TITLE PAGE

PROJECT TITLE

DESIGN PROPOSAL FOR COCOA PROCESSING INDUSTRY IDANRE, NIGERIA

WITH EMPHASIS ON SANITATION

BY

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A THESIS SUBMITTED TO THE DEPARTMENT OF ARCHITECTURE, (POSTGRADUATE) SCHOOL, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF M.TECH DEGREE IN ARCHITECTURE.

AUGUST, 2003

DECLARATION

I, Ologunagba Adenike hereby declare that this thesis titled: design proposal for cocoa processing industry Idanre, Nigeria, is an original product of my own research work under the supervision of Arc Paul Haruna

11/02/2004

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CERTIFICATION

This is to certify that this thesis titled: Design proposal for Cocoa processing Industry Idanre, Nigeria is an original work undertaken by: Ologunagba Adenike of the department of architecture, (Postgraduate) school, Federal University of Technology, Minna in partial fulfilment of the requirements for the award of m. tech. degree in architecture and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This project is dedicated to Almighty God for his protection and direction to me and to the loving memory of my late mother Mrs. J.A. Ologunagba and my late younger sister Ologunagba Rosemary Idowu. May their soul rest in perfect peace.

ACKNOWLEDGEMENT

First, I want to express my gratitude to God Almighty for his protection over me and the members of my family throughout the duration of my course.

To my late mum Justina Abiola Ologunagba and my dad Mr. A.T. Ologunagba for their wonderful support and encouragement. To my younger ones. Taiwo, Kehinde Idowu (late) and Abidemi for their patience, understanding and encouragement.

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Finally, I want to thank all my course mates, the person assisting me in typing my project in the name Julie Adeleke.

May God Almighty bless every one of you amen.

LIST OF TABLES

LIST OF FIGURES

LIST OF ILLUSTRATIONS

TABLE OF CONTENT

CHAPTER FOUR

CHAPTER FIVE

ABSTRACT

This project paper discusses Cocoa-processing industry Idanre, Nigeria. A substantial aspect of this project involves the processing of cacao seeds better known as cocoa bean, to given cocoa powder and cocoa butter as the finished end product. In doing this, the origin of cocoa tree and the processing of cocoa seed were extensively discussed. Sanitation, which is the research area, was put into consideration at every stage of the processing.

The project is mainly centered on the primary process, which is obtained from where the raw cocoa bean is taken to bean silos before it flows into the cleaning machine, to the roasting machine through the micronising and winnowed section. It is then passed on to the Nib grinding then goes to the cake grinding sieving, blending and alkalizing where it is then separated to the two end products, cocoa cake and cocoa butter. The cocoa cake is further process to cocoa powder.

CHAPTER ONE

1.0 INTRODUCTION

The main focus of this project is on the design of cocoa processing industry Idanre in Ondo State. The word cocoa as defined by the new Webster's dictionary of English language, is a brown powder obtained after extracting the fats from a cocoa bean.

Cacao is a common name for a tree and certain other related trees in a family that also contains the cola. The cocoa tree yields several harvests annually. First cultivated in South America, it was introduced into Africa during the 16^{th} century, where it is now mainly grown.

The average cacao tree attains a height of about 6m (20ft) and has shiny leaves, as long as 30cm (12in), and small pink flowers on the truck and older braches. Only about 30 of the 6,0000 annual blossoms eventually bear seeds commonly called cocoa beans, the seeds are surrounded by a yellow or reddish – brown pod about 28m (11m) long. Cocoa bean is rather purple or off – white and resemble almonds.

The processing of the cacao seeds, better known as cocoa beans, is complex. The fruit harvest is cured or fermented in a pulpy state for three to nine days, during which the heat kills the seeds and turns them brown. The enzymes activated by fermentation impart the substances that will give the beans their characteristic chocolate flavour later during roasting. The beans are

then dried in the sun and cleaned in special machines before they are roasted to bring out the chocolate flavour.

Before the discovery of crude oil in 1958, Cocoa was the dominant foreign exchange for the country. Going by statistics, in 1971 alone, Nigeria produced a whopping 257,000 tonnes of cocoa as the world second largest producer after Ghana. Cocoa was selling at the international market for 3,000 per tonne. Sadly enough with the oil boom cocoa was rejected like a bad cargo. Expectedly Nigeria subsequently lost its second place to keener nation ranks fifth in the world.

The western states region government decided to establish cocoa processing industry in 1964, for local consumption and exportation. Since then a lot of cocoa industry has sprung up examples are Ebun cocoa industry Lagos, Oregun cocoa industry Lagos, Ile-oluji cocoa industry Ondo, and Ede cocoa industry. However, most of these cocoa industries are located far away from where cocoa are being grown and as such, some are short of cocoa bean for production. Most of these industries proclaimed that they are off-season meaning this is not harvest time of cocoa.

In Ondo State, all requirements to make siting of industries feasible and viable are naturally intact and deposited in the vast lowlands and coastline areas of the state, these existing in different locations within the confines of the state.

Idanre enjoys so many influencing factors such as being located at the largest raw materials production zone that will boost its operation all year round and optimise the use of industrial machines obtainable in the factory. It is naturally endowed with a beautiful panoramic landscape; it has the highest benchmark but still enjoys vast lowland.

An inventory into market setting in Idanre and some surrounding towns with the aim of verifying their readiness to consume cocoa product that acclaimed the efforts of investing into processed product of cocoa. Since there exist a ready market, demand have impliedly existed, and supply to meet this demand, has influenced cocoa processing factory to be situated at Alade, in Idanre.

1.1 AIMS OF STUDY.

In establishing cocoa processing industry Idanre Ondo state, this will promote business activities and the attempt to make an industry available to everyone within the state will be augmented through;

1. Providing an enviable and conducive working environment that will attract both insiders and outsiders to the state.
2. Making efficient use of the cocoa plantation within the state and Idanre, one of the economic front line towns in Ondo state and Nigeria as a whole.
3. To satisfy the urge of the Idanre people and its environs to industrialisation.

4. Creating an avenue for job employment within the state and Nigeria as a whole.

1.2 OBJECTIVES: -

1. To carry out a study on the procedure of processing, personnel and operational spaces with a view to creating an ideal industry for Idanre, which is wholesome and adequate for cocoa processing.
2. To provide an hygienic and clean working environment where cocoa product can be produced.
3. To serve as a source of income to the state and also serve as a source of revenue to the government.

1.3 RESEARCH METHODOLOGY

In embarking on the design of a cocoa processing industry a great deal of enquiry on the activity of cocoa-processing industry is required. I made use of descriptive methodology of research methodology example is carrying out of case studies on some existing cocoa processing industry found in the country namely, Oregun cocoa processing industry, Ile-Oluji cocoa processing industry, Oregun cocoa processing industry, Ebun cocoa processing industry. To get acquainted with the general and physical layout of cocoa industry and the activities that take place within.

1. LITERATURE REVIEW

This was taken from textbooks, relevant journals, publications, magazines past project was carried out from the various libraries and schools.

2. CASE STUDIES

This is to know the extent of work carried out in this area of study. Identifying the architectural design problems encountered and correcting them in my project. Among the cocoa industry visited, we have Ile – Oluji cocoa processing industry.

3. INTERVIEWS.

This is in the form of familiarization with the natural and general characteristics of the study.

1.4. SCOPE OF STUDY

This study is divided into two basic parts, the written part and the Design aspect. The former basically documents the design process, problems, solutions, improvements and literature review of the design. The latter deals with industrials space, which lays elaborate emphasis on both architectural and landscape design. The scope of study includes the following.

1.4.1 THE ADMINISTRATIVE BUILDING.

- The Directorates
- Accounts department

- Internal audit department
- Human audit department.
- Purchasing department
- Human resources management
- Boardroom
- Marketing
- Training

1.4.2 WELFARE BUILDING

Clinics.

Changing room

Restaurant (dining, kitchen, servery, store, coffee room)

Common room

Ambulance bay

Toilet and bath

1.4.3 QUALITY AND ASSURANCE DEPARTMENT

Research and development

Analysis section

Food technologist

Microbiologist

1.4.4. ENGINEERING WORKSHOP

- Electricity mechanical department
- Carpentry workshop
- Office
- Store

1.4.5 PRODUCTION HALL

- Warehouse
- Store
- Control room
- Packing room
- Store keepers
- Chocolate production hall
- Chocolate powder production hall

1.4.6 AUXILLIARY FACILITIES

- Water tank
- Gas chamber
- Bore hole
- Generator house
- Security gate
- Check off sort
- Mini petrol station
- Fire fighting station

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 HISTORICAL DEVELOPMENT.

Going straight on to review of how industries come to existence without a thought for the review of origins and evolution of the raw materials used to make the industry in context work is like putting the cart before the horse.

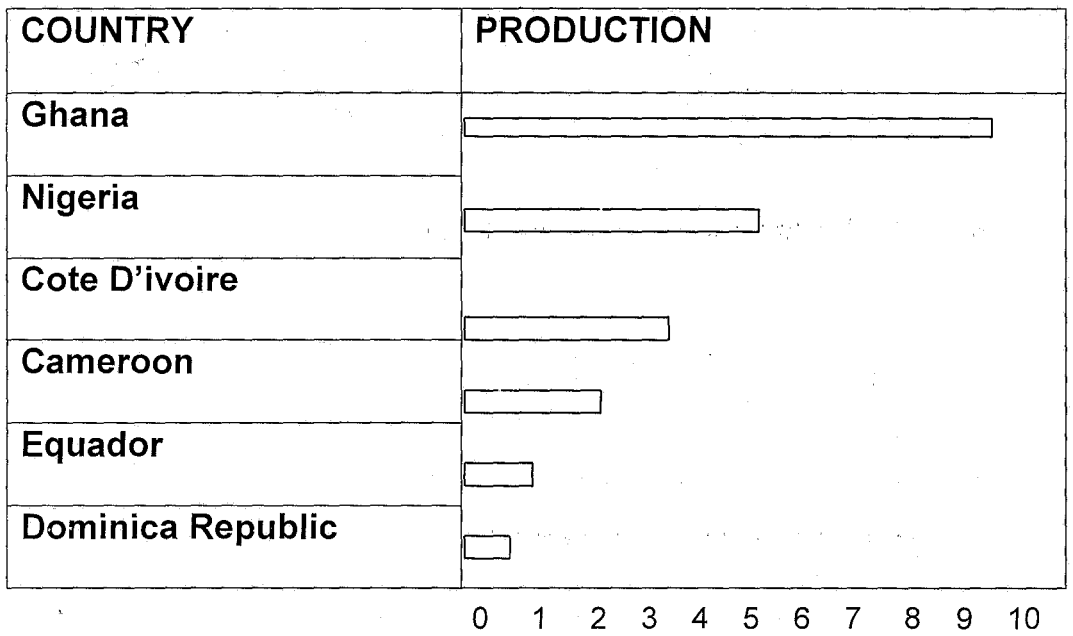
A good exploration hence starts with "cacao" the major raw material, which the proposed processing factory will use to operate for its optimum and effective output

Cacao has been cultivated since ancient times in Central America, from Mexico to southern Costa Rican border, possibly for over 2000years. The theory of divine origin and its use as currency would appear to support this view Export of cocoa to Spain began shortly after Spanish Conquest of Mexico. Production was then extended to Venezuela and Trinidad.

The defecting of cocoa and manufacture of Chocolate in the 19th century led to an increasing demand for the crop. For many years cocoa production was confined to the western hemisphere. The Amelonado forms of Amazonian "forastero" with dark purple cotyledons were taken into cultivation in Bahia in Brazil.

The Spanish and Portuguese introduced those in the Gulf of Guinea. In the half of the 19th century, the plant was introduced into West Africa. It is one of the main economic tree crops of Ghana, Nigeria, Cameroon, the republic of Benin and Togo and it grows in the low land forest zones of these countries. So successful has been the introduction of this crop that many thousands of farmers in Ghana and Nigeria are involved in its cultivation. Ghana is the main producer of cocoa bean with Nigeria as second in world production see fig 1.below

COCOA LEADING COUNTRIES



Source: Encarta Encyclopaedia, 1999

In 1900 world production was approximately 100,000 tons of which the New World produced 81 percent and West Africa 16 percent, the latter now produces over 60 percent of the world raw cocoa. In 1960 world production rose

to 1 million tons with Ghana producing about 30 percent, Nigeria about 15 percent, other Africa countries about 30 percent of which Brazil is the biggest production with 20 percent, west Indies 5 percent (Dominican republic 3.5 percent, Trinidad 0.7 percent) and Asia 2 percent.

Cocoa is very important in the economy of those two countries. It contributes about 60% of the export trade of Ghana and 10% of that of Nigeria. Its importance as a major foreign exchange earner in Nigeria is now dwindling due to the booming petroleum industry. Cocoa beans are exported mainly to the United Kingdom, the Netherlands, the United States, Western Germany, Italy and the USSR. Basiel trading company limited, known today as Union Trading Company Limited (U.T.C) exported the first shipment of cocoa in 1891 in Nigeria.

Cocoa is grown mainly in the Mampong, Kumasi, Bekwai, Gbaso and Sunyani areas of Ghana and in many parts of Ogun, Oyo and Ondo states. Cocoa also grows well in the northern part of Benin area of the former Bendel State and Ikom areas of the eastern Nigeria.

2.2 ORIGIN OF CACAO-THE RAW MATERIAL.

The cacao tree, whose pods yield the cocoa beans of commerce, is a native of low land tropical forest of the upper Amazon basin of South America and also of the coastal strip West of the Andes where it grows as an 'under Storey' species beneath the tall forest tree.

Cacao is botanically known as Theo brome cacao linn. Other types of cacao occasionally grown for their little economic importance include T grandiflora, T bicolor, T. Speciosa, T. Microcanda and Herrania. These are found only on experimental stations in West Africa

2.2.1 CLASSIFICATION OF COMMERCIAL VARIETIES.

Cacao varieties are classified on the bean and fruit (pod) characters. Two distinct races are recognized.

1 Criollo (cacao dulce).

(a) Central American Criollo

(b) South America

2 Forastero (cacao Amargo)

(a) Amazoruan Forastero)

(1) Upper Amazon e.g F3 Amazon

(2) Conner Amazon e.g Amelando.

b. Trinitarian complex.

The distinguishing factors of the different types of cacao are show in Table 2.2.1 below.

Table 2.2.1 Distinguishing character of difference types of cacao.

Distinguishing	CACAO TYPES		
Unripe	Red green	Green	Red or Purple
Ripe	Yellow, Orange	Yellow	Orange
Apex	Conspicuous	Round but with small definite point.	
Bottleneck	Distinct		Hybrid swarm of forastero Criollo
Pod surface.	Warty conspicuously furrowed	Inconspicuously furrow, not warty	
Fruit wall	Thin, easy to cut	Thick and woody	Stocks, Quite
Seeds	Plump	Flat	Heterogeneous
Cotyledons	White or pale violet	Dark Purple	

Source:-

2.3 THE GROWTH HABIT OF CACAO TREE.

The cacao tree grows to an average height of 7-10 metres requiring shades from larger trees. When the seedling off shoots 1-2metres, it throws out 3-5 fan branches. The flowers are about 1 cm in diameter and are formed in small colony on the truck and lower main branches of tree. They are bisexual and are pollinated by small midge (cero topogonidae) out of many flowers

produced, a few is pollinated and breaks into pods, which mature in 5-6 months while many wilt and drop off.

The pod attained to a length of 12-20cm by 6-8cm in diameter containing almost 40 seeds surrounded by a mucilaginous pulp when pod is ripe the pods are harvested by plucking with sickle.

(1) CULTIVATION.

Cacao is one of the most exciting plants in its soil requirements. For proper development and maximum yield, the soil should possess the following characteristics.

1. Should be easily penetrated by taproot of cocoa as the taproot can penetrate as deep as 1.5-3.0m.
2. Must be well drained and be water retentive in West Africa conditions clay loam soil is most suitable.
3. Soil should permit easy air and water circulation with a pore space of 60-70% of total volume.
4. Soil must be fertile containing equal proportion of (k+Na to ca+ mg) elements.
5. In West Africa the PH Value should be between 6 and 7.5 extreme of pH can be harmful to cocoa growth and production.

Planting begins when all these conditions are met.

(1) Seeds are sown at stake.

(2) Seedling through Nursery bed is later transported into field.

(3) Planting is done around June when rain is steady.

(4) 2-3 bean or 3-4 beans are sown per stand.

(5) Emerging seedling is later thinned.

(6) Planting distances are irregular giving rise to cocoa tree densities.

(7) Average density of surviving cocoa tree ranges between 600 and 1000 per hectare.

(8) During plantation, land is cleared, mound made and some food crops such as Yama, Cocoyam and Okro Manioc. The supply shade needed by cacao plant to become properly established.

(2.) HARVESTING.

After maturity say from 3-9 years when a pod is rated to bear 20-40 pods per tree per year of dried fermented cocoa beans, pods one harvested using cutlasses or sickles over a period of several mouths. Ripe pods are carried to a suitable central point for opening and removal of woody pulp and hence carried to ferment.

(3) PROCESSING OF CACAO SEEDS.

The processing of cacao seeds, better known as cocoa beans is complex. The fruit harvest is cured or fermented in a pulpy State, for three to nine days,

during which the heat kills the seed and turns them brown. The enzymes activated by the fermentation impart the substances that will give the beans their characteristics chocolate flavour. They are then shelled in the crushing machine and ground into chocolate liquor which is used to make chocolate candy or is filtered to remove the fat and then cooled and ground to produce cocoa power.

(4). FERMENTATION.

It is usually done in trays to provide more uniform fermentation than both heap and basket methods hitherto used. The tray method is also quicker requires less labour and results in latter quality cocoa beans after drying than the other methods. Chocolate flavour is developed in fermentation.

(5). DRYING.

Once a Cocoa bean is fermented, it should be dried to acceptable moisture content of about 6%. The method normally used is sun drying on concrete slab or other flat surface with good protection of beans from rodents, reptile and mammal attack.

Artificial drying is frowned at because of the possibility of flavour that may result from improper use of leakage of Smoke.

(6). STORAGE.

Cocoa needs proper storage to keep the moisture content low and the beans away from any contamination by insect pests and other foreign matters. New jute or kenal Sacks kept off the ground and away from walls of store,

house in waterproof surroundings are implored.

(7). GRADING.

The produce inspectors to ensure the maintenance of satisfactory standards of quality carry out grading of cocoa.

The regulations for cocoa grading are as follows:

GRADE I.

Cocoa which is thoroughly dry. Free from foreign matter and from smoky velvety or black beans and which contains less

(a) 3% by count of salty beans.

(b) 3% by count of moundy beans.

(c) 3% by count of other defective beans.

GRADE II

Cocoa which does not quality for grade 1 and which is thoroughly dry, free from foreign matter and from smoky velvety or black beans and contains less than.:

(a) 4% by count of salty beans.

(b) 8% by count of moundy beans.

(c) 6% by count of other defective beans

A list of the different types of defective beans with the factors responsible for then is shown in table below.

TABLE 2.3

DETECTIVE BEANS AND THEIR CAUSES.

NO	DEFECTIVE BEANS	CAUSES	REMARKS.
1.	Smoky beans	Storing beans in smoky area or room or near fire or dryer.	Many of such beans unacceptable to manufactures.
2.	Velvety	Leaving ripe pods on the tree unharvested for several weeks collecting beans from black pod diseased pods.	Ditto''
3.	Black Beans	Not fermenting in time, drying on iron or metal sheets collecting beans from black pod diseased pods.	Many of such beans unacceptable to manufacturers.
4.	Mouldy Beans	Under dried beans and bad storage. Storing in a damp place	Reduces the price and renders the Cocoa beans unsolvable if found in large number.
5.	Weevil Beans	Collecting beans from pods damaged by rodents, storing Cocoa near tobacco, Maize and other foodstuffs, storing in a damp place leaving bags on the ground.	Ditto.

6.	Flat or Empty Beans	Beans from immature pods in which the cotyledons are not well filled (they are not diseased).	Ditto.
7.	Germinated Beans	Leaving ripe pods unharvested for several weeks, fermenting in holes in the ground not turning beans during fermentation.	Lowers quality and reducer price of cocoa beans becomes unstable if too many are found.
8.	Slaty Beans	Result of non-fermentation of beans	Forbidden entirely.
9.	Purple Beans	Result of under fermentation	Lowers the quality and reduces the price. Cocoa beans unsellable if too many are found.

Source: Adaptive from Soyele, W.A. (1971) processing of cocoa for the market Progress in tree crops Research in Nigeria. CRIN, Ibadan.

2.4 MAINTENANCE OF COCOA FARM

Maintenance operation is carried out throughout the year. These vary with factors such as the rainfall and the fertility of the sol, the age, spacing and vigour of the cocoa trees, and the method of establishment of the cocoa trees.

It is done in many ways including:

1. WEEDING

Weeds compete with cocoa for soil nutrients and their removal may increase the growth and yield of cocoa. It also helps to improve circulation of air within the farm, thus reducing relative humidity within the farm and consequently the incidence of black pod disease. It is done usually with a cutlass or hoe.

2. MULCHING

Mulching helps to maintain soil fertility, by acting as anti-erosion measure and by conserving organic matters. It also helps to conserve soil moisture during dry season and can bring about substantial yield increases, it is done towards the end of the rainy season i.e. Mid October in West Africa.

3. PRUNING

It is done to enhance the foliage to be umbrella like effective for shade. It encourages removal of all unnecessary growth closer to the cacao stem. It is also done to remove branches that can harbour diseases to the stem. Pruning is done at early stage of tree. A sharp cutlass and pocket knives are employed in pruning action for removal of chupons and young flushes, while a heavy bow saw is recommended for removing big branches and stems. All pruned surfaces bigger than 2.5cm in diameter should be painted with ordinary paint or a tar-sealing compound to prevent entry of fungi and other pathogens.

4. REGENERATION

This is done to maintain the continuity of cocoa farms. Earth is heaped up around the base of the new shoots to encourage formation of independent root system. It is a tricky operation to fit the young chupons into the overall canopy of the surrounding, undamaged trees. With adequate care, the new chupons will flower and bear their first pods about 2 years after the new buds started growing.

5. REPLACEMENT OF DEAD SEEDLING

Dead seedlings are found when seed is transplanted from nursery into field without much care and attention. Pests such as CSSV disease also destroy seedlings. Replacement is done during the first two rainy seasons after field planning of the new farm. The operation carried out as soon as the rain is regular to assure the survival of the seedlings.

6. SHADE MANAGEMENT

When overhead shade is too heavy like in Ghana and sierra Lone, it must be thinned gradually, but can be completely removed if cacao has formed a closed canopy. Thinning and final shade is done at the end of dry season. Big trees, especially timber, should not be felled but killed with poison. It must also be noted that final shade removal wills not produce good results unless capsids, which tend to attacks the exposed cacao, are controlled.

7. FERTLIZER APPLICATION

Cacao was established on many unsuitable soils in West Africa, hence the need to apply fertilizer to maintain high yields. It is revealed that application of fertiliser to immature cacao in Nigeria does not give beneficial effects; but shade removal increases yields effectively.

8. CONTROL OF PLANT PARASITES

Two parasites afflicts cacao in West Africa, they are:

1. Mistletoes
2. Epiphytes

Cutting off the affected part of cacao during rain season controls both.. Effective control requires collective efforts of neighbouring farmers.

9. CONTROL OF PESTS AND DISEASES

This is another important aspect of farm management. Uncontrollable pest in Africa has led to degeneration, poor yield and eventually early death of the trees. The pests include; Mirids, Termites, Monkeys and Rodents,

2.5 USES OF COCOA

Originally cacao was grown to make a drink cocoa or drinking chocolate but at the end of Nineteenth century eating chocolate gradually become more popular.

It has also been noted that cocoa is commercially classified as 'fine' or 'superior' and 'basic'. For the manufacture of both cocoa and chocolate. The

basic cocoa beans are mainly used with some blending of the finer types. Of the basic types. The beans from Amelonado and F3 Amazon are most suitable for chocolate making (especially milk chocolate) become of their mild flavour.

2.5.1 COCOA FOOD VALUE

The nibs of cocoa are rich in calcium, phosphorous, iron and vitamins A and D nutrients, which are essential for growth, and in combination with milk, cocoa beverages are ideal to give strength and energy. Further studies revealed that nibs contain the following percentage compositions:

Table 2.3.1: Constituents of cocoa Nibs

Moisture	5%
Protein	10.5%
Fat	53.3%
Crude Fibre	2.6%
Pentosons	1.5%
Iron tannins	5.8%
Organic acid	2.5%
Theobromine	1.45%
N-free Extract	7.5%
Starch	6.0%
Suars	1.0%
Ash	2.6-3.0%

2.5.2 COMMERCIAL USES OF COCOA

It is processed into the enumerated commercial products but with care allotted to hygiene during processing

1. Cocoa powder
2. Chocolate
    a. Plain chocolate
    b. Milk chocolate
    c. Assorted chocolate
1. Chocolate biscuits coated with a or b or c above
2. Cocoa wines
    a. Sweet wine
    b. Dry wine
1. Cocoa brandy
2. Soy fortified chocolate
    1. jam
    2. Lolly pp
    3. Cocoa balls
    4. Cocoa Rolls and Flakes
    5. Cocoa pop corn and chinchin
    6. Cocoa butter
    7. Cocoa liquor

8. Cooking fat
9. Lighting oil
10. Ointments
11. Hard and soft soap
12. Cocoa oil and candle fat
13. Cocoa as fuel
14. Cocoa ash fertiliser
15. Cocoa medicine
16. Cocoa bread
17. Cocoa biscuits
18. Cocoa cake

2.5.3 ANIMAL FEED

This is one of the by-products of cocoa production via the cocoa pod husk. Groundnut, palm kernel cake, dried fish and prawn all conforming to 30%is added to corn shaft (70%) and traces of cocoa nibs for flavour. This is further packed in polythene sacks measured in 25kg and sold for animal husbandry farmers

2.5.4 EDIBLE AND INEDIBLE PRODUCTS OF COCOA

1. EDIBLE PRODUCT

These are cocoa products that can be consumed by human being i.e. the final processed end product. These are the products of secondary processes. It

includes products such as:

1. chocolate
2. wine and brandy
3. Bread and cake
4. jams and lollipop
5. Dry malt mix and wet malt mix etc.

2. INEDIBLE PRODUCT

These are by products of cocoa that emanates form primary processes and are not consumable by men but animals and some used for household utilities. These include products such as:

1. Animal feed and livestock feeds
2. Soap etc.

The proposed factory shall look into the edibles.

2.6. FACTORY DEFINITION

Having considered the raw material in great details it is also expedient to extensively briefly say something about the envelope in which the raw material is to processed i.e. the factory itself.

A factory in its simplest term can be seen as comprising a defined set of spaces in which man, materials and energy are qualitatively and quantitatively brought together for the purpose of producing a given set of end products.

2.6.1 FUNCTION OF A FACTORY

Basically, a factory is a complex network of functions, including:

1. Material storage
2. Component manufacture
3. Assembly
4. Interprocess storage
5. Packaging
6. Dispatch
7. Transport interface

All of which must work and flow together.

2.6.2 ANTECEDENTS OF FACTORY DEVELOPMENT

The history of factory development has been one of continually changing requirements following improvements in production equipment, mechanical handling and motive power associated with shift of philosophy from individual craftsmanship to soulless production line. The latest innovation is rapidly outdated, and the buildings designed to accommodate it are often obsolete before they are commissioned. The following are considered past landmark in factory development:

a. Agrarian beginnings

b. The philanthropists

c. Industrialist

a. **Agrarian Beginning**

The water powered mills for grain and textiles factory first built were owned by agrarian with the aim of bringing work to depressed agricultural areas to improve the frequently squalid conditions of poverty stricken rural workers at the end of eighteenth century and the employment opportunity this starter brought gave birth to industrial growth.

b. **The Philanthropists**

Early industrialists built where there were sources of power, labour and raw materials. Power was by water wheels; transport by horse and cart, later by canal. A number of industrialists were sincere in aiming at improving the workers lot.

c. **The Industrialist Epoch**

Utopian aspirations in the first generation of mill owners were eroded by the accelerating demand for goods for rapidly expanding empires. Here new economic theories were being developed to stimulate markets artificially by expanding ranges of products. The growth of the second generation jettisoned the communities well being in lieu of expansion and wealth. Hence, demand increases without significant advances in production technology, and the import of labour from outside the immediate area.

2.7 EVOLUTION OF THE PROJECT

The proposed cocoa processing factory is to handle the raw materials, process it from primary stage to the finished cocoa butter and cocoa

powder stage. The proposed type opted for is a processed based production with centralised facility on a process layout.

Process layout is generally used in plants that produce relatively small numbers of many products, all of which require similar process.

2.7.1 ADAPTABILITY IN FACTORIES

In recent past, factories were either designed rigidly around a specific process; or else speculatively to a mean specification, resulting in buildings that are unsuitable for many modern processes. Adaptability must then be in built into factory designs to allow:

1. Change of process to avoid obsolescence
2. Change of process and product following change of ownership

Apart from alterations within the envelope, there may also be requirements for extension; and the design should anticipate this

2.7.2 WORKING METHODS OF FACTORIES

Two major methods van is used to operate production lines in any factory. These are:

(i) Linear assembly and

(ii) Team technology methods

(i) **Linear assembly Method**

This appears to restore to the labour force a feeling of responsibility and achievement. The machines are arranged in group, and all or a substantial part

of the work is assembled within the group. There is a need for storage of materials and components. The main planning requirements are for unrestrictive space and strong floors to enable the machines to be located at will, with adaptable overhead services system. Storage and assembly spaces should be interchangeable.

The two working methods would be subscribed to in the proposed factory design as a response to adaptability in design.

1. MACHINE SIZES

The sizes of typical machines for light and medium duty industries depend on their outline specifications and what they are intended for. Machines in heavy assembly are expected to be denser in girth as compared to the ones to be accommodated in light industries if low technology sizes.

2. NON-PRODUCTION ACCOMMODATION IN FACTORY

Apart from the manufacturing section that is, the factory production lines envelope. All other supporting facilities provided are tagged non-production accommodation and these including;

1. The administrative outfit (office spaces)
2. Employee facilities arena
3. Internal and external Engineering services.

4. ADMINISTRATIVE OFFICES

These are lettable office spaces provided to be occupied by all personnel and administrative officers of the processing factory it is the place business is conceived before production starts. The design is that obtains from all other similar office spaces. Details of the occupants are dealt with explicitly in schedule of accommodation in chapter six.

5. EMPLOYEE FACILITIES

These are ancillary facilities utilised by all this administrative workers, the machine operators, technicians, production managers and plant mangers. The maintenance outfit of the production line is housed there. This envelope brings unity among the teaming workers. The utilities provided within this section includes;

1. The laundry and ironing bay
2. General storage for clothing
3. First aid station
4. Mechanical workshops
5. Electrical workshop
6. Automobile workshop
7. Fuelling station
8. Canteen for staffs
9. Offices for mechanical and Electrical engineers
10. Painters and carpenters workshop
11. Lavatories and bathrooms

6. INTERNAL ENGINEERING

This is a service unit of the factory that is at close proximity to the manufacturing machinery. Facilities belonging to this broad group include:

1. The transformer station
2. The generator house
3. High tension room
4. Power station
5. Boiler
6. Pneumatic equipment (air compressor)
7. Water treatment tank and pumping station

7. EXTERNAL ENGINEERING'S

This consists of the stockpiles, pylon lines, Hoppers, general maintenance facilities i.e. the refrigeration workshop, electrical workshop0, mechanical workshop, automobile workshop, services where AGO, LPFO and Rubia are purchased etc Some of these facilities are segregated are segregated to the factory's envelope for they are prone to fire outbreaks.

Although, all services needed by the factory is supplied by it.

Conversely, the warehousing for raw materials storage and the factory building conformed to the production accommodation in an individual environment, the former and latter added together constitute parts of a whole.

8. USERS DESCRIPTION

To describe operations performed by factory workers efficiently, various facilities provided in each productive and the non-productive accommodation spaces need be reviewed analysed further; hence:

9. PRODUCTION ACCOMMODATION

This is a general store for cocoa bean intake and storage, it is very big open plan space to store as many tonnages' of cocoa bags as possible in a maintained and controlled environment.

Storage of new jute bags to re-bag fault or torn cocoa bags is accommodated with this facilities as well.

2.8. THE FACTORY-PRIMARY PROCESSING

This building accommodates all the machines used in production operations right from the beans intake or bean receptor, bean silos, cleaning machines, Destonner, Winnower, Control room, Roaster, Grinding machine, intermediate storage tanks, pot pressing machine, Butter, tank, cake kbbling machine and powder machines. All these machines have different operations and works they do; and all belong to the primary production processes in an industrial layout. Conveyors stockpiles, Hoppers water reservoirs, pneumatic pumps, boilers, Air handling machines, transformers, power station, Quality control laboratory, loading bay, unloading bay, generator house, High tension room are all factory facilities; but as said earlier, perform different functions.

(ix) POT PRESS

At this point, excess oil is pressed out of the liquor, which have aged for 24 hours in the tank and a hardened circular cake and butter evolved.

The process undergone by the cocoa mass turning to power is called alkalisation while that involved turning same into butter is know as pulverisation.

a. Roller conveyor to the power plant where circular cake is kibbled into granules and further into power and packed into polythene sacks ready for sale transports the cake.

b. Conversely, the butter is further transported into the dirty butter tank where all impurities are filtered off and removed before it enters into the clean butter tank.

(x) TEMPERING MACHINE

This machine cools the butter and turns it viscous before it is packed into cartons for further processing. This product cost N3, 300 per carton; hence it is exported for foreign exchange earnings to be used by pharmaceuticals and confectioner. But the proposed factory shall make use of it in its further processing for National consumption.

(xi) CONVEYORS

Like lifts and stairways, conveyors are transport equipment's used to transfer materials under processes from one place to another in the

factory. The common types in the food-processing factory are:

1. The roller conveyor
2. The screw conveyor

(i) Roller conveyor can transport cartons, bottles or any canned objects from one point to another, it is used in bottling company and in the secondary processing unit of the food processing factory

(ii) Screw conveyor is continuous screw with interlocking spaces along the threading but boxed up in a rectangular or circular steal walling travelling vertically or horizontally carrying granules, nibs, powders op pellets from a pace to another. It is used in the cocoa-processing factory at the primary processing unit.

(xii) **STOCKPILES**

This is a large storage of materials, for futures uses incase, it becomes scarce. Depending on what it is to store, containers can be a giant cylindrical structure made of steel or massive reinforced concrete overhead, underground tanks.

In most factories I went to, the steel ones are used to reserve AGO-adulterated gas oil, LPFO-black oil or diesel, Rubia-engine oil the underground for water reservoir, petroleum products etc. All these are stored outside the factory but at a reasonable distance to factory claddings in case of fire.

(xiii) HOPPERS

It is the name given to those cylindrical containers having a conical outlet with a height advantage. Some are supported on reinforced concrete stand and others having built in tubular tripods from manufacturers. They are flexible in use that is, it can be used to reserve water, diesel etc.

(xiv) PNEUMATIC PUMPS

Both Air compressors producing air at 10 bars of pressure used to generate local evaporative cooling for the air handling units and the Bogel compressor that produces air for gravitational pull within the hoppers belongs to this pneumatic groups and their effects cannot be overemphasised.

(xv) BOILERS

As the name implies, it is a steam manufacturer and infact the power behind the production line. Up to 10or11 bars of steam is supplied into the pot pressing machine, Winnower, liquor tanks, reactors to operate but-5-6 bars of steam is used by each.

It is noted during survey that only feeding machine can work if boiler packed up and that simply implies no production at any rate.

(xvi) AIR HANDLING UNIT (AHU)

This is mechanical device that extracts air at 5-6 bar of pressure from the air compressor to produce cooling effect in factory interiors and office

species by evaporation. AHU is conducted having outlet at strategic openings on ceilings or through the walls.

(xvii) TRANSFORMERS

The pylon lines carrying NEPA cables directly supply the transformers. The transformer is an electromechanical device that steps up or step down power supply from the mains.

The pylon line supplies 33kv to the transformer, which is further, stepped down to 11kv in the high-tension room besides it and further stepped down to 400v at the power station. All these electrical substations clamor around each other and are built to expatriates specifications for they are fire prone areas.

These substation acts as power source to all other parts of the production and non-production commendation in the factory.

(xviii) QUALITY CONTROL LABORATORY

The quality control unit is responsible for:

1. Specification for the entire management. The quality and grades of cocoa purchased and processed before consumption.
2. Microbiological and analytical tests of raw materials, in process and final products.
3. Provision of chemicals at strategic places in workstations on production floors.

4. Taking care of the block off areas in the drainage and in machines

5. Seeing to the packaging of the products.

6. Ensuring operators wore good overall, gloves, and shoes and conducts them hygienically during production process.

7. Carrying out various tests at each stage of production line.

For their great tasks, this same departments is segregated into two viz.:

1. The microbiological

2. The Analytical

The former deals with the biological analysis and the latter, the chemical analysis of the processes.

a. THE MICROBIOLOGICAL SECTION

This is medium open plan space with worktops of 1050mm height with various equipment at strategic places. Equipment used here include:

1. Water bathe

2. Weigh balance

3. Colony counter-micro-organism detector

4. Distiller

5. Auto clave –sterilise

6. Oven-for drying

7. Incubator

8. Fridge.

b. THE ANALYTICAL SECTION

This is almost same size with the biological laboratory, but it is the chemical laboratory and equipment used here is:

1. Moisture determinate machine
2. Centrifuge to checks for fat content in cake and power
3. Supertonic machine to check for clarity of butter.
4. pH machine to check for acidic and alkaline value of solutions, water inclusive.
5. Carbolite machine used to dry stone to wade off fats.
6. Desiccators-helps in reducing moisture content via silica gel.
7. Oven
8. Vacuum oven-to reduce moisture content under vacuum
9. Bunsen burners
10. Burettes, pipettes, conical flasks etc.

(xviiii)HIGH TENSION ROOM

This is the second substation where the power supplied by pylon lines is further stepped down to 11kv before it is sent to the power station which further steps it down to 400v for factory consumption.

(xx) GENERATOR HOUSE

Depending on the production capacity of the industrial layout, generators used in factories are the 650KVA types. Cocoa industry ltd. used 5 Nos. of his types to back up NEPA in case power fails.

2.8.2 LOADING BAYS

A factory's loading area is the link between the production process, its supply of materials and the distribution of the finished product of the market place. It is more than an opening in a factory's envelope for vehicle access; it dictates the speed of vehicle turn around, i.e. manoeuvring, materials handling efficiency, security, energy conservation and the integration of equipment with the building.

(i.) INTERPROCESS STORAGE

This is considered necessary especially on centralised facility assembly. The semi processed materials from the primary processing is stored in a small buffer and later conveyed into the secondary processing floor where it is finished before dispatch. It can also store ingredients needed at subsequent workstations if need be.

It act as buffers and compartmentation for fire between the primary and secondary processing's

(ii) SEMI FINISHED PRODUCT STORAGE

Storaging facilities provided here comply strictly with the secondary processes. A very big illuminated store acting as interface between the marshalling and loading dock. It contains stacking in steel shelf, pallets with the spaces (aisle) for forklifts to manoeuvre.

2.8.3 THE WEIGHT BRIDGE HOUSE

A small enclosure to contain the weight measuring machine and the operators. This building should be visible to the truck weighed.

(i) THE WEIGHT BRIDGE

It is an hydraulic system built of reinforced concrete slab and forged steel plates over a trench long enough to accommodate the longest truck i.e. 15m long and 2.5m wide. The hydraulic system is connected directly to the measuring machine in the weight bridge house. The truck weighs on it while full on ingress and reweigh after unloading at egress, the balance struck and weight of materials supplied determined before payment is made. This is purely used on the primary processing sites.

2.8.4 THE GATE HOUSE

Some gatehouses accommodate the clock in house for the employees, a seat of the security outfits, and a public reception bay. It is highly visible and located to oversee traffic flow both of the vehicular and pedestrian in an industrial environment. To ease traffic congestion and baulking at ingress points, it is considered on a recess acting as set back to the service main access road

CHAPTER THREE

3.0 SANITATION IN FOOD (COCOA) PROCESSING

3.1 HISTORY

A growing awareness of the need for higher standards of sanitation in food industries, this awareness being partly stimulated by a disturbing number of food borne outbreaks in public eating-places has resulted in an increase in formal training programmes.

Historically, New York City has been a municipality that had shown an active interest in upgrading the sanitary standards in its food service establishments. Its history of trying to succeed in this effect has had its ups and downs successful at times, then again fraught with disappointments and setbacks caused by lack of interest and co-operation on the part of the operators and managers of the food service establishment concerned. Courses offered by the health department on voluntary basis were popular at first, but as the years went by increasingly fewer participants attended it, while food poison outbreak were on the increase. Finally, beginning in 1973, the health code takes a course on food protection, set up by the city department of Health. (Hinckley, 1974)

In the meantime in 1971, a conference was conducted by the U.S. food and drug Administration, the public health Association, and representatives of food service industries conducted a conference. The purpose of this conference was to scrutinize existing food protection programs. The consensus was that

food service management personnel should become more knowledgeable in sanitation and sanitary food handling practices.

In 1973 the other department of health developed the first state-wide; food service manager training and certification program in the United States. The FDA showed an interest in Ohio's activities of training and certification, and since then, the concept of food services manager training and certification has spread rapidly. The foodservices industry became increasingly motivated to improve foodservice sanitation through manager training and certification (Palmer et al 1975, Bower and Davis, 1976; White, 1977); it was felt that an industry as large as the foodservice industry (Hall, 1977) has an obligation to raise its sanitary standards and uphold them. To uphold high sanitary standard is no easy task because, the foodservice industry employs approximately four million persons and has an extremely high turnover of employees, possibly one of the highest in any major industry in the United States.

For the purpose of this write up the following expressions have the meaning Stated.

(1). Cleaning: - The removal of soil, food residue dirt, greases or other objectionable matter.

(2). Contaminant: - Any biological or chemical agent foreign matter or other substance not intentionally added to food, which may compromise food safety or suitability.

(3). Contaminant: - Introduction or occurrence of a contaminant in food or environment.

(4). Disinfectant: - the reduction by means of chemical agents and/or physical methods, of the number of micro-organisms in the environment, to a level that does not compromise food safety or suitability

(5). Establishment: - Any building or area in which food is handled and the surroundings under the control of the same management

(6). Food hygiene: - All conditions and measures necessary to ensure the safety and suitability of food at all stages of the food chain with the potential agent in, or condition of, food with the potential to cause an adverse health effect.

HACCP: - A system, which identifies, evaluates, and controls hazards, which are significant for food safety.

FOOD HANDLER: - Any person who directly handles packaged or unpackaged food, food equipment and utensils or food contact surfaces and is therefore expected to comply with food hygiene requirements.

FOOD SAFETY: - Assurance that food will not cause harm to the consumer when it is prepared and is/or eaten according to its intended use.

FOOD SUITABILITY: - Assurance that food is acceptable for human consumption according to its intended use.

3.1.2 PRIMARY PRODUCTION OF COCOA PROCESSING

The steps in the processing of cocoa powder and butter, it should be managed in a way that ensures that food is safe and suitable for its intended use where necessary this will include.

- Avoiding the use of areas where the environment poses a threat to the safety of food.
- Controlling contaminants, pest and diseases of animals and plants in such a way as not to pose a threat to the safety of food
- Adopting practices and measures to ensure food is produced under appropriately sanitation condition.

Rationale:

To reduce the likelihood of introducing a hazard which may adversely affect the safety of food or its suitability for consumption, at later stages of the food chain.

3.1.3 ENVIRONMENTAL SANITATION IN COCOA PROCESSING

Potential source of contamination from the environment should be considered. In particular, primary food production should not be carried on in areas where the presence of potentially harmful substances would lead to unacceptable levels of such substances in food.

3.1.4 SANITISED PRODUCTION OF FOOD SOURCES

The potential effects of primary production activities on the safety and suitability of food should be considered at all times. In particular, this includes identifying any specific points in such activities where a high probability of contamination may exist and taking specific measures to minimize that probability. The HACCP-based approach may assist in the taking of such measures – see Hazard analysis and Critical Control

Producers should as far as practicable implement measures to:

- Control contamination from air, soil, water foodstuffs, pesticides, veterinary drugs or any other agent used in primary production;
- Control plant and animal health so that it does not pose a threat to human health through food consumption, or adversely affect the suitability of the product.
- Protect food sources from faecal and other contamination. In particular, care should be taken to manage wastes, and store harmful substance appropriately. On-farm programmes, which achieve specific food safety goals, are becoming an important part of primary production and should be encouraged.

3.1.5 HANDLING, STORAGE AND TRANSPORT IN COCOA PROCESSING

Producers should be in place to:

- Sort raw cocoa bean to segregate material which is evidently unfit for human consumption
- Dispose of any rejected material in an hygienic manner; and
- Protect food and food ingredients from contamination by pests, or by chemical, physical or microbiological contaminants or other objectionable substances during handling, storage and transport.

Care should be taken to prevent, so far as reasonably practicable deterioration and spoilage through appropriate measures, which may include controlling temperature, humidity, and/or other controls.

3.1.6 CLEANING, MAINTENANCE AND PERSONNEL SANITATION AT PRIMARY PRODUCTION

Appropriate facilities and procedures should be in place to ensure that:

- Any necessary cleaning and maintenance is carried out effectively; and
- An appropriate degree of personal sanitation is maintained.

3.2 ESTABLISHMENT: DESIGN AND FACILITIES IN COCOA PROCESSING INDUSTRY.

OBJECTIVES:

Depending on the nature of the operations and the risks associated with them, premises, equipment and facilities should be located, designed and constructed to ensure that:

- Contamination is minimized;
- Design and layout should permit appropriate maintenances, cleaning, disinfections and should minimize air-borne contamination; for example the first section, which is the bean preparatory section is a separate factory on its own, it should be done in a secluded and confined area because the raw cocoa beans contains a lot of bacteria and dust that could contaminate the sterile and semi sterile product.
- Surface and materials, in particular those in contact with cocoa products, are non-toxic in intended use and, where necessary, suitably durable, and easy to maintain and clean;
- Where appropriate suitable facilities are available for temperature, humidity and other controls; this is why the control room becomes necessary when designing.
- There should be effective protection against pest access and harborage.

The press and the product end section should also be confined in the design to prevent the problem of real contamination.

Rationale:

Attention to good hygiene design and construction, appropriate location, and the provision of adequate facilities, is necessary to enable hazards to be effectively controlled.

3.2.1 LOCATION OF COCOA PROCESSING INDUSTRY.

Potential sources of contamination needs to be considered when deciding where to locate cocoa processing industry, as well as the effectiveness of any reasonable measures that might be taken to protect cocoa products. Cocoa industry should not be located anywhere where, after considering such protective measures, it is clear that there will remain a threat to food safety or suitability. In particular, cocoa industry should normally be located away from:

- Environmentally polluted areas and industrial activities which pose a serious threat of contamination food:
- Areas subject to flooding unless sufficient safeguards are provided:
- Areas prone to infestations of pests:
- Areas where wastes, either solid or liquid cannot be removed effectively

3.2.2 EQUIPMENT

Equipment should be located so that it:

- Permit adequate maintenance and cleaning;
- Functions in accordance with intended use; and
- Facilitate good sanitation practices, including monitoring.

3.2.3 PREMISES AND ROOMS WITHIN THE INDUSTRY.

3.2.4 DESIGN AND LAYOUT

Where appropriate, the internal design and layout of cocoa industry should permit good food sanitation practices including protection against cross-contamination between and during operations by foodstuffs.

3.2.5 INTERNAL STRUCTURES AND FITTINGS

Structures within cocoa industry should be soundly built of durable materials and be easy to maintain clean and where appropriate, able to disinfected. In particular the following specific conditions should be satisfied where necessary to protect the safety and suitability of food.

- The surfaces of walls partitions be made of impervious materials with no toxic effect in intended use:
- Walls and partitions should have a smooth surface up to a height appropriate to the operation;
- Floors should be constructed to allow adequate drainage and cleaning;
- Ceilings and overhead fixtures should be constructed and finished to minimize the build up of dirt and condensation, and the shedding of particles;
- Windows should be easy to clean, be constructed to minimized the build up of dirt and where necessary, be fitted with removable and cleanable insect-proof screens. Where necessary, windows should be fixed;

- Doors should have smooth, non-absorbent surfaces, and easy to clean and, where necessary, disinfect;
- Working surfaces that come into direct contact with food should be in sound condition, durable and easy to clean, maintain and disinfect. They should be made of smooth, non-absorbent materials. And insert to the food, to detergents and disinfectants under normal operating conditions.

3.3 EQUIPMENT

3.3.1 GENERAL

Equipment and containers (other than once-only use containers and packing) coming into contact with cocoa products should be adequately cleaned, disinfected and maintained to avoid the contamination of food. Equipment and containers should be made of material with no toxic effect in intended use. Where necessary. Equipment should be durable and movable or capable of being disassembled to allow for maintenance, cleaning, disaffection, monitoring and for example, to facilitate inspection for pests.

3.3.2 FOOD CONTROL AND MONITORING EQUIPMENT

In addition to the general requirement in paragraph 3.3.1. Equipment used to heat, treat, cool, store or freeze cocoa products should be designed to achieve the required food temperature as rapidly as necessary in the interests of food safety and suitability, and maintain them effectively. Such equipment should also be designed to allow temperatures to be monitored and

controlled. Where necessary, such equipment should have effective means of controlling and monitoring humidity, air-flow and any other characteristic likely to have a detrimental effect on, the safety or suitability of the products. These requirements are intended to ensure that:

Harmful or undesirable micro-organisms or their toxins are eliminated or reduced to safe levels or their survival and growth are effectively controlled;

- Temperatures and other conditions necessary to food safety and suitability can be rapidly achieved and maintained.

3.3.3 CONTAINERS FOR WASTE AND INEDIBLE SUBSTANCES

Containers for waste, by-products and inedible or dangerous substance, should be specifically identifiable, suitably constructed and, where appropriate, made of impervious material. Containers used to hold dangerous substances should be identified and, where appropriate, be lockable to prevent malicious or accidental contamination of food.

3.4 FACILITIES

3.4.1 WATER SUPPLY

An adequate supply of potable water appropriate facilities for its storage, distribution and temperature control should be available when ever necessary to measure the safety and suitability of food.

Potable water should be as specified in the latest edition of WHO Guidelines for Drinking Water Quality, or water of a higher standard. Non-potable water (for use in, for example, fire control, steam production, refrigeration and other similar purpose where it would not contaminate food), shall have a separate system. Non-potable water systems shall be identified and shall not connect with, or allow reflux into, potable water systems.

3.4.2 DRAINAGE AND WASTE DISPOSAL

Adequate drainage and waste disposal systems and facilities should be provided. They should be designed and constructed so that the risk of contaminating food or the potable water supply is avoided

3.4.3 CLEANING

Adequate facilities, suitably designated, should be provided for cleaning food, utensils and equipment. Such facilities should have an adequate supply of hot and cold potable water where appropriate.

3.4.4 PERSONNEL HYGIENE FACILITIES AND TOILETS

Personnel sanitation facilities should be available to ensure that an appropriate degree of personal sanitation can be maintained and to avoid contamination. Where appropriate, facilities should include:

- Adequate means of washing and drying hands, including wash basins and a supply of hot and cold (or suitably temperature controlled) water;

- Lavatories of appropriate sanitation design: and
- Adequate changing facilities for personnel.

Such facilities should be suitably located and designated.

3.4.5 TEMPERATURE CONTROL

Depending on the nature of the food operations undertaken, adequate facilities should be available for heating, cooling, cooking, refrigerating and freezing food, for storing refrigerated or frozen foods, monitoring food temperatures, and when necessary, controlling ambient temperatures to ensure the safety and suitability of food.

3.4.6 AIR QUALITY AND VENTILATION

Adequate means of natural or mechanical ventilation should be provided, in particular to:

- Minimizing air-borne contamination of food, for example, from aerosols and condensation droplets;
- Control ambient temperatures;
- Control doors which might affect the suitability of food; and
- Control humidity, where necessary, to ensure the safety and suitability of food.

Ventilation system should be designed and constructed so that air does not flow from contaminated areas to clean areas and, where necessary, they can be adequately maintained and cleaned.

3.4.7 LIGHTING

Adequate natural or artificial lighting should be provided to enable the undertaking to operate in a sanitised manner. Where necessary, lighting should not be such that resulting colour is misleading. The intensity should be adequate to the nature of the operation. Lighting fixtures should, where appropriate, be protected to ensure that food is not contaminated by breakages.

3.4.8 STORAGE

Where necessary, adequate facilities for the storage of cocoa products (e.g. cleaning materials,) should be provided.

- Where appropriate, cocoa products storage facilities should be designed and constructed to:
- Permit adequate maintenance and cleaning;
- Avoid pest access and harbourage;
- Enable cocoa butter and cocoa powder to be effectively protected from contamination during storage.
- Where necessary, provide environment, which minimizes the deterioration of cocoa products (e.g. by temperature and humidly control).

The type of storage facilities required would depend on the nature of the food where necessary, separate, secure storage facilities for cleaning materials and hazardous substances should be provided.

3.5 CONTROL OF OPERATION

3.5.1 OBJECTIVES

To produce food which is safe and suitable for human consumption by?

- Formulating design requirements with respect to raw materials, Composition, processing distribution, and consumer use to be met in the Manufacture and handling of specific food items; and
- Designing implementing, monitoring and reviewing effective control systems.

Rationale

To reduce the risk of unsafe food by taking preventive measures to assure the safety and suitability of food at an appropriate stage in the operation by controlling food hazards.

3.5.2 CONTROL OF FOOD HAZARDS

Food business operators should control food hazards through the use of systems such as HACCP. They should:

- **Identify** any steps in their operations which are critical to the safety of food;
- **Implement** effective control procedures at those steps;
- **Monitor control** procedures to ensure their continuing effectiveness; and
- **Review** control procedures periodically, and whenever the operations change

The systems should be applied throughout the food chain to control food sanitation throughout the shelf life of the product through proper product and process design.

Control procedures may be simple, such as checking stock rotation calibrating equipment, or correctly loading refrigerated display units. In some cases a system based on expert advice, and involving documentation, may be analysis and critical control (HACCP) System and guidelines for its application (Annex).

3.5.3 KEY ASPECTS OF SANITATION CONTROL SYSTEMS

3.5.4 TIME AND TEMPERATURE CONTROL IN COCOA PROCESSING.

Inadequate food temperature control is one of the most common causes of food borne illness or food spoilage. Such control includes time and temperature of cooking, cooling, processing and storage. System should be in place to ensure that temperature is controlled effectively where it is critical to safety and suitability of food.

Temperature control system should take into account:

- In the micronising and winnowing section under cocoa processing we have the control room, in this section it is ensured that the cocoa is pre dry to about 4% moisture content e.g. its water activity, pH, and likely initial level types of micro- organism;

- The intended shelf-life of the product;
- The method of packaging and processing and
- How the product is intended to be used, e.g. further cooking/processing or ready-to-eat.

Such systems should also specify tolerable limits for time and temperature variations.

Temperature recording devices should be checked at regular intervals and tested for accuracy.

3.5.5 SPECIFIC PROCESS STEPS

Other steps, which contribute, to food hygiene may include, for example:

- Chilling
- Thermal processing
- Irradiation
- Drying
- Chemical preservation
- Vacuum or modified atmospheric packaging

3.5.6 MICROBIOLOGICAL AND OTHER SPECIFICATION

Food handlers, contact surface or the air can transfer pathogens from one food to another, either by direct contact or. Raw, unprocessed cocoa beans should be effectively separated, either physically or by time, from ready-to-eat

finished cocoa products with effective intermediate cleaning and where appropriate disinfections.

Access to processing areas may need to be restricted or controlled where risks are particular high, access to processing areas should be only via a changing facility. Personnel may need to be required to put on clean protective clothing including footwear and wash their hands before entering.

Surface, utensil, equipment, fixtures and fittings should be thoroughly cleaned and where necessary disinfected after raw food, particularly meat and poultry, has been handled or processed.

3.5.7 PHYSICAL AND CHEMICAL CONTAMINATION

Systems should be in place to prevent contamination of foods by foreign bodies such as glass or metal shards from machinery, dust, harmful fumes and unwanted chemicals. In manufacturing and processing, suitable detection or screening devices should be use where necessary.

3.5.8 INCOMING RAW COCOA BEAN REQUIREMENTS

Raw cocoa bean should not be accepted by the establishment if it is known to contain parasites, undesirable micro-organisms, particles, veterinary drugs or toxic, decomposed or extraneous substances which would not be reduced to an acceptable level by normal sorting and/or processing. Where appropriate, specifications for raw materials should be identified and applied.

Raw materials or ingredients should, where appropriate, be inspected and sorted before processing. Where necessary, laboratory tests should be made to establish fitness for use. Only sound, suitable raw cocoa bean or ingredient should be used.

Stocks of raw materials and ingredient should be subject to effective stock rotation.

3.5.9 PACKAGING

Packaging design and materials should provide adequate protection for products to minimize contamination, prevent damage, and accommodate proper labelling. Packaging materials or gases where used must be non-toxic and not pose a threat to the safety and suitability of food under the specified conditions of storage and use. Where appropriate, reusable packaging should be suitably durable, easy to clean and, where necessary, disinfect.

3.6 WATER

3.6.1 IN CONTACT WITH COCOA PROCESSING

Only potable water should be used in cocoa handling and processing, with the following exception.

- For steam production, fire control and other similar purposes not connected with food; and
- In certain food processes, e.g. chilling, and in food handling areas, provided

this does not constitute a hazard to the safety and suitability of food (e.g. the use of clean sea water).

Water recalculated for reuse should be treated and maintained in such a condition that no risk to the safety and suitability of food results from its use. The treatment process should be effectively monitored. Recalculated water, which has received no further treatment, and water recovered from processing of food by evaporation or drying may be used, provided its use does not constitute a risk to the safety and suitability of food.

3.6.2 AS AN INGREDIENT

Potable water should be used wherever necessary to avoid food contamination.

3.6.3 ICE AND STEAM

Ice should be made from water that complies with section 3.4.1. Ice and steam should be produced, handled and stored to protect them from contamination.

Steam used in direct contact with food or food contact surface should not constitute a threat to the safety and suitability of food.

3.6.4 MANAGEMENT AND SUPERVISION

The type of control and supervision needed will depend on the size of the industry, the nature of its activities and the types of food involved. Managers and supervisors should have enough knowledge of food sanitation principles and

practices to be able to judge potential risks, take appropriate preventive and corrective action, and ensure that effective monitoring and supervision takes place.

3.6.5 DOCUMENTATION AND RECORDS

Where necessary, appropriate records of processing, production and distribution should be kept and retained for a period that exceeds the shelf life of the product. Documentation can enhance the credibility and effectiveness of the food safety control system.

3.6.6 RECALL PROCEDURES

Managers should ensure effective procedures are in place to deal with any food safety hazards and to enable the complete, recall of any implicated lot of the finished food from the market. Where a product has been withdrawn because of an immediate health hazards, other products which are produced under similar conditions, and which may present a similar hazards to public health, should be evaluated for safety and may need to be withdrawn. The need for public warning should be considered.

Recall products should be held under supervision until they are destroyed, used for purposes other than human consumption, determined to be safe for human consumption, or reprocessed in a manner to ensure their safety.

3.7 MAINTENANCE AND SANITATION

3.7.1 OBJECTIVES:

To established effective system to:

- Ensure adequate and appropriate maintenance and cleaning;
- Control pests;
- Manage waste; and
- Monitor effectiveness of maintenance and sanitation procedure.

Rationale

To facilitate the continuing effective control food hazards, pest and other agent likely to contaminate food.

3.7.2. MAINTENANCE AND CLEANING

3.7.3 GENERAL

Establishment and equipment should be kept in an appropriate state of repair and condition to:

- Facilitate all sanitation procedure;
- Function as intended, particularly at critical steps
- Prevent contamination of food e.g. from metal shards, flaking plaster debris and chemicals.

Cleaning should remove food residues and dirt, which may be a source of contamination. The necessary cleaning methods and material will depend on the nature of the food business. Disinfections may be necessary after cleaning.

Cleaning chemicals should be handled and used carefully and in accordance with manufacturer instructions and stored, where necessary, separated from food, in clearly identified containers to avoid the risk of contaminating food.

3.7.4 CLEANING PROCEDURES AND METHODS

Cleaning can be carried out by the separate or the combined use of physical methods, such as heat, scrubbing, turbulent flow, vacuum cleaning or other methods that avoid the use of water, and chemical using detergents, alkalis or acids.

- Cleaning procedure where appropriate
- Removing gross debris from surface;
- Applying a detergent solution to loosen soil and bacterial film and hold them in solution or suspension;
- Rising with water which complies section 4, to remove loosened soil and residues and detergent;
- Dry cleaning or other appropriate methods for removing and collecting residues and debris; and
- Where necessary, disinfections.

3.7.5 CLEANING PROGRAMMES

Cleaning and disinfecting programmes should be continually and effectively monitored for their suitability and effectiveness and where

necessary, documented.

Where written cleaning programmes are used, they should specify:

- Areas, item of equipment and utensils to be cleaned
- Responsibility for particular tasks;
- Method and frequency of cleaning; and
- Monitoring arrangements

Where appropriate, programmes should be drawn up in consultation with relevant specialist expert advisors.

3.7.6 PEST CONTROL SYSTEMS

3.7.7 GENERAL

Pests pose a major threat to the safety and suitability of food. Pest infestations can occur where there are breeding sites and a supply of food. Good sanitation practices should be employed to avoid creating an environment conducive to pests. Good sanitation, inspection of incoming materials and good monitoring can minimize the likelihood of infestation and thereby limit the need for pesticides.

3.7.8 PREVENTING ACCESS

Building should be kept in good repair and condition to prevent pest access and to eliminate potential breeding sites. Holes, drains and other place where pests are likely to gain access should be kept sealed. Wire mesh screens, for example on open windows, doors and ventilators, will reduce the problem

of pest entry. Animal should wherever possible, be excluded from the grounds of factories and food processing plants.

3.7.9 HARBORAGE AND INFESTATION

The availability of food and water encourage pest harborage and infestation. Potential food source should be stored in pest-proof containers and/or stacked above the ground and away from walls. Areas both inside and outside food premises should be kept clean. Where appropriate, refuse should be stored in covered, pest proof containers.

3.7.9a MONITORING AND DETECTION

Food industry and surrounding areas should be regularly examined for evidence of infestation.

3.7.9b ERADICATION

Pest infestation should be dealt with immediately and without adversely affecting neither food safety nor suitability. Treatment with chemical, physical or biological agents should be carried out without posing a threat to safety or suitability of food.

3.7.9c WASTE MANAGEMENT

Suitable provision must be made for removal and storage of waste. Waste must not be allowed to accumulated in food handling, food storage, and other working areas and the adjoining environment except so far as is unavoidable for the proper functioning of the business.

Waste stores must be kept appropriately clean.

3.7.9d MONITORING EFFECTIVENESS

Sanitation system should be monitored for effectiveness, periodically verified by means such as audit of pre-operational inspections or, where appropriate, microbiological sampling of environment and food contact surface and regularly reviewed and adapted to reflect changed circumstances.

3.8 PERSONAL SANITATION

3.8.1 OBJECTIVES

To ensure that those who come directly or indirectly into contact with cocoa products are not likely to contamination food by:

- Maintaining and appropriate degree of personal cleanliness;
- Behaving and operating in an appropriate manner.

Rationale

People who do not maintain an appropriate degree of personal cleanliness, who have certain illnesses or condition or who behave inappropriately, can contaminate food and transmit illness to consumers.

3.8.2 HEALTH STATUS

People known, or suspected, to be suffering from, or to be a carrier of a disease or illness likely to be transmitted through food should not be allowed to enter any food handling area if there is a likelihood of their contamination food. Any person so affected should immediately report illness or

symptoms of illness to the management. Medical examination of a food handler should be carried out if clinically or epidemiological indicated.

3.8.3 ILLNESS AND INJURIES

Conditions which should be reported to management so that any need for medical examination and/or possible exclusion from food handling can be considered, include:

- Vomiting
- Fever
- Sore throat with fever
- Visibly infected skin Lesion (boils, cuts, etc)
- Discharge from the ear, eye or nose

3.8.4 PERSONAL CLEANLINESS

Food handler should maintain a high degree of personal cleanliness and, where appropriate, wear suitable protective clothing, head covering, and footwear. Cut and wounds, where personnel are permitted to continue working, should be covered by suitable waterproof dressings.

Personnel should always wash their hands when personal cleanliness may affect food safety, for example:

- At the start food handling activities;
- Immediately after using the toilet; and

- After handling raw food or any contaminated material, where this could result in contamination of items; they should avoid handling ready-to-eat food, where appropriate.

3.8.5 PERSONAL BEHAVIOR

People engaged in food handling activities should refrain from behaviour, which could result in contamination of food, for example:

- Smoking;
- Spitting
- Chewing
- Sneezing or coughing over unprotected food.

Personal effects such as Jewelry, watches, pins or other items should not be worn or brought into food handling areas if they pose a threat to safety and suitability of food.

3.8.6 VISITORS

Visitor to food manufacturing, processing or handling areas should, where appropriate wear protective clothing and adhere to the other personal hygiene.

3.9 TRANSPORTATION IN THE PROCESSING OF COCOA

3.9.1 OBJECTIVES

Measures should be taken where necessary to:

- Protect food from potential source of contamination;
- Protect food from damage likely to render the food unsuitable for consumption; and
- Provide an environment which effectively controls the growth of pathogenic or spoilage micro-organism and the production of toxins in food.

Rationale

Food may become contaminated, or may not reach its destination in a suitable condition for consumption, unless effective control measure are taken during transport, even where adequate hygiene control measures have been taken earlier in the food chain.

3.9.2 GENERAL

Cocoa must be adequately protected during transport. The types of conveyances or containers must be in accordance with the specified one.

3.9.3 REQUIREMENTS.

Where necessary, conveyances and bulk container should be designed and constructed so that they:

- Do not contaminate foods or packaging;
- Can be effectively cleaned and, where necessary, disinfected;
- Permit effective separation of different foods or foods from non-food items where necessary during transport;

- Providing effective protection from contamination, including dust and fumes;
- Can effectively maintain the temperature, humidity, atmosphere and other conditions necessary to protect food from harmful or undesirable microbial growth and deterioration likely to render it unsuitable for consumption; and
- Allow any necessary temperature, humidity and other condition to be checked.

3.9.4 USE AND MAINTENANCE

Conveyance and container for transporting cocoa should be kept in an appropriate state of cleanliness, repair and condition. Where the same conveyance or container is used for transporting different foods, or non-foods, effective cleaning and, where necessary, disinfection should take place between loads.

Where appropriate, particularly in bulk transport, containers and conveyance should be designated and marked for food use only and marked for food use only and be used only for that purpose.

3.9.5 PRODUCT INFORMATION AND CONSUMER AWARENESS

3.9.6 OBJECTIVES:

Products should bear appropriate information to ensure that:

- Adequate and accessible information is available to the next person in the food chain to enable them to handle, store, process, prepare and display the product safely and correctly;
- The lot or batch can be easily identified and recalled if necessary.

Consumer should have enough knowledge of foods hygiene to enable them to:

- Understand the importance of product information;
- Make informed choices appropriate to the individual; and
- Prevent contamination and growth or survival of food borne pathogens by storing, preparing and using it correctly.

Information for industry or trade user should be clearly distinguishable from consumer information, particularly on food labels.

Rationale

Insufficient product information, and/or inadequate knowledge of general food hygiene, can lead to products being mishandled at later stage in the food chain. Such mishandling can result in illness, or products becoming unsuitable for consumption, even where adequate sanitation control measure have been taken earlier in the food chain.

3.9.7 LOT IDENTIFICATION

Lot identification is essential in product recall and also helps effective stock rotation. Each container of food should be permanently marked to

identify the producer and the lot. Codex General Standard for the labelling of pre-packaging foods (CODEX STAN 1-1985) applies.

3.9.8 PRODUCT INFORMATION

All food product should be accompanied by or bear adequate information to enable the next person in the food chain to handle, display, store and prepare and use the product safety and correctly.

i. LABELING

Pre-packaged food should be labelled with clear instructions to enable the next person in the food chain to handle display, store and use the product, safety.

Codex. General Standard for the Labelling of Pre-packaged food (CODEX) STAN 1-1985) applies.

ii CONSUMER EDUCATION

Health education programmes should cover general food hygiene. Such programmes should enable consumers to understand the importance of any product information and to follow any instructions accompanying products, and make informed choices. In particular consumers should be informed of the relationship between time/temperature control and food borne illness.

3.9.9 TRAINING

i. OBJECTIVE:

Those engage in food operations that come directly or indirectly into contact with food should be trained, and/or instructed in food hygiene to

a level appropriate to the operations they are to perform.

Rationale:

Training is fundamentally important to any food sanitation system.

Inadequate sanitation training, and/or instruction and supervision of all people involved in food related activities pose a potential threat to the safety of food and its suitability for consumption.

3.10. AWARENESS AND RESPONSIBILITIES

Food sanitation training is fundamentally important. All personnel should be aware of their role and responsibility in protecting food from contamination or deterioration. Food handlers should have the necessary knowledge and skills to enable them to handle food hygienically. Those who handle strong cleaning chemicals or other potentially hazardous chemicals should be instructed in safe handling techniques.

3.10.1TRAINING PROGRAMMES

Factors to take into account assessing the level of training required include:

- The nature of the food, in particular its ability to sustain growth of pathogenic or spoilage micro-organisms:
- The manner in which the food is handled and packed, including the probability of contamination;
- The extent and nature of processing or further preparation before consumption;

- The conditions under which the food will be stored; and the expected length of time before consumption.

3.10.2 INSTRUCTION AND SUPERVISION

Periodic assessments of the effectiveness of training and instruction programmes should be made, as well as routine supervision and checks to ensure that procedures are being carried out effectively.

Managers and supervisors of food processes should have the necessary knowledge of food sanitation principles and practices to be able to judge potential risks and take the necessary action to remedy deficiencies.

3.10.3 REFRESHER TRAINING

Training programmes should be routinely reviewed and updated where necessary. Systems should be in place to ensure that food handlers remain aware of all procedures necessary to maintain the safety and suitability of food.

CHAPTER FOUR

4.0 CASE STUDIES

The three case studies chosen for this project are

1. Stan mark Cocoa Processing Limited, Ondo
2. Ile-Oluji Cocoa Products Company Limited
3. Cocoa Industries Limited, Akilo Road, Ogba-Lagos.

4.1 CASE STUDY ONE

4.1.1 STANMARK COCOA PROCESSING LMITED, ONDO

4.1.2 General Information

(i) **Location of Site**

Stan mark Cocoa Processing Company is situated at an equidistant position between turnings to Idanre and Ile-Oluji, along a major Akure-Ondo/Ore Expressway.

(ii) **Purpose of Establishment**

As a fully integrated export-oriented unit, Stan mark is established with a singular mission to be preferred supplier of:

(a) Cocoa Butter

(b) Cocoa Liquor

(c) Cocoa Powder

To selected user customers around the world, but as at field survey investigation, only cocoa butter and cocoa powder are produced for exports.

(iii) **Ownership**

Stan mark is a sister company of Cadbury Nigeria Plc., with the latter owning 90% capital investment share of the processing factory. So it is more or less a private corporation managed by Cadbury Nig. Plc.

4.1.3 STATE OF ARTS OF STANMARK FACTORY BUILDING

The architecture of this factory will be discussed and analysed via the following sets of parameters:

(i) **Building Purpose Type**

The design can be traced to a batch production and assembly of a dispersed facility on a processing.

(ii) **Walling System**

Sand Crete block wall and stanchion columns are used to erect and support the roofs structure. Walls and columns are painted with cream paint in and out of the existing buildings on site.

(iii) **Flooring System**

Over site in-situ mass concrete floor finished with granolithic paving is noticed on factory floors and terrazzo floors on all other facilities provided.

(iv) **Roofing System**

Steel trusses are assembled forming simple gable freely to the ground and draining into subsoil catchments area. Skeletal framework on roof is cladded with industrial long span roofing sheet in its natural aluminum anodized colour.

(v) **Colour Scheme**

Butter cream sandtex paint textured both walls and stanchion units forming a visual rhythm of colour.

(vi) **Accessibility**

Stan mark Cocoa Processing factory is easily accessible from the main arterial along Ondo. Although set back is 25m from the edge of the road to the fence line.

(vii) **Flexibility**

Space provided is more flexible. Automation and modernization is encouraged by interior spaces.

(viii) **Landscape**

The only lot enjoying soft landscaping is the little narrow stretch outside the fence. All other space is massively concreted.

(ix) **Interior Design**

The Butter cream paint on interior walls enhances redistribution of reflected light at workstations and visual task is done without glare discomfort.

(x) **Fenestration**

Indoor air is through evaporated cooling derived on site via the air handling equipments.

(xi) **Illumination**

Wall is almost drab. Lighting is achieved mostly by permanent supplementary artificial lighting coupled with roof light through transparent sheets on the roof.

(xii) **Zoning**

The high decibel zone is located at the western axis of site while places of low decibel are located close to the main gate. The administrative building and employee facility building are located at an interface to customers to buffer factory building.

(xiii) **Future Expansion**

Virtually all the spaces have been maximized in use leaving a directional expansion axis.

(xiv) **Site Plan**

Planning is more compact. Circulation is highly defined. Location

of mechanical equipment such as Weight Bridge is at the entire gatehouse on truck entrance.

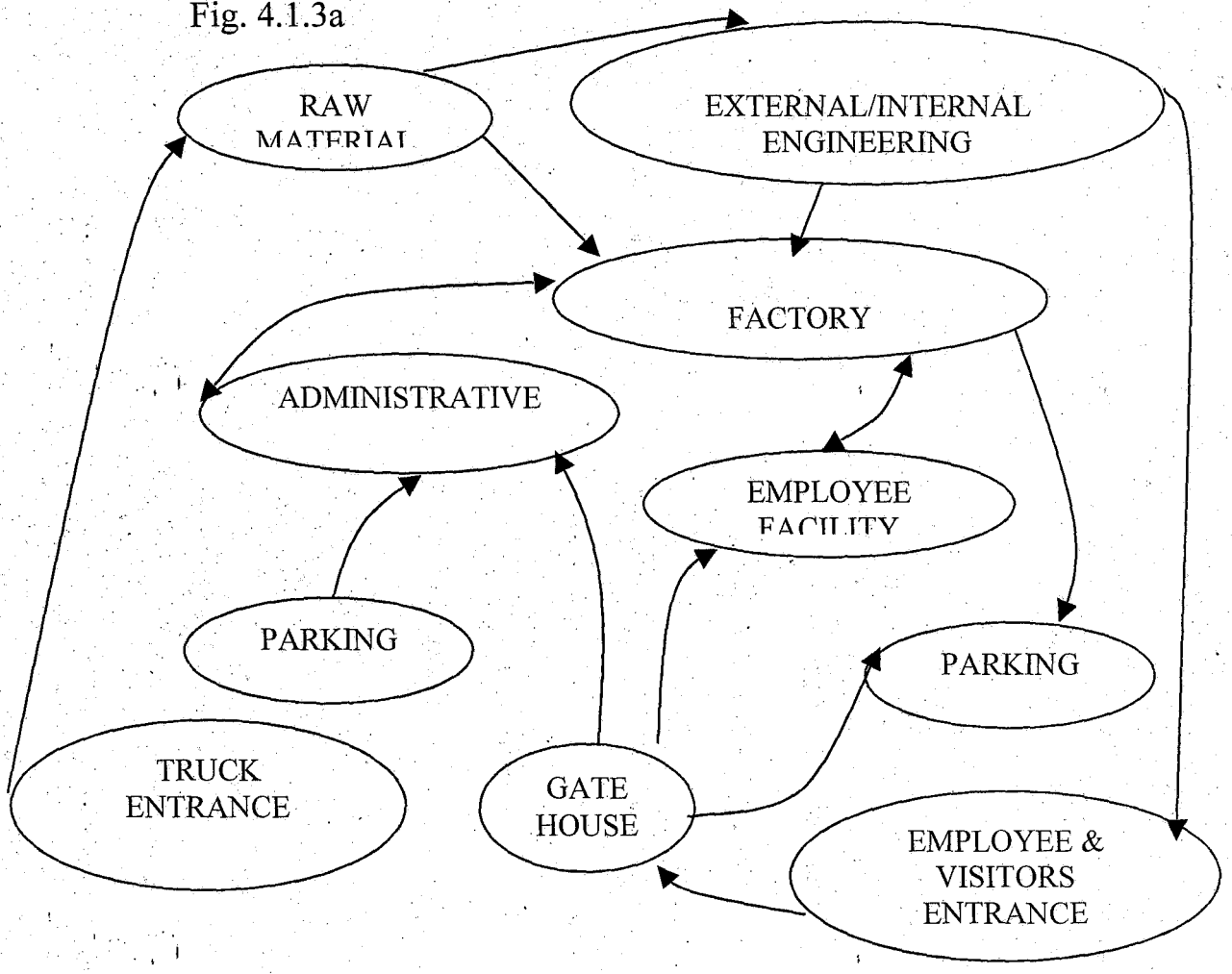
Administrative building is detached from the factory but with questionable set back. The whole layout looked clustered; with the factory in an L shape plan imposing its three dimensional portrait to observers along Ondo-Ore road.

(xv) **Drainage**

The site is a considerably flat but subsoil catchment slope gradually to the rear of the site where it is drained.

(xvi) **Flow Diagram of Stan mark Cocoa Limited**

Fig. 4.1.3a



Service route (raw materials)
Vehicular route (trucks and cars)
Pedestrian route (working forces)

The only addition on Stanmark production flow is the weight bridge; which weighs all raw materials needed by the factory to automatic hydraulic machines before it gets to the raw store which is appended to the factory at the rear where bean is conveyed through

(xvii) **Production Capacity**

The production capacity of Stan mark is 1/3 of its Ile-Oluji counterpart. In a month Stan mark processing line processes 833 tones of Cocoa bean, which means a net processing. Capacity of 10,000 tones per annum. Statistically, it implies that 13,328 bags month and 159,938 bags per annum is processed of raw cocoa beans purchased from produce merchants.

(xviii) **Products**

With reference to 3.31 (ii) in subsequent parts, Stan mark Cocoa Processing Limited produces three products which are: -

Cocoa butter Cocoa Liquor mainly for exports Cocoa powder (used by Mother Company, Cadbury)

(xviiii) **Sources of Raw Materials**

Cocoa beans are sourced from neighbouring towns and village settlements and from designated produce merchants. Borehole is sunk into subsoil of site to generate water, which is treated on site before conveyed for factory use. Two underground storage tanks are used having 33,000 litres capacity each.

(xx) **Sources of Power**

Pylon lines from NEPA feeds the on site assembled transformer for power to drive machines and a complimentary arrangement of two 50KVA generators are installed on site in case NEPA fails.

(xxi) **Staff Strength**

Stan mark working force equals 120 staffs, comprising of the directors managers, technologists, and casual workers. Four shifts are per day for 6 man-hours of work and 7 days of the week.

(xxii) **Staff Training**

Training for her mother body does staffers i.e. Cadbury in Lagos and qualified trainees sent to Stan mark in Ondo to take on task he has been trained for.

4.1.4 MAINTENANCE

(i) **Services**

Services enjoyed at Stan mark Cocoa Ltd. Includes employee facilities, internal and external engineering respectively.

(ii) **Waste Management**

Used water from canteen, factory and maintenance units is treated before effluent into cesspool. Contract staffs do sewage treatment.

(iii) **Security System**

Outwardly facing floodlights mounted at strategic position on factory exterior walls coupled with security surveillance by officers in patrol day and night helped Stan mark ward of theft activities while not in operation.

4.1.5 EVALUATION

Merits

(i) Site is easily accessible from Ondo-Ore road.

(ii) Set back from edge of road to fence line at the gatehouse interface is considerable.

(iii) Internal circulation is controlled, both vehicular and pedestrian.

(iv) Site is considerably flat, truck movement is uninhibited.

(v) The protruded canopy above loading bay checks out vagaries of weather and helps in outdoor palletising.

(vi) The environment looked well maintained; and hygienic.

(vii) Hydraulic weight bridges location is satiable, dictates controlled and good managerial and production function.

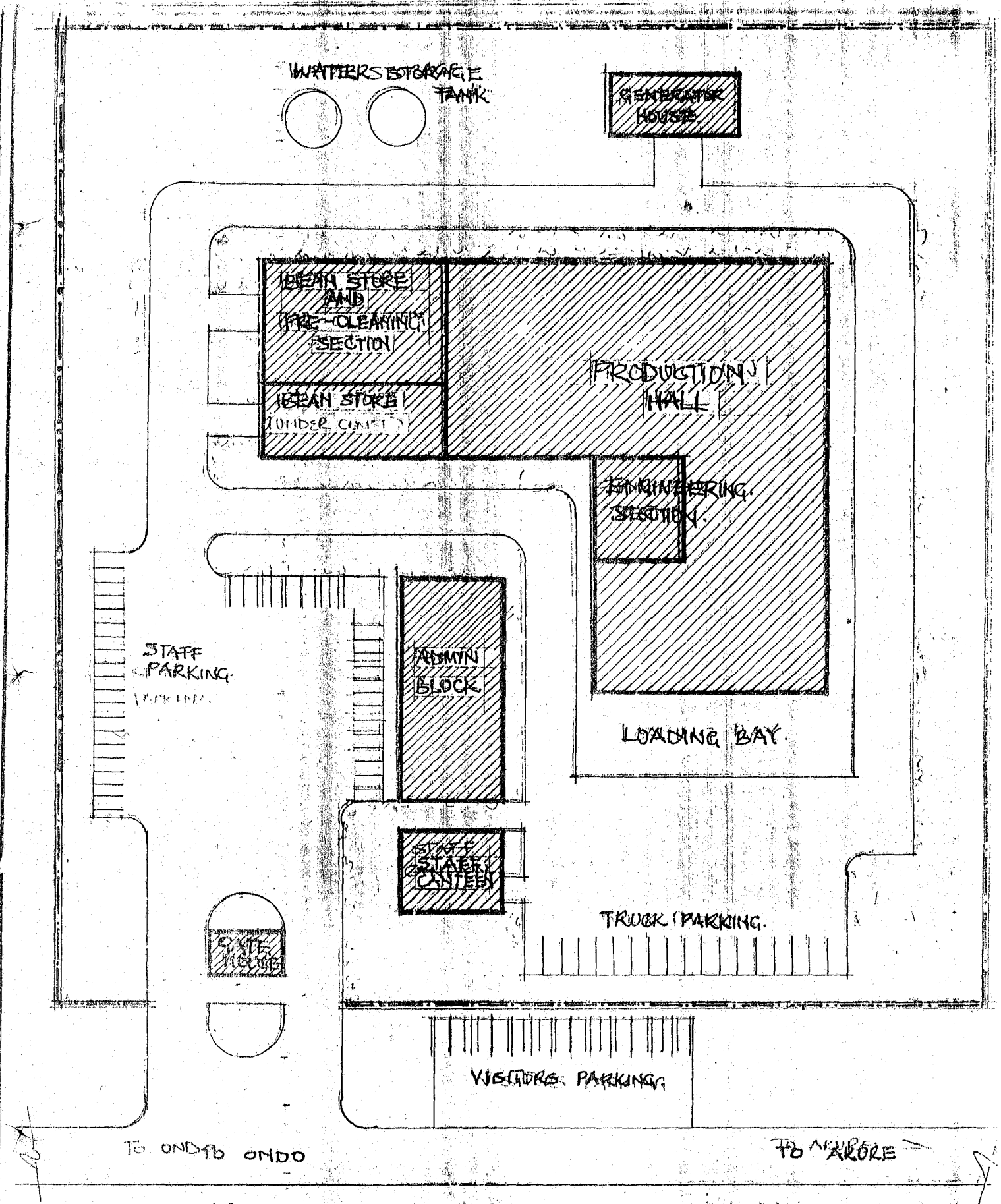
Demerits

(i) Location of Administrative offices falls to a noise producing machinery zone.

(ii) Employee's facilities building do not allow breathing space for administrative staffs.

(iii) Raw materials storage is small compared to the processing capacity.

ILLU. 4.1.1.



STANMARK COCOA PROCESSING LIMITED, ONDO STATE.

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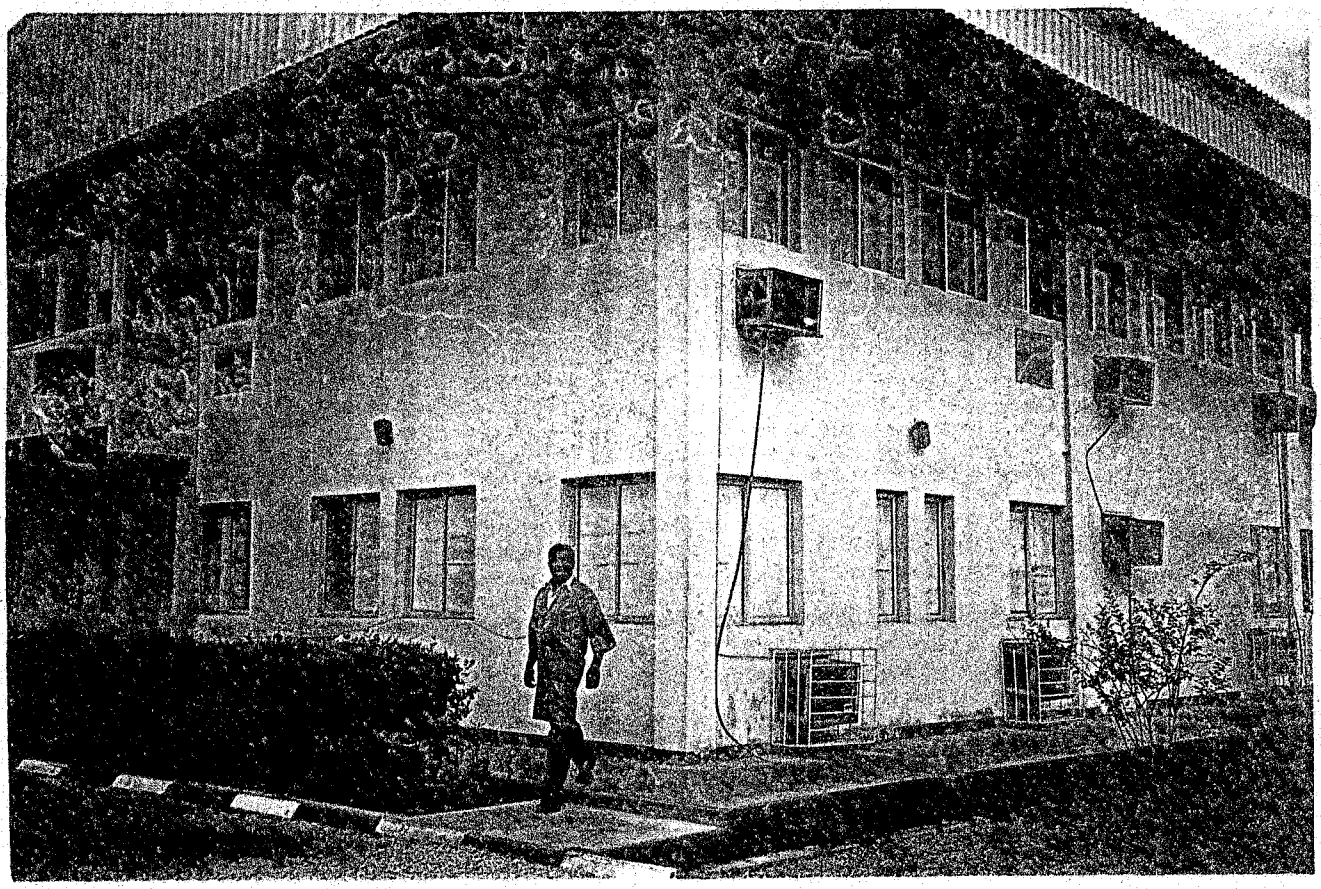
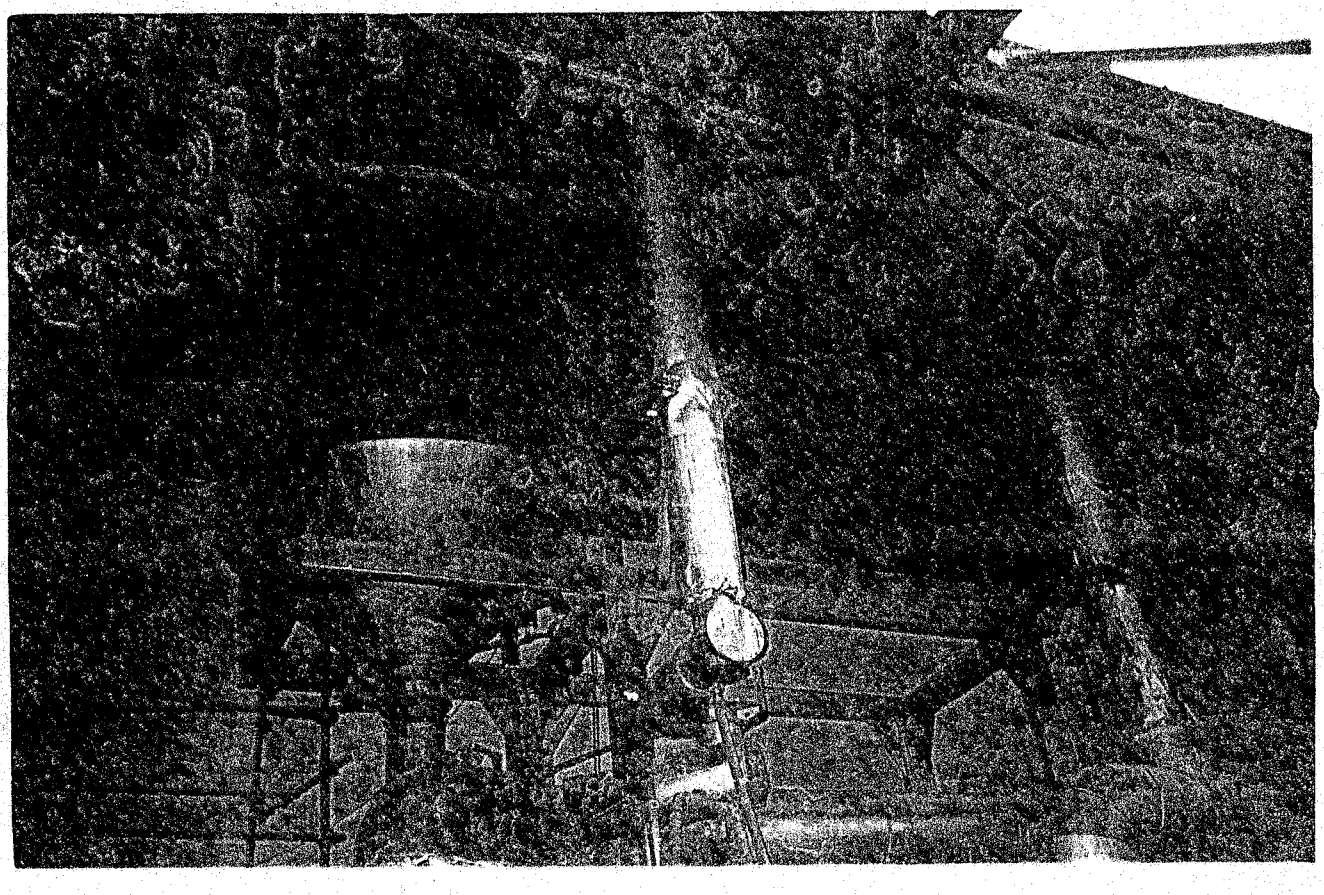
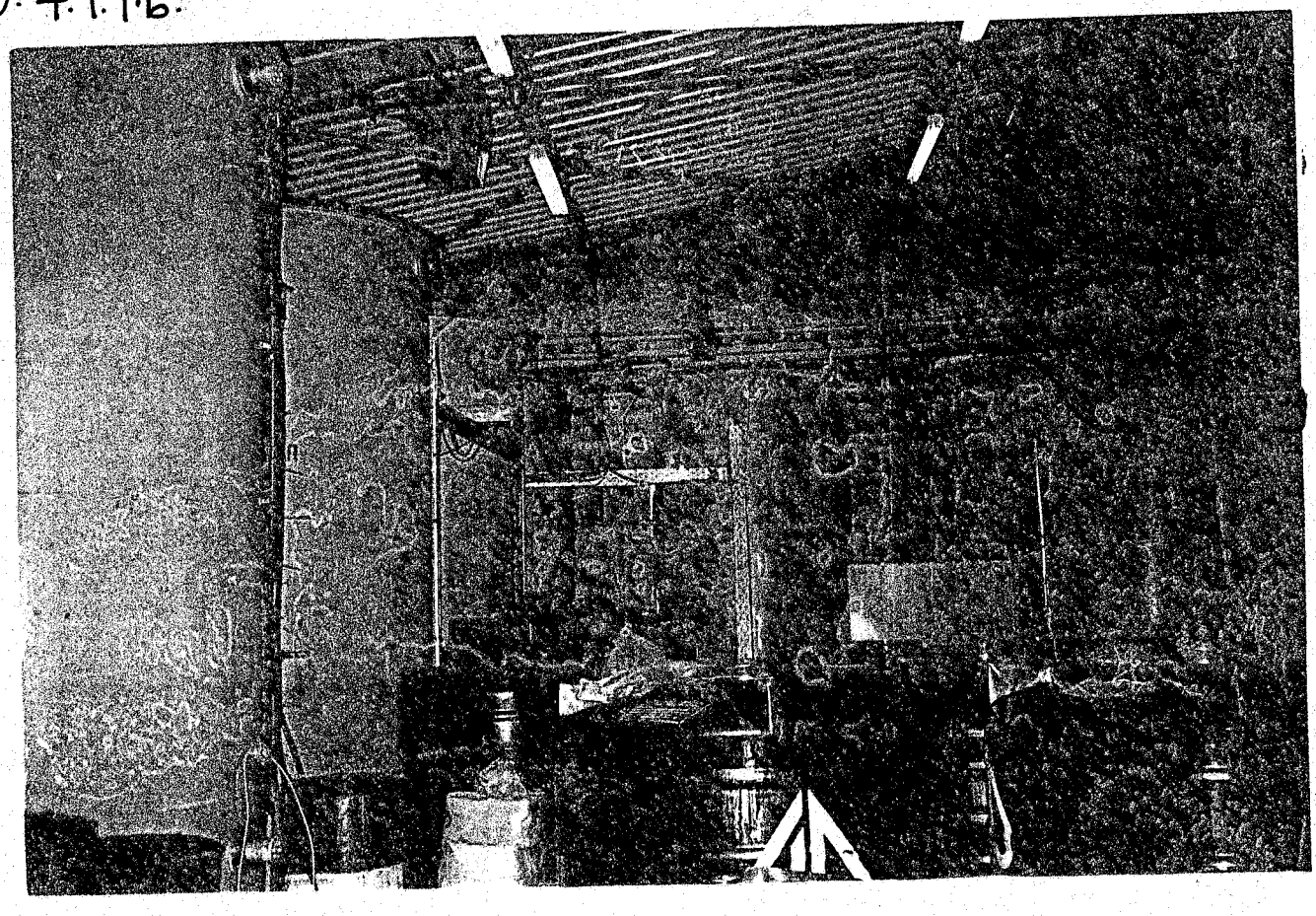


ADMINISTATIVE OFFICE

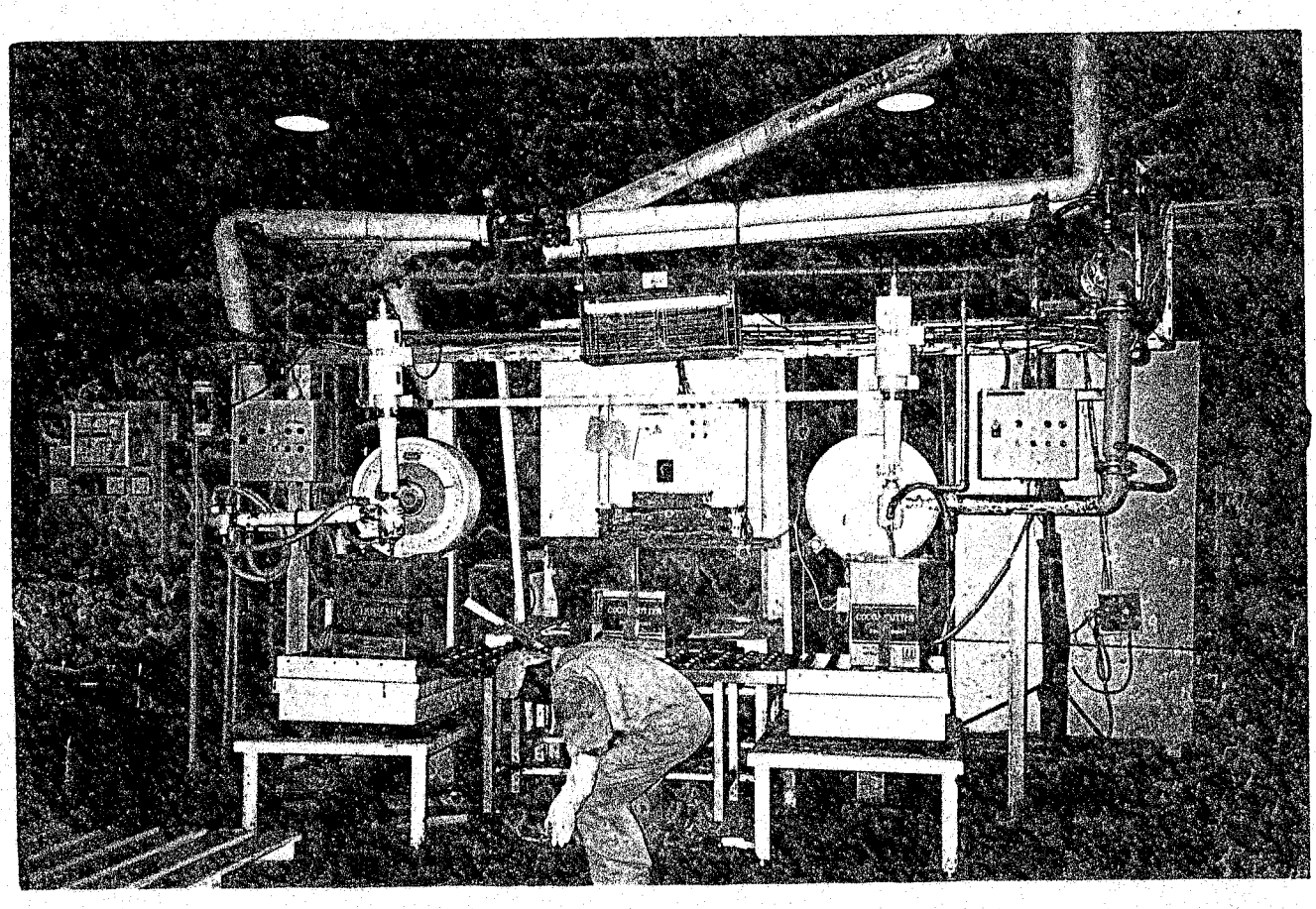


PRE- CLEANING SECTION.

ILLU. 4.1.16.



CLEAN BUTTER TANKS.



BUTTER PARKAGING SECTION.

4.2 CASE STUDY TWO

4.2.1 ILE-OLUJI COCOA PRODUCTS COMPANY LIMITED, ONDO STATE.

4.2.2 General Information

(i) **Location of Site**

The factory is at 30 minutes drive from Stan mark Cocoa Processing Ltd. and 20 minutes drive form Ondo Motor Park. It is situated on the outskirts of Ile-Oluji to the left hand side of Ondo-Ile-Oluji access road.

(ii) **Purpose of Establishment**

Unlike Stan mark Cocoa Processing Factories, it is not an export products factory but acts as processors for speculative produce merchants. This factory buys cocoa in a larger quantity, stores it and processes it to be sold locally. Processes involved:

(i) Cocoa Cake

(ii) Cocoa Powder

(iii) Cocoa Liquor

(iv) Cocoa Butter

As at the time of field survey, some machines have broken down and it was gathered that 30,000 tones produced annually has been drastically reduce to 1,000 tones per annum for this reason.

(iii) Ownership

Just recently due to the factory's debt burden under Mr. Olutola Senbore amounting to N1.5 billion, Adefarati government pledged through the Nigerian Deposits Insurance Corporation (NDIC) to resuscitate the epileptic factory and put it back to production shape.

Hence, the Ondo State government now owns Ile-Oluji.

(Source from the PUNCH April 20, 2000)

4.2.3 STATE OF ARTS ILE-OLUJI FACTORY BUILDINGS

The architectural drawing is not accessible so the industrial architecture shall be analysed via the under listed parameters:

(i) Building Purpose Type

The design can be traced to a batch production and assembly of dispersed facility on a processing.

(ii) Walling System

Sand Crete block wall stanchion columns are used to erect and support the roof but stopped at some 600mm below the industrial roofing eaves to allow for air movement through wired mesh that covered the opening.

(iii) Colour Scheme

Butter cream, Sandtex Paint textured both wall and stanchion unit forming a visual rhythm of colour.

(iv) Accessibility

The factory site easily accessible through the combined ingress and egress vehicular route manned by security outfit at the gatehouse. This opening is economical as compared to Stan mark Cocoa factory. No meandering is done by trucks till it gets to the designated raw material store at the rear of the factory.

(vii) Flexibility

The factory is to a high degree more flexible than Stan mark Cocoa Processing Company.

(viii) Landscape

Landscape is integrated into planning scheme and this gives as a sense of ornamentation and balance throughout the building space. Stan mark is least landscaped.

(ix) Interior Design

Spaces allocated to machineries, workstations are generous and enhances automation and future expansion. The interior spaces are more versatile than Stan mark Cocoa Ltd.

(x) Fenestration

The whole of factory appears drab on the wall from the ground line to a 600m drop in height below roof where a continuous opening is accommodated for air movement. External engineering building open up to air for its liability to catch fire easily.

(xi) Illumination

Light comes in through large door openings, openings on walls and the artificial lighting system provided.

(xii) Zoning

All facilities were detached and arranged in order of necessity to the factory employees and production ethics. By this arrangement, Public, semi-public and private zones are desperately mapped out and this manifests as one travels deeply into the factory interiors.

(xiii) Site Plan

Planning is dispersed. Functions are located at specific distances to one another. This encourages easy fire check by bridges. Location of Weight Bridge is rightly incorporated. Although vehicular access within factory does not encapsulate it but still more functional.

An extension to the administrative block is located parallel to an axis of the factory. The external and internal engineering were located a distance apart from factory building and raw material store outweighs those of cooperative and Stan mark to a larger extent.

(xiv) Drainage

Subsoil catchment flows on the gradual gradient of the site, which is to the rear direction and flows along the curvilinear road at the base of store, passes by the administrative extension and flows into a cesspool where it finally drains off.

(xv) Flow Diagram of Ile-Oluji Cocoa Company

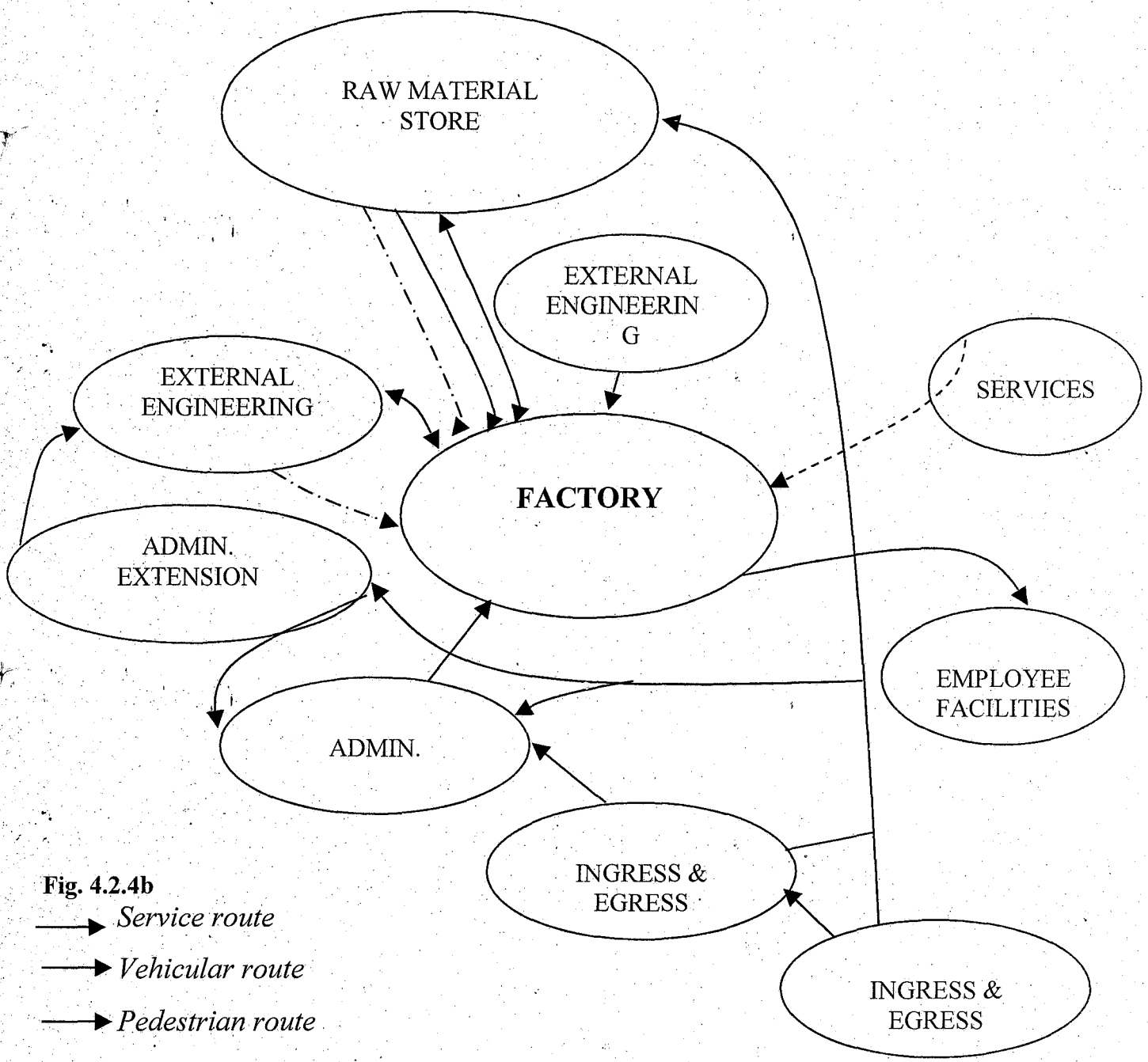


Fig. 4.2.4b

Service route

Vehicular route

Pedestrian route

4.2.5 PRODUCTION AND OPERATION MANAGEMENT

(i) Machineries and Equipments

All machinery's and processing line are old modeled types, having 3 times the capacity of Stan mark Cocoa Ltd. All other equipments correlate with the Cooperative and Stan mark Cocoa factories. 2 Nos. 630KVA generators are used to generate power for production.

(ii) Working Methods of Ile-Oluji Cocoa

Methods subscribed to here is flexible, as processing line encourages both linear and team assembly programmes at workstations, which is an added advantage over cooperative and Stan mark Cocoa companies.

(iii) Production Flow

The raw materials storage is situated at the rear of the factory. Cocoa reception bay is directly accessible to it and production processes starts from the cleaning machine, to micronising and winnowing machine and through Roaster to Refinery goes through pressing machine to butter cleaning section moves towards the cake kibbling machine and to the powder plan and ends at butter and liquor packaging as well as at powder store ready for dispatch. Impliedly, production processes starts from the rear-ending at an

interface with the general administrative building where trucks load end products to various consumers.

Factory is also an L shape correlating with Stan marks', but now in a complete 2-dimensional scale.

(iv) Production Capacity

When in full operation Ilé-Oluji can process 2,500 tonnes of raw cocoa per month. This culminates in 30,000 tonnes production capacity per annum, i.e. it processes 40,000.50kg bags of raw cocoa per month and 480,000.50kg of same per annum but as at the time of reconnaissance survey, only 1,000 tones of raw cocoa was processed as some production machineries has broken down and the raw materials distribution/supplier had run away.

Out of this input tonnage, end products have been liquor, powder and cake.

(v) Products

Same as in Cooperative Cocoa Ltd., but Ile-Oluji is not an export product Limited.

(vi) Sources of Raw Materials

Cocoa is bought from Ile-Oluji and Idanre farmers. The water station constructed on site supplies water used for processing.

(viii) Staff Strength

During survey, production had dropped from 30,000 tonnes to 1,000 tonnes annually which implies 83 tonnes of production per month and this had greatly reduced the staff strength to the minimum. Less than 60 working force are there presently.

(ix) Staff Training

No provision for staffers training exists during reconnaissance survey.

4.2.6 MAINTENANCE

(i) Services

Services provided correlates with those of Cooperative and Cocoa Industries Limited, Ede.

4.2.7 EVALUATION

Merits

(i) Site is located at outskirt of Ile-Oluji reducing environmental Hazard risks to settlers at large.

(i) Site is well landscaped and a good scenario is imposed upon observers.

(ii) The factory is easily accessible from the distributive road.

(iii) Adequate parking spaces are provided for visitors and employees within the factory's premises.

(iv) Dispersed distribution functions on site reduces fire risk and hazards.

(v) Stockpiles of diesel are compartmentalized from generator room with solid wall.

(vi) Production flow is unlimited unlike what obtains in Cooperative Cocoa.

(vii) Raw material storage is extra big and can retain the required tones of cocoa beans and other complimentary raw materials at the same time.

(viii) Low rise Main Administrative, Administrative extension and auxiliary room enhances free flow of air and light into factory spaces.

(ix) Drainage system is effectively oriented without blockage.

(x) The environment is hygienic and appears architectural.

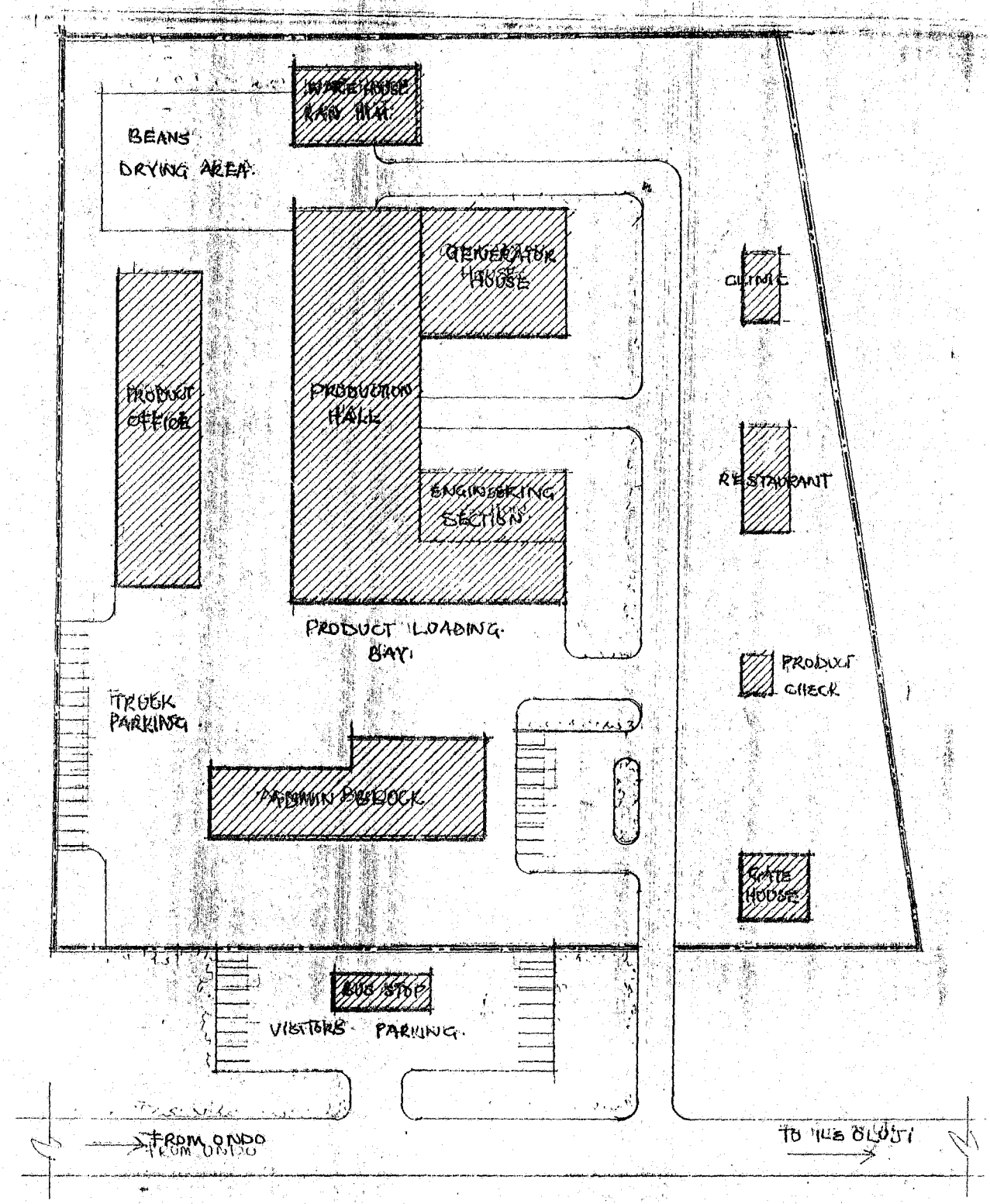
(xi) Power sourced through high-tension room is conveyed through underground channel into the factory space; making the factory environment looks neater.

Demerits

(i) Structures are too many on site; spaces are not judiciously planned and used.

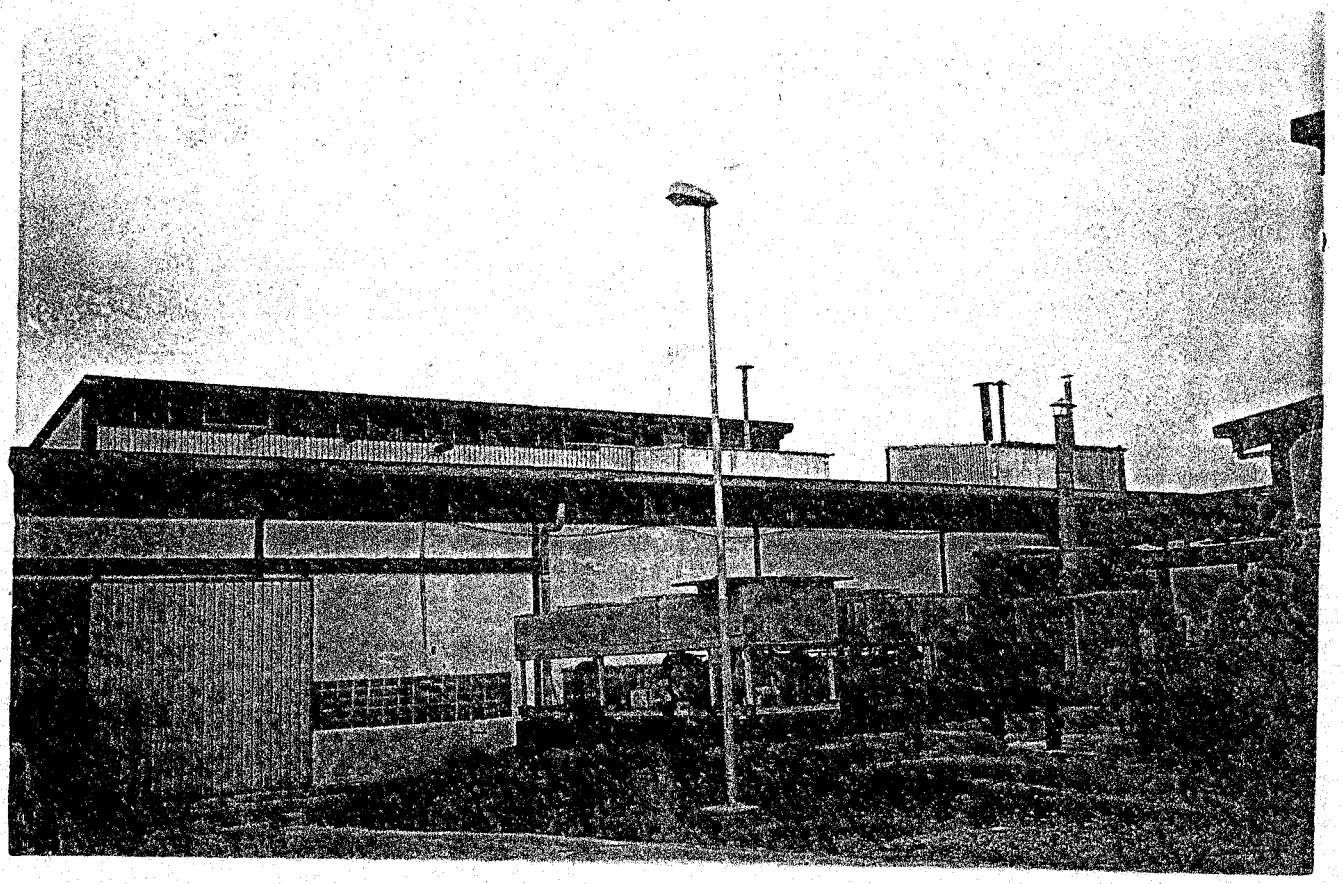
(ii) No specific outdoor recreation for workers.

ILLU 4.2.1. ILE-OLUJI COCOA PRODUCT COMPANY LIMITED, ONDO STATE

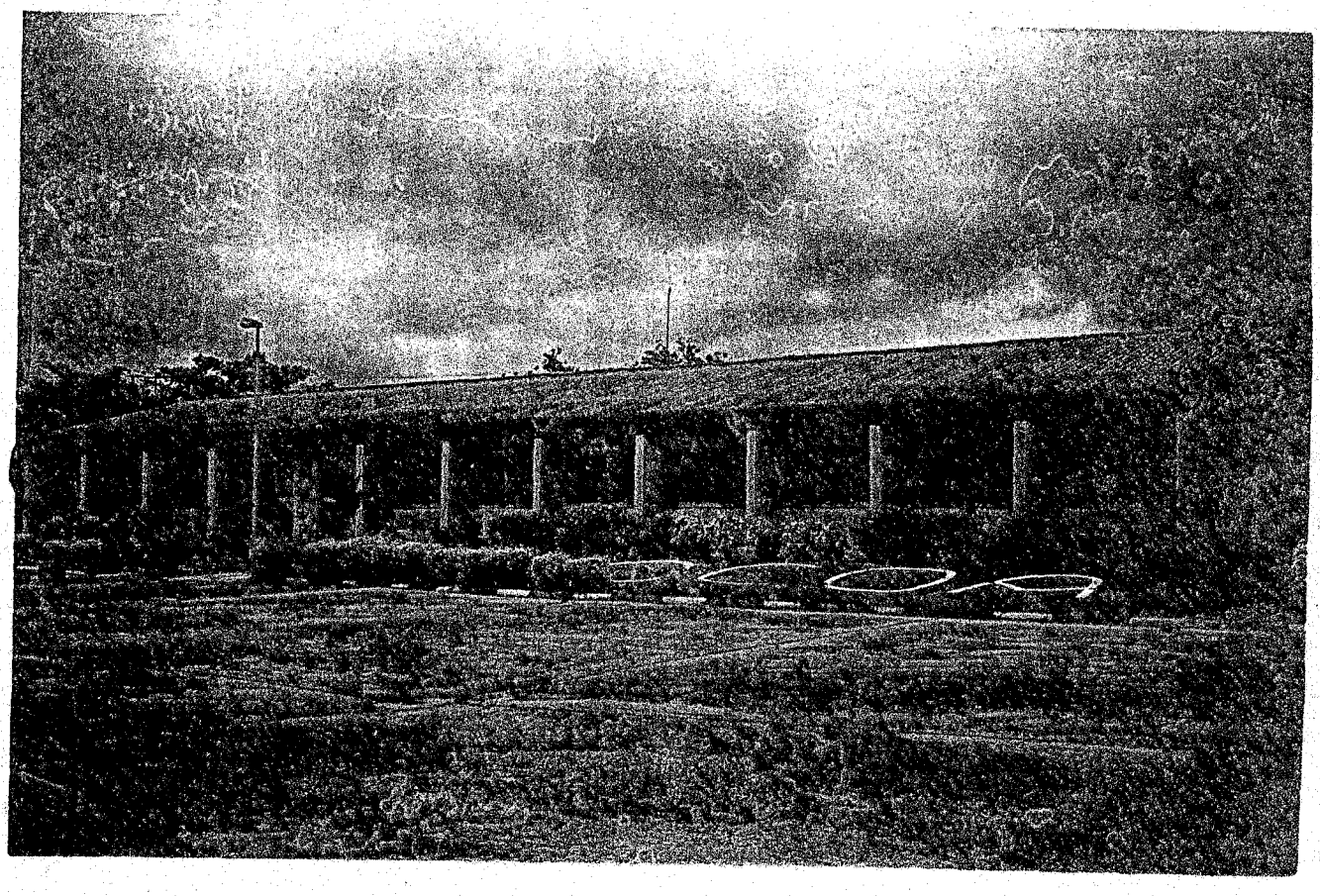


SITE PLAN.

ILLU-4.2.1.a

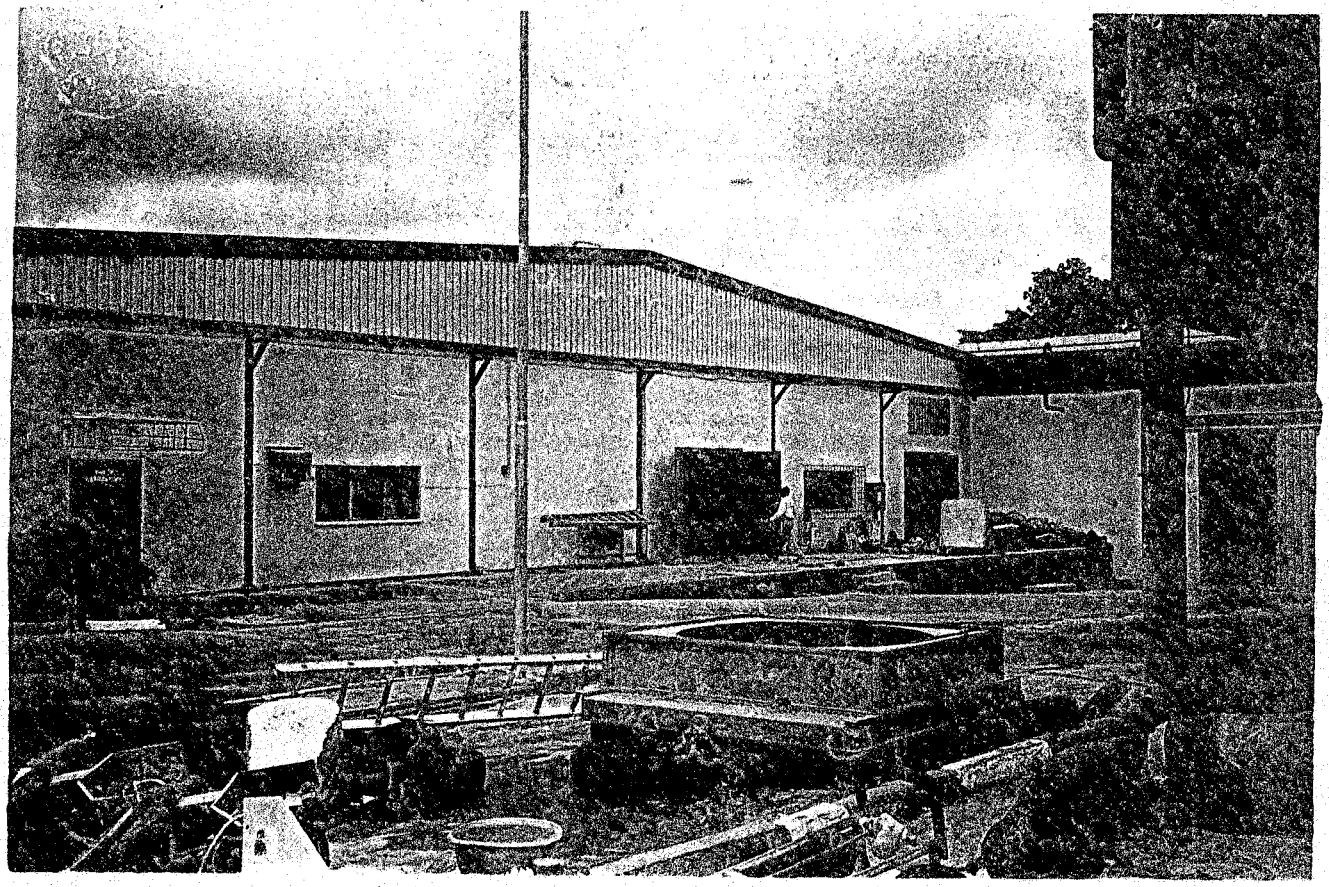


GENERATOR SECTION.

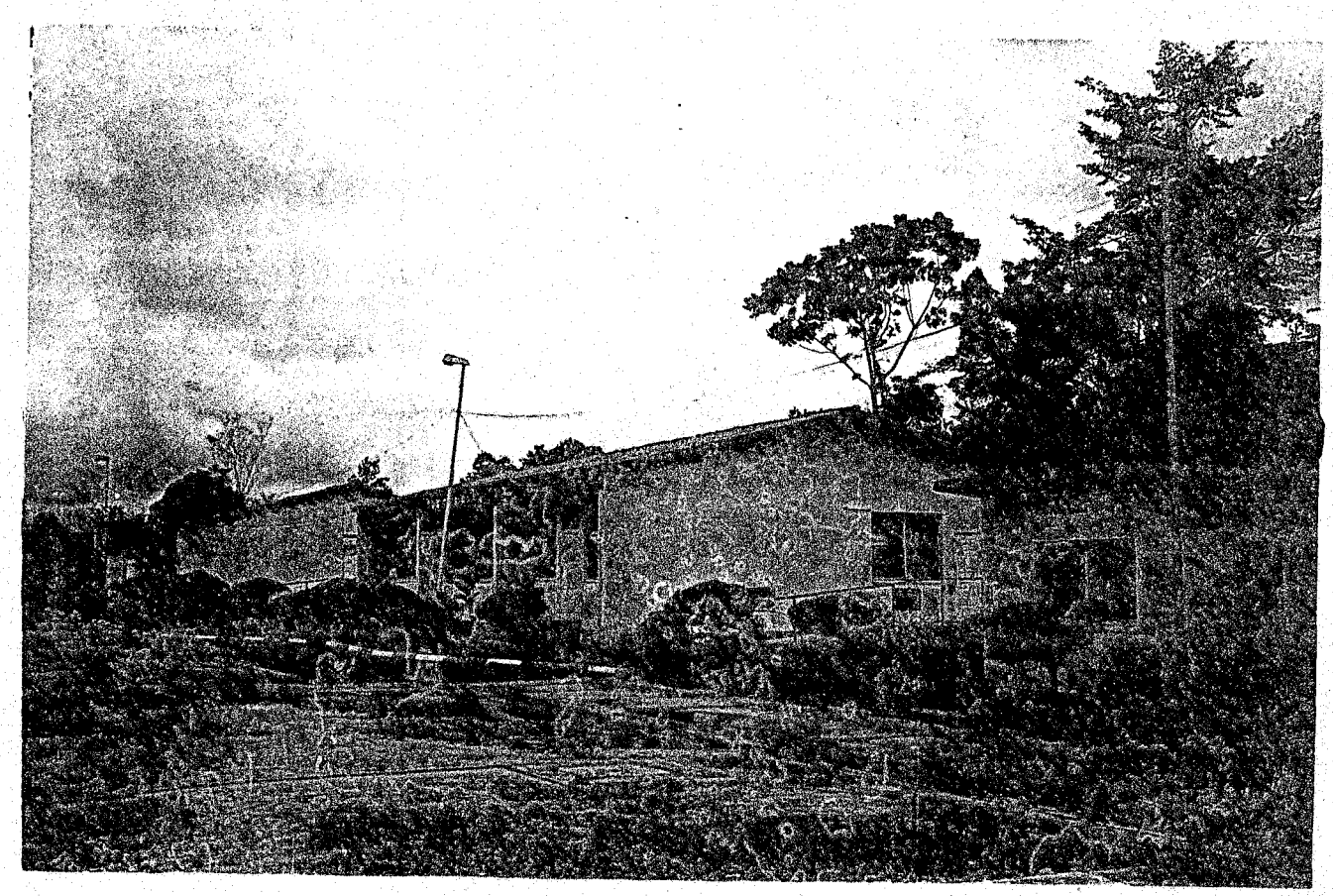


ADMINISTRATIVE OFFICE

ILLV. 4.2.1.B



RIGHT SIDE ELEVATION.



RESTAURANT / CLINIC

(iii) Employee faculties are too far from the factory space.

(iv) Lighting system in Butter, Liquor and powder packing closer to the loading bay is insufficient.

4.3 CASE STUDY THREE

4.3.1 COCOA INDUSTRIES LIMITED, AKILO ROAD, OGBA, LAGOS

4.3.2 General Information

(i) Location of Site

This Cocoa-processing factory is located in the confines of Ogba industrial estate layout with easily accessible roads passing by Nigeria Breweries Ltd., brewer of Harp beer distributing vehicular traffics on three sides of the site. Existing manufacturing industries, malls and pharmaceutical companies bounded the site in all its cardinals.

CIL Ogba is specifically located on the left hand side along Akilo road.

(ii) Purpose of Establishment

CIL was incorporated in 1985, started operation in 1967 as the only pioneer cocoa processing company initially managed by German experts COUTINHO, CARO & CO. until 1970 when it was taken

over by Nigeria-Odua Investments. Since then it has been producing:

(i) Cocoa cake
(ii) Cocoa powder } Primary processes
(iii) Cocoa butter

(iv) Vitalo – a beverage drink (secondary process)

All these products are available in loading bays as at the time of reconnaissance survey.

(iii) Ownership

Odua Investments and Emerald of Germany, with Odua 70% investment share and the latter 30% investment share jointly own Cocoa Industries Limited up to date. Odua and Emerald are both private corporations; hence C.I.L. is a private company.

4.3.3 STATE OF ARTS C.I.L. FACTORY BUILDINGS

The architectural drawings are not available so the following parameters shall be used to judge C.I.L. industrial layout.

(i) Building Purpose Type

With reference to July on Drury, building purpose type is a batch production assembly of a centralized processing facility.

(ii) Walling System

Modular coordination of reinforced concrete columns and beans

with non-loading bearing cement sand Crete walls are used as walls. Openings on facades are screened by closely arranged reinforced concrete fins travelling from underside of beans and stopping on the finished floors forming a structural rhythm on approach vistas of all existing buildings on C.I.L. site.

(iii) Flooring System

Over site in situ mass concrete is finished with granolithic paviours as seen on C.I.L. floors.

(iv) Roofing System

Roofing system in Cocoa industries limited is purely monolithic, exhibiting exploits in reinforced concrete with multi bay longspan cylindrical shells carried by modular coordinated columns and beams.

(v) Colour Scheme

Massive exterior wall is painted butter cream and the r.c. fins appear in-marine grays colour showing a sharp contrast in visual perception against the environment.

(vi) Accessibility

Although located in an urban industrial layout, is still accessible from major service roads but with drastically reduced set backs from fence line unlike what obtains at factories in Osun and Ondo

states. The loading bay faces ingress road directly easing manoeuvring and marshalling without baulking of vehicular traffics.

(vii) Flexibility

Production hall is flexible in nature. It can accommodate new technology and automation.

(viii) Landscape

Factory premise is not adequately landscaped as site is covered with granolithic paving, and tarmac exposing almost all the site to vehicular accesses. No trees and walkways. The spacing lawn is on the right flank opposite Nigerian Brewery Ltd.

(ix) Interior Design

Underside of roof looks interesting and reflects illuminated lights through shells chord on its spans. No glare discomfort occurs at workstations.

(x) Fenestration

Factory space is ventilated through openings below shells. Butter room is ventilated through evaporative cooling, together with all office spaces.

(xi) Illumination

A chord opening or reinforced concrete shell allows solar radiation

without glare discomfort at workstations. Permanent supplementary artificial lighting is used in the Butter, cake and powder sections.

(xii) Zoning

The administrative and training school buildings are situated closer to the ingress points while production hall and maintenance workshops (external engineering outfits) are located towards the rear. Although, by the close to the 1st gate are located stockpiles for fuel and generator house which imposes an unsightly appearance of the factory. Raw material store is far from production floor, loading bays closely connected to production floor, Employees facilities is closer to the Administrative area, visitors car park is outside the factory, only executives have car packs situated besides the gate house other employees parking causes baulking for loading trucks.

(xiii) Future Expansion

The landmass left for future expansion towards the risk flank of the factory is so small and can only allow expansion on an axis.

(xiv) Site Plan

Layout is dispersed in arrangement. Two ingress points are provided but one is put to use. Truck manoeuvring follows a U shape i.e. ingress at one point and egress through the other, but this concept has been rendered futile as trucks are subjected to U-turning in the minimum circulation space provided.

Administrative, personnel training, Employees facilities, raw materials store and quality control departments are on an axis detachable from production hall. The entire site plan looked uncoordinated and not well thought out.

(xv) Drainage

The subsoil catchments flow parallel to longer axis of production hall, treated on site and effluent into public drainage systems.

(xvi) Flow Diagram of Cocoa Industries Limited, Ogba-Lagos.

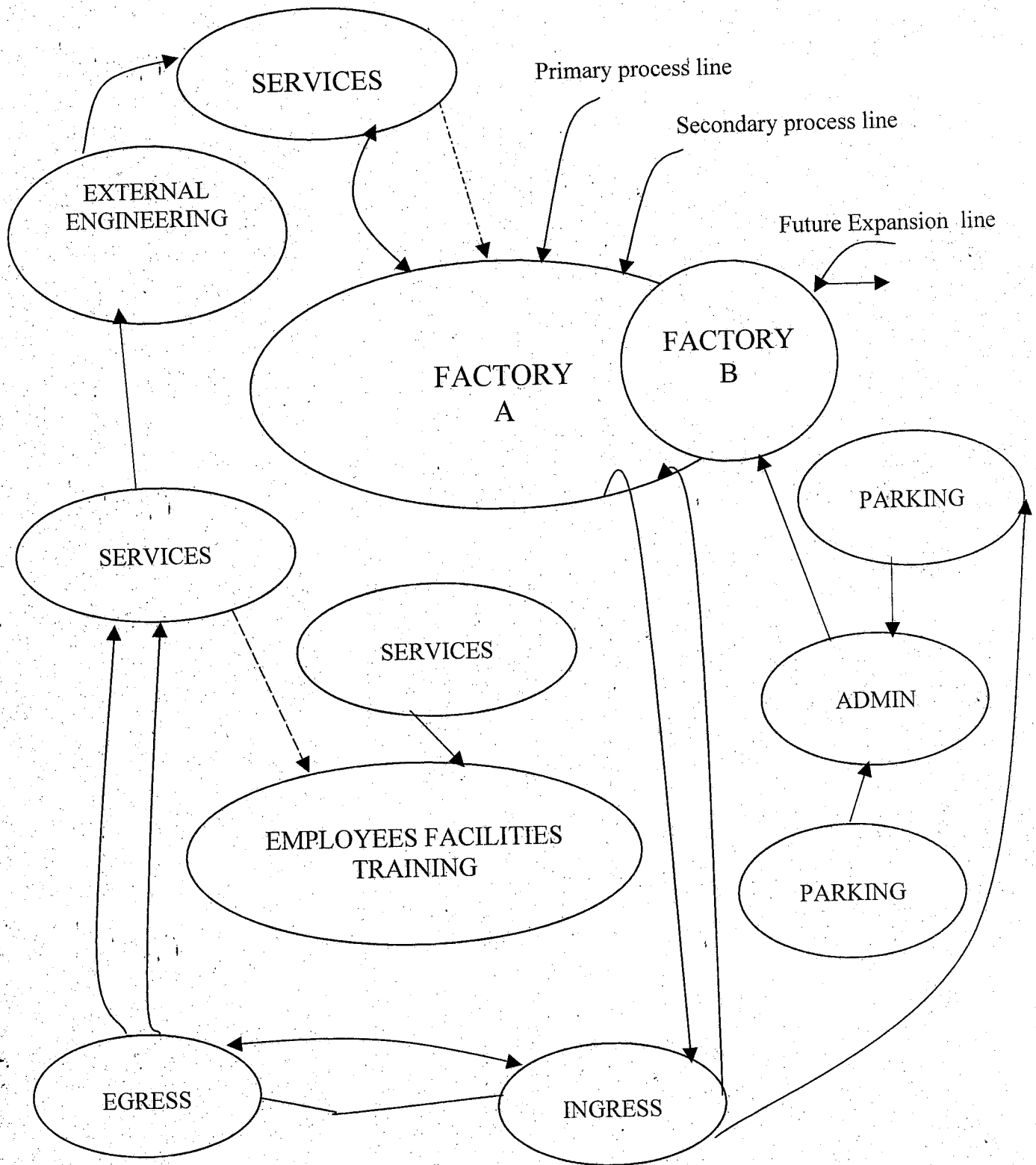


Fig. 4.3.3b: (Traffic flow diagram of C.I.L., Ogba, and Lagos
Traffic route
Pedestrian route
Vehicular route

4.3.4 PRODUCTIONS AND OPERATIONS MANAGEMENT

(i) Machines and Equipment's

Primary processing machines as provided for at Cocoa industry are used with some additional facilities such as:-

(i) Premix section

(ii) Agglomeration section

(iii) Packaging section

Mechanical handling equipment such as forklift trucks, and material handling equipment such as hoppers, stockpiles for fuel and water are installed to service the internal and external engineering aspect of the production hall. Horizontal alkalisation is used and buildings height is not unnecessarily high.

(ii) Working Methods of Cocoa Industries Ltd., Lagos

Both team and linear assembly are engaged. Machines are arranged in a U shape encouraging addition of components at workstations and removal of wastes simultaneously.

(iii) Production Flow

Production process is taken a step further here to produce a cocoa dry malt mix called Vitalo on the same site. This has simply combined two major processes on a site. (i.e. both primary and secondary).

Primary processes are those obtained from bean intake at receptor to butter, powder, and cake effluent and secondary is that processes that further

produces series of end products traceable to the primary products. Cocoa Industries Limited is considered as a centralized, processed based batch production and assembly factory on which my conception to invest into further secondary processes emanates.

(iv) Production Capacity

850 tonnes of raw cocoa bean is processed per month. If production is consistent, 10.200 tonnes is processed per annum. Cocoa powder, and end product in the primary processing is conveyed into the premix section, Agglomeration section and packing to yield a final end product which is locally and nationally consumable.

(v) Products

With reference to Cocoa Industries Limited products are:-

(i) Cocoa Cake (produced for exports)

(ii) Cocoa butter (produced for exports)

(iii) Cocoa powder (for local consumptions)

(iv) Dry Cocoa malt mix (Vitalo)

(vi) Sources of Raw Material

Cocoa bean is sourced from Ondo and Osun States produce merchants and farmers. Water for production is supplied mostly from the underground stockpile for water, a 333,000 litres reservoir. Egg albumen, skimmed milk, sugar are purchased in

larger quantities directly from manufacturing companies and stocked in the raw materials store besides boiler room.

(vii) Sources of Power

Source of power is primarily from NEPA mains but in case there is failure 3 Nos. 50KVA generators are standby to boost production processes. 160,000 litres tank of stockpile for diesel fibres the generators to work.

(viii) Staff Strength

The working force is 320; with 300 employees in the Administrative. And primary process factory and 20 employees in the secondary processing hall. Normal shifting is applicable here too to maximize throughout of end products.

(x) Staff Training

There is a special provision for personnel training. A bungalow building by the left flank of the used vehicular access is used as staff training facilities. Not more than 15 staffers are trained at a time.

4.3.5 MAINTENANCE

(i) Services

Internal, external engineering, employee facilities, fire station, represents services areas of Cocoa Industries Limited.

(ii) **Waste Management**

Used water effluent from employee facilities, factory and external engineering spaces are treated before effluent into public subsoil drains. Other paper waste is collected in waste bags and disposed off ever day by Lagos State Waste Management Board.

(iii) **Security System**

From research, it is learnt that degree of security risk is high on product theft, average on company's secret, high on technical secrets, high on process sabotage and high on petty theft in a centralized processed based production, and there is need for surveillance by security outfits and use of outwardly facing flood light systems and sophisticated remote sensing optical instrument monitored on an interior screen, but this is rather two expensive and eventually add to running cost.

4.3.6 EVALUATION

Merits

(i) Fire station assembly is permanently on site to stop incidence of fire.

(ii) Structural system of the whole factory buildings acts as fire compartments.

(iii) Training provided for employees is a long-term boost on product output.

(iv) The 9-metre factory height is utilized for gravity feed of raw materials unto mezzanine floors.

(v) Centralising both primary and secondary processes on same site reduces packing and freighting costs of throughput of final end products.

(vi) Interiors of production hall is adaptable to full modernization and automation in case present machines becomes obsolete.

(vii) Good colour schemes improve employee's comfort at workstation with no effect of glare.

(viii) High decibel zone located at rear of factory acclaimed a worthwhile resale value for the factory.

(ix) Roofing system used is purely architectural and appealing at its built environment.

(x) The site is situated in an industrial environment to enjoy free infrastructures facilities supplied by the industrial layouts.

Demerits

(i) The blocked first gate cause baulking in the interiors of the factory.

(ii) Site is not properly landscaped.

(iii) The stockpiles for fuel and generator house by the fence at the approach of factory are unethical and bewilder the image of the industry.

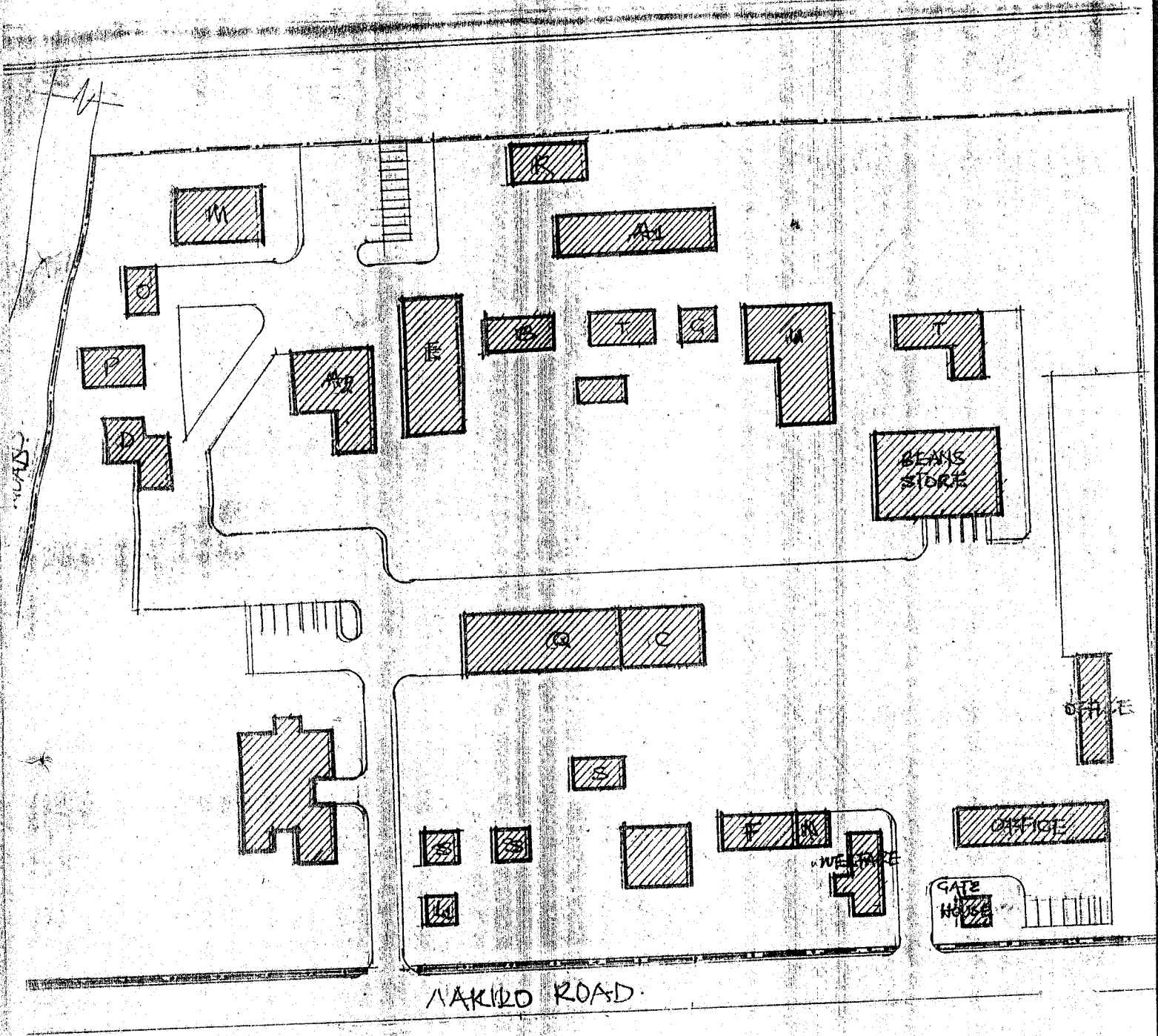
(iv) Site layout is dispersed and not directly accessible by any definite

pedestrian routes.

(v) Raw material store by boiler room may contact mildew through adjoining walls and become infected causing total throughput loss.

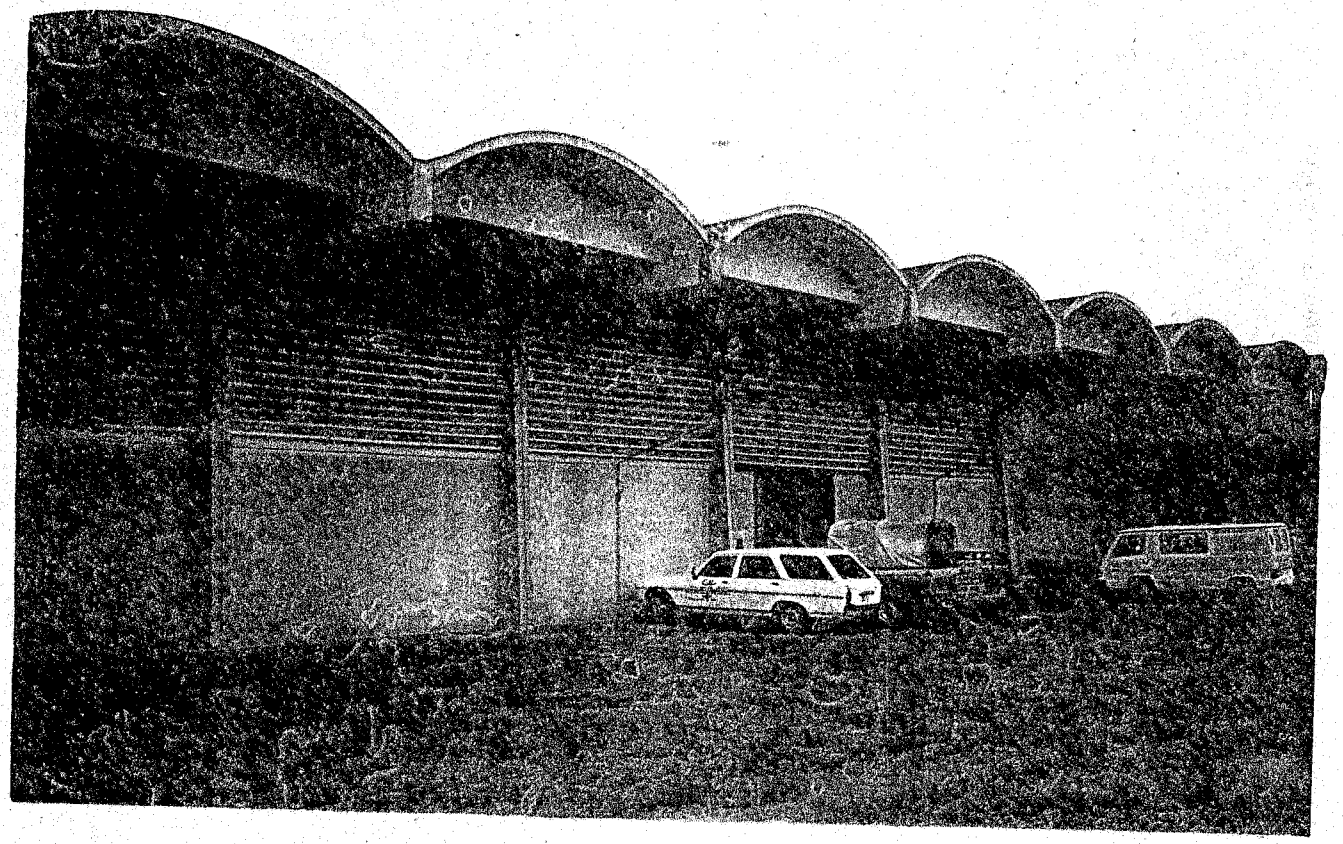
The quality control department is too remote from the production

ILLU. 4·3·1

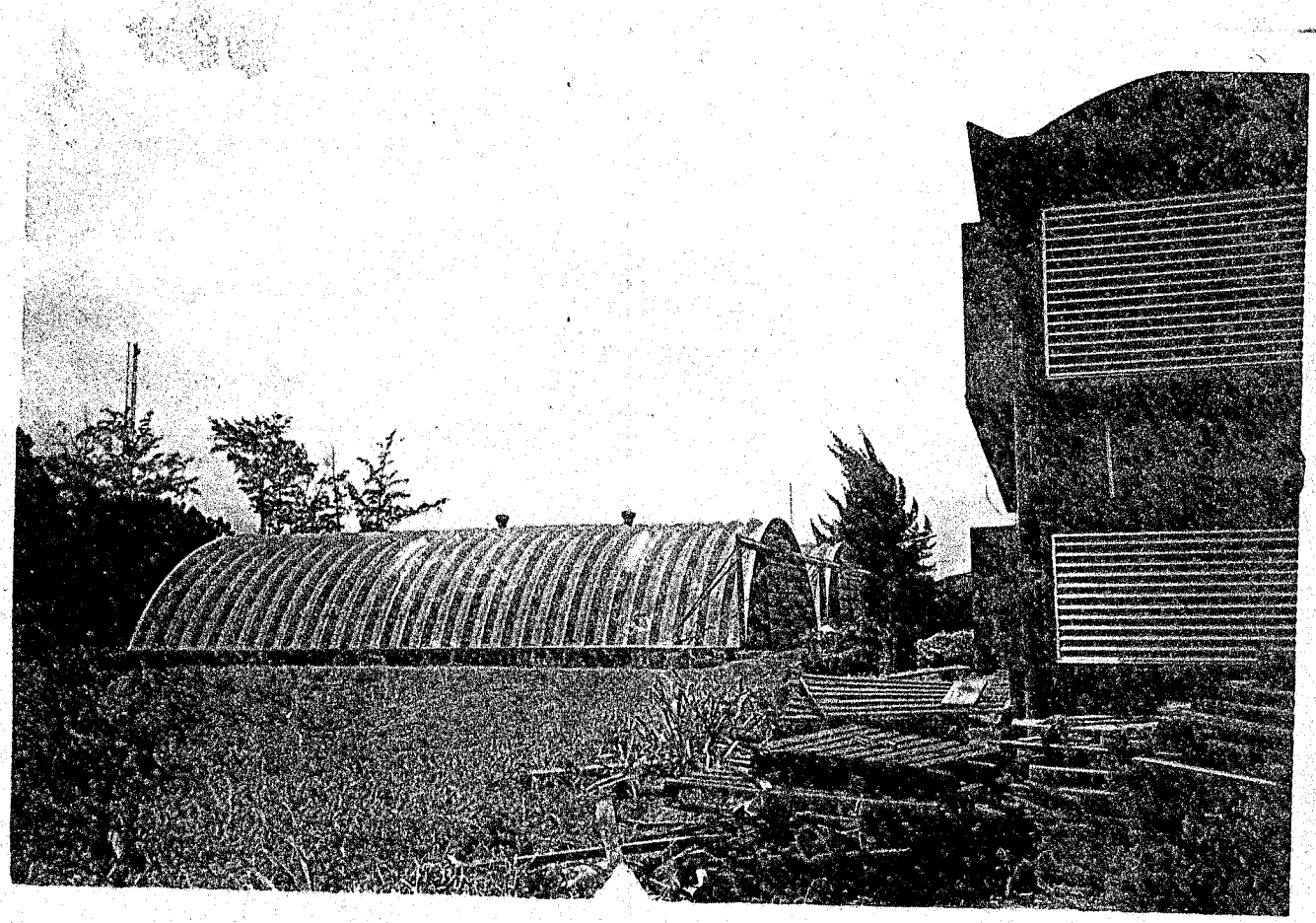


COCOA INDUSTRIES LIMITED AKILO ROAD, OGBA, LAGOS.

ILLU 4.3-1a

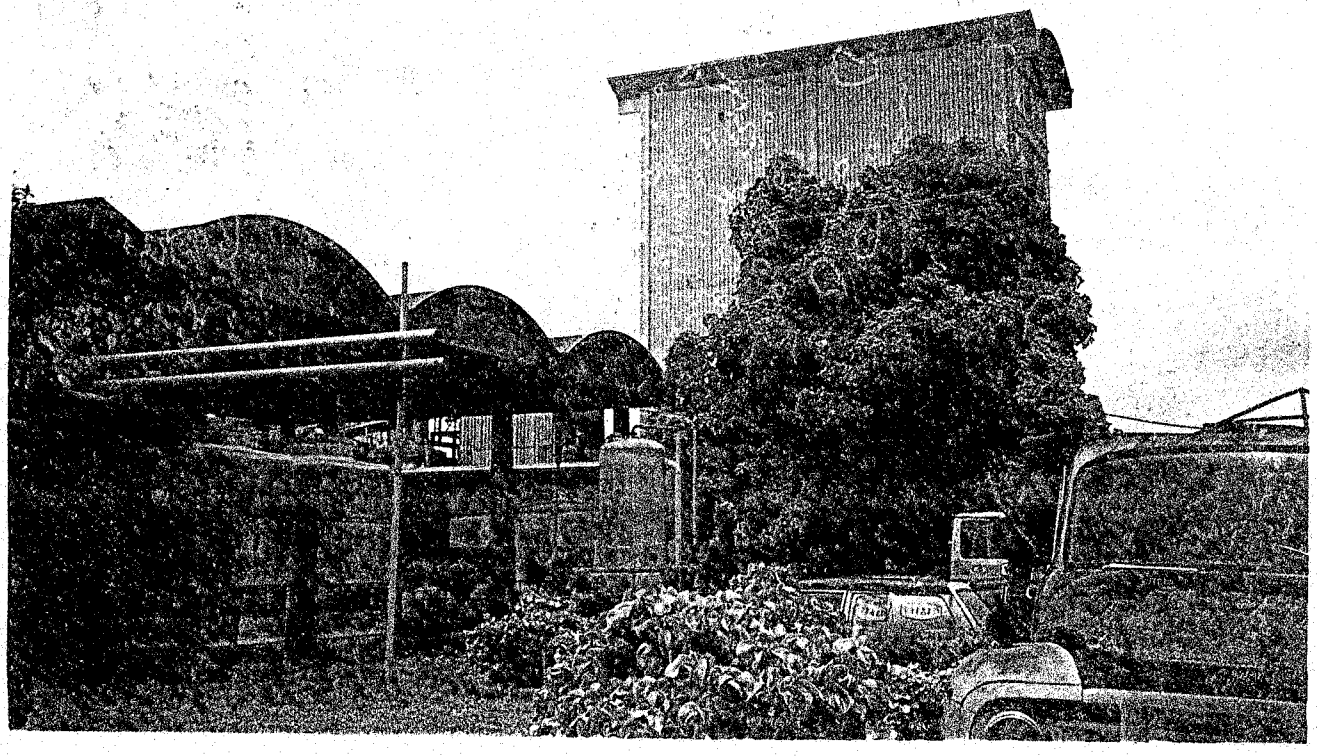


FRONT ELEVATION.

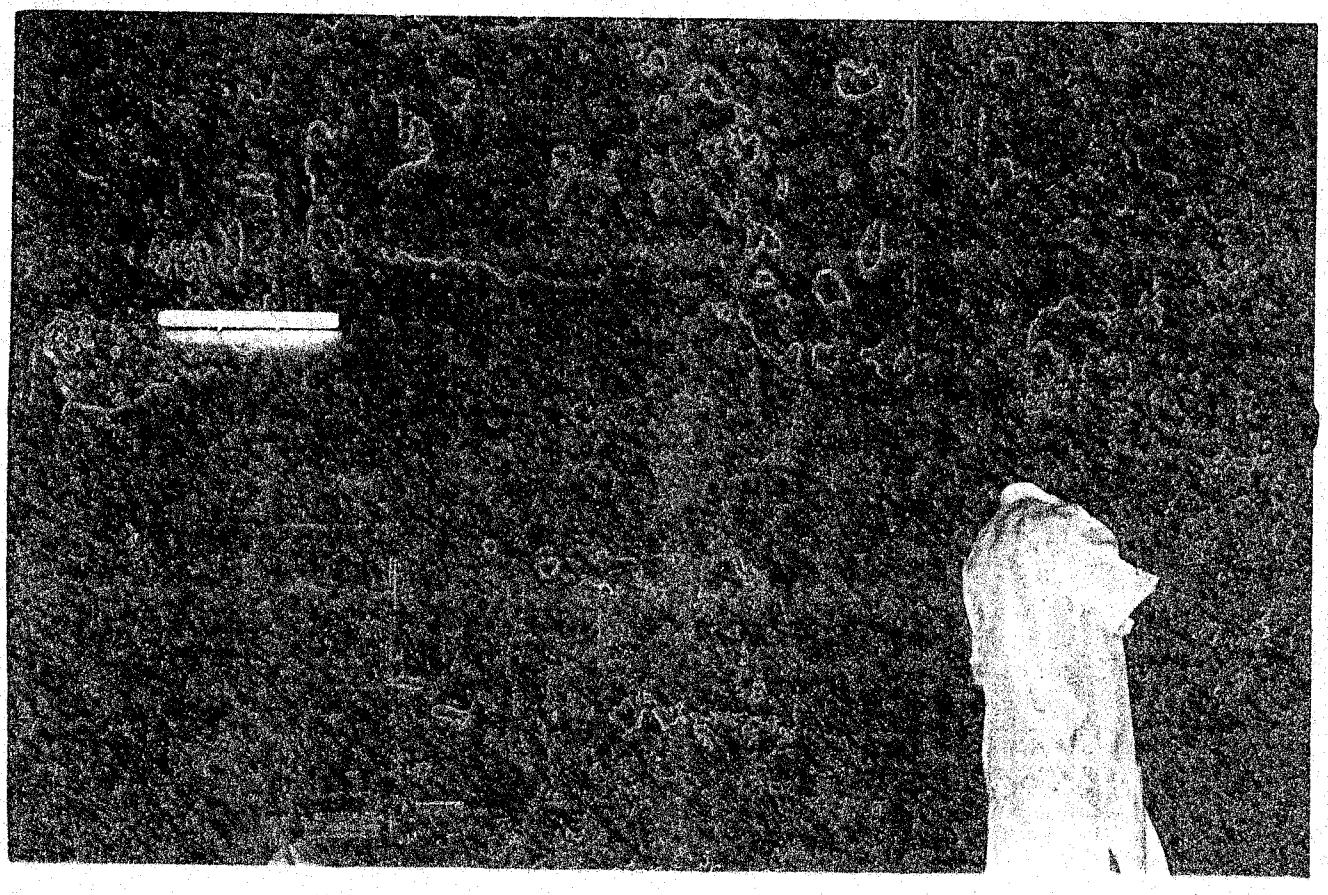


WARE- HOUSE.

ILLU 4.3.1.b



GENERATOR HOUSE



COCOA STORE

CHAPTER FIVE

5.0. DATA COLLECTION

5.1. CLIMATE CONDITIONS

The climate of Nigeria is basically monsoon in character, and like all monsoon climate, it is expressed as a contrast between a dry season and wet season. These two regimes of the climate are very dependent on the prevailing air masses blowing over the country at different time of the year. The dry north-eastern air mass of savannah origin, and the humid maritime airwaves blowing from over the Atlantic. Rainfall from the southwest following the direction of the prevailing wind pattern. Variation occurs which result to rain falling in the direction of the Northeast. The prevailing wind passes through the site from the southwestern wind axis, which comes with harmattan and dust. Thus planning is in accordance with climatic condition and very important to attain a functional and successful design.

5.2. CLIMATE PATTERN

Ondo state is bordered within latitudes $4^0$30' E and 6 00E, longitudes 5^0 45N and 7.45^{0}N which are traceable on worlds climate chart to bear the equatorial hot, wet climate characteristics, with low annual precipitation of about 2413m (95 inches) with low rainfall in July, average in April, high in August, September, October and November and peak at may and June.

5.3. TEMPERATURE

Temperature in this areas is usually at its highest during the dry season when there is no cloud cover. For such a period the mean annual temperature ranges from 24^0C-27C on its average. Throughout the year there is descriptively a high uniform temperature, heavy and well-distributed rainfall characteristic of an equatorial rain forest region.

5.4. HUMIDITY

The relative humidity increases from January to August and reduces drastically from September to December. The southern part is a typical mangrove swamp while the central to the Northern part typifies a tropical rainforest region.

The hot and humid conditions are taken into consideration in the Architectural

Design by utilising the site and by making provision for natural cross ventilations.

5.5. SUNSHINE

Ondo State is usually exposed to over 1500 hours of sunshine annually.

This figure even rises higher in the month of November to March. When the sunshine is higher there is need for the provision of roof overhang especially on the southern orientation and the presence of tree to absorb solar radiation and provide cooling.

In the rainy seasons, there is usually cloud cover thereby reducing the sunshine hours to minimum especially in August.

5.6. GEOLOGY AND TOPOGRAPHY

In the south-western zone of Nigeria, Ondo state (where the proposed project is located) is the highest benchmark but still enjoys a vast lowland area.

The proposed factory shall be sited on a low land area for economic reasons, although shall enjoy the granite outcrop background sceneries, which lies on the far southern zone of the proposed site.

The proposed site slopes gently in the north South direction toward the Ofosu River. The soil is firm and substrata component compact with low water table. The natural slope shall be exploited for subsoil catchments and drainage flows.

5.7 SOCIO – CULTURAL

Ondo State was carved out of the old western states on the third day of February Nineteen seventy-six that is 3/2/76 under the administration of General Muritala Mohammed, the then head of state.

There are 22 local government areas within the state with Akure as the capital city. Across the local government, the common language is Yoruba and the religion practised ranges from Christianity, traditional worshippers and Muslims in their minority.

Culturally their belief systems, festivals, arts and artefacts, are an enigma, as are their hot and sandy beaches on the Atlantic coast and cool lofty hill.

It is the ancestral home of palm wine, pounded yam and the bush meat stew that goes with it.

5.8. ECONOMIC AND COMMERCE

The 20% of cocoa contribution to world market came from Nigeria, with greater proportion from Ondo state; it also harbours numerous mineral resources, which yield major raw materials for industrial in Nigeria.

Petroleum and natural gas exist, bauxites, iron ore, kaolin are traceable to the state, while all these are naturally endowment under Ondo state soils they also serve the country at large in her gross national development programme generate earnings from foreign exchange deals through exportations. Hence; it is pertinent to know that Ondo state in its vast territorial coverage is a seat of economic structural propellants.

5.9 DEMOGRAPHIC DATA.

By the census of 1963 the state population was put at 2,729,690 and 1987 quoted as 5,198,064 connoting an increase of 47.4% in growth in 24 years as quoted in incentives for industrial investors in Ondo state government bulletin.

Going by this arithmetic progression one may assume that the next period of 13 years that is from 1987 to this second millennium the population should

have increased by 1,334,604 that is 25.67% increase. This implied that the expected total population at the end of this year is 6,532,667. It therefore accounts for about 6.8% of the nations total population covering a territorial expanse of 20,959, square kilometres.

However, it is expedient to note that Ekiti has a population of 1,036,015m 1963 with an increase of 37.95% after the first 24 Years reference to the projected population had grow to 2,497147 and when this is deducted from 6,532,667 over all figures, Ondo State has 62.04% that is 4,052,866.

This analysis is needful, as Ekiti State is now a new state carried out of the old Ondo State. This proposed industry should gainfully employ quite some number of the teaming population of the state.

5.10. TRANSPORTATION AND TRAFFIC FLOW.

There are two main categories of transportation service existing in Ondo, to ensure it meets its obligation as an efficient commutable state.

The first deals with the provision of facilities to accommodate the daily function of the state, they are roads streets, public transport service and a pyramid of auxiliary facilities and services required to provide for the diverse movement of people and goods essential to the operation of major urban area.

The second category of transport service is those required to allow the state to interact with the rest of Nigeria in the fulfilment of national functions.

In the first category, there is the use of linear and spine/feeders system, which makes possible a series of entrance and exit to allow buses to loop off the spine and to provide district, services to a district and then return to the spine.

The street pattern allows maximum flexibility in transport services within the sector through the transit spine. This is not a fixed feeder loop thus; it is an added access to accommodate projected transit demand.

5.11. EXISTING LAND USE AND FUTURE TRENDS.

Although the state has about 20,959 square kilometres of territorial coverage but it is alarming to note that 45% of this coverage has still not been developed, farming is practised on vast part of it, and at some wider areas along Idanre and Oke – Igbo there is a forestation project with bearest minima of settlers, while along the estuaries via bight of Benin at Uaje, fish farming dwelling units on the mangrove swamp area, and disperse development are only traceable on floating dwelling units on the mangrove and some sparse developments on its mainland. Quite a large percentage of the allotted land encroaches into the mining and refineries of existing mineