²
CAFETERIA	
Kitchen	15m²
Store	6.0m²
Rating area	189m²
CHANGING AREA	
Male	210m²
Female	108m²
PRODUCTION AREA	
Hall	Total Area
Refinery	756m²
Extraction unit	130m²
Main Production hall	1080m²
Raw material store	72m²
Finished product store	864m²

AUXILLIARIES

SPACE	TOTAL AREA
Workshops	34m²
Boiler house	72m²
Generator house	36m²
Effluent treatment unit	144m²
Waste disposal unit	216m²
Husk yard	216m²

CONCLUSION

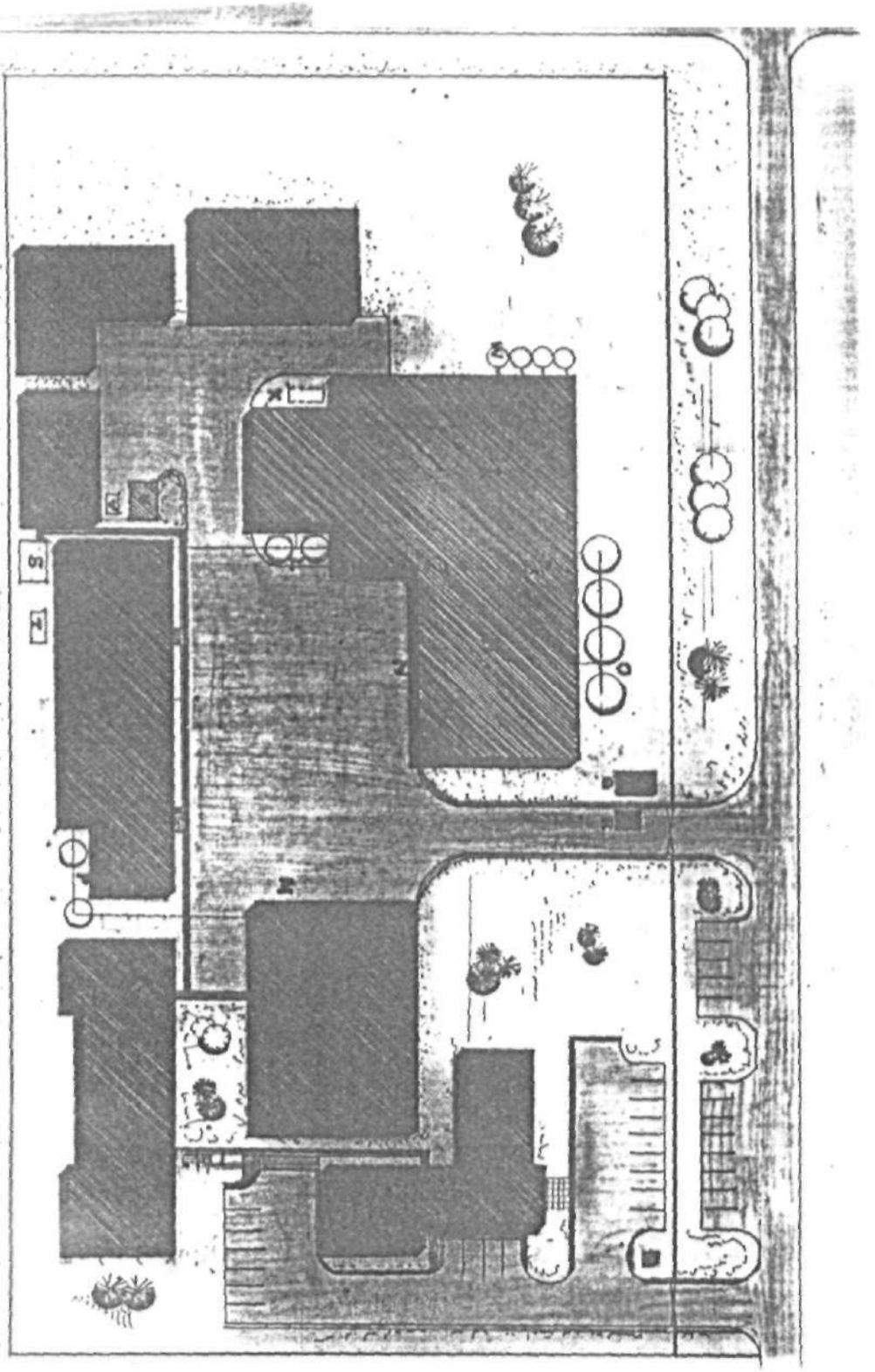
This research has shown the availability of oil seeds in the northern part of Nigeria especially Gusau and her neighbouring towns. The need of proposing oil mill that will process these oil seeds into different products has been uncovered with the benefit of industrial development stressed.

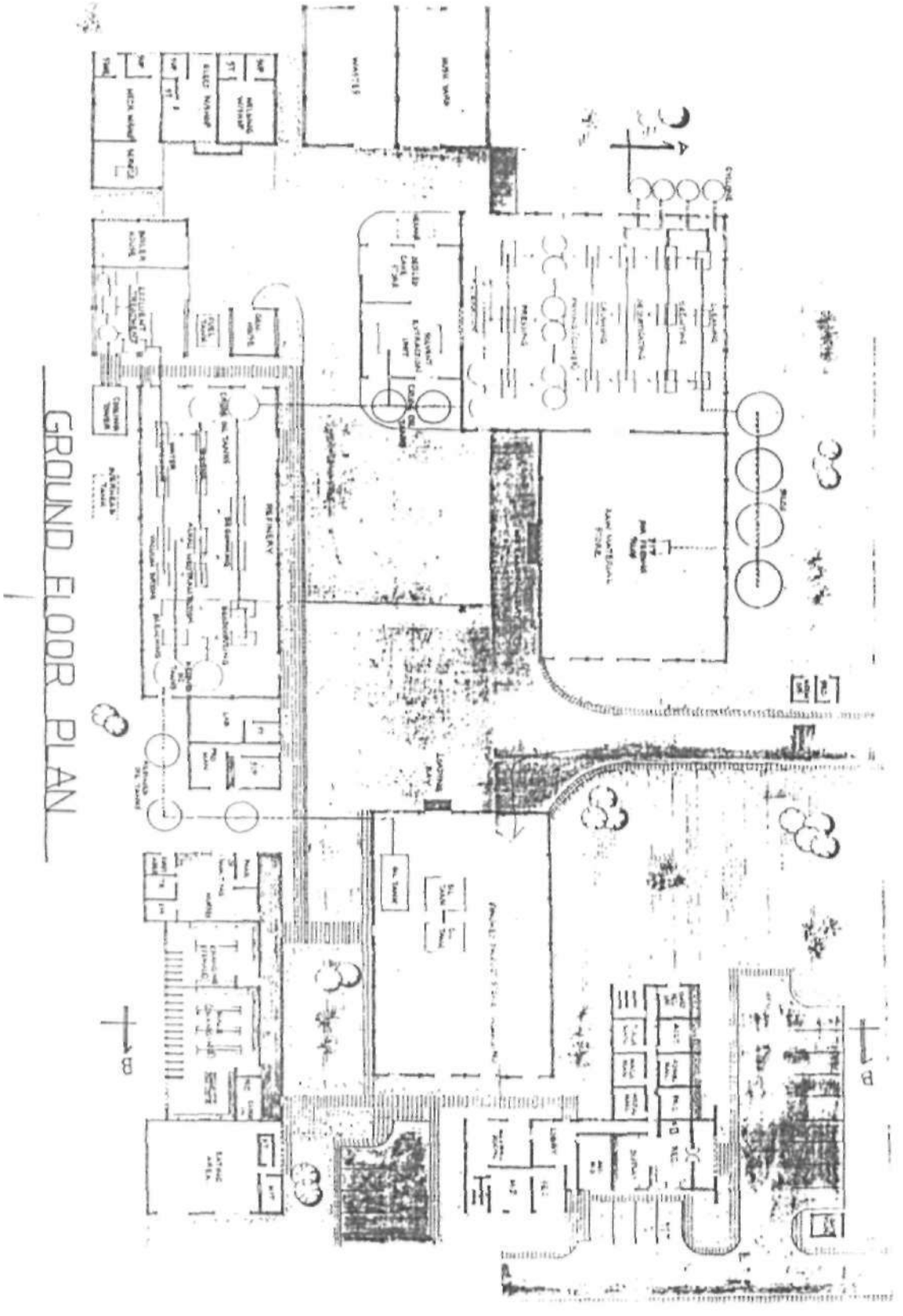
Also, sources of hygiene problems and control principles are given together with design considerations to hygiene in industries. Hygiene is seen to go beyond good sanitary condition; welfare of workers, being free from hazards and contamination, satisfaction and safety are all under hygiene.

The part to be played by the architect is to give a functional, good suitable design that will house both human beings and machines in such a way that the aim of the work will be accomplished.

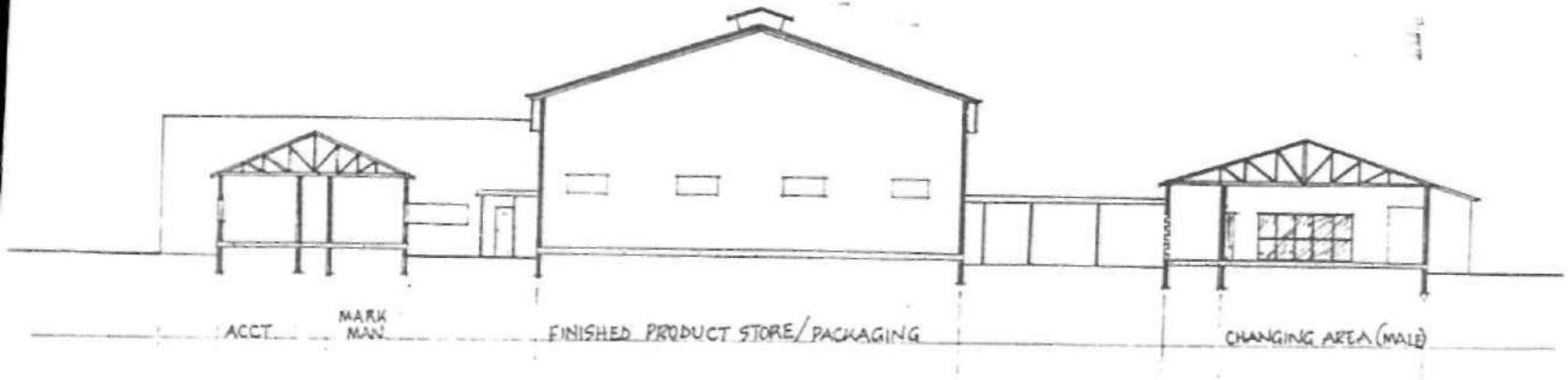
ADMINISTRATIVE BLOCK
LESS NOISE
WORKERS' FACILITIES
LESS HAZARDS
FINISHED PRODUCTS

RAW MATERIAL
MAIN PRODUCTION HALL
EXTRACTION UNIT
NOISE
HAZARDS
REFINERY

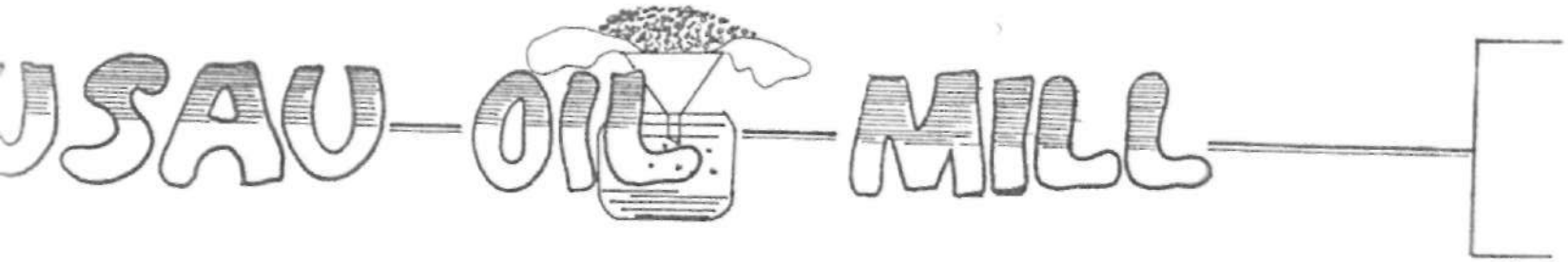




GROUND FLOOR PLAN


ACCT.
MARK MAN.
FINISHED PRODUCT STORE/ PACKAGING
CHANGING AREA (MALE)

SECTION B – B

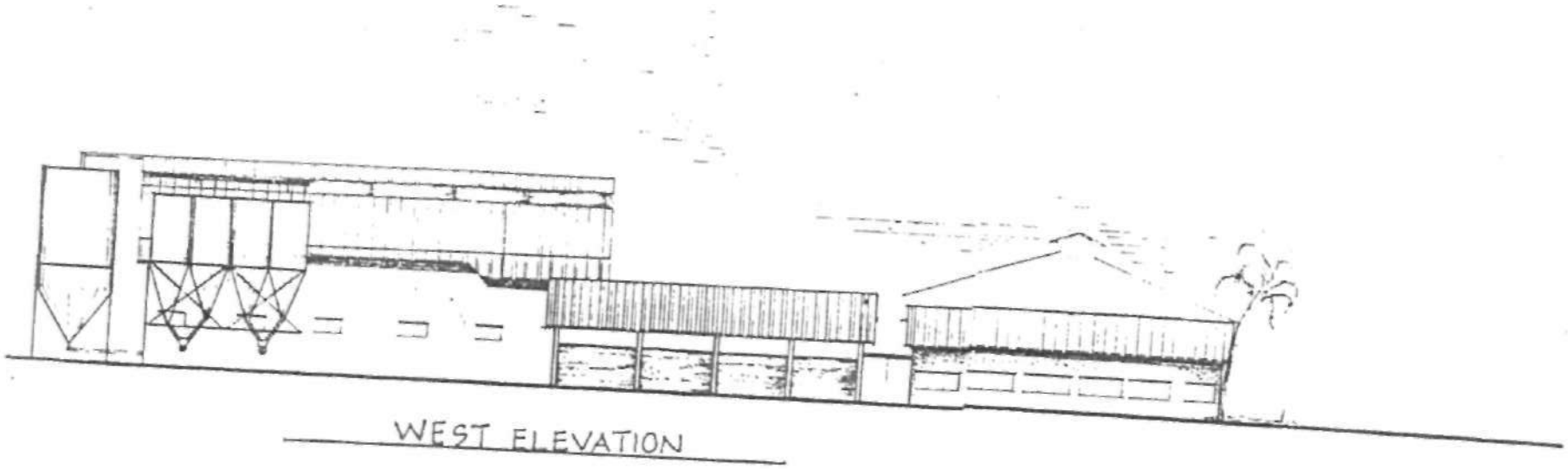

USAU OIL MILL

MAIN PRODUCTION HALL
RAW MATERIAL STORE
TOILET
PUNCH MARK WORKS
MAN
MAN
DISPLAY AREA

SECTION A — A



NORTH ELEVATION



WEST ELEVATION

GUSAU OIL MILL

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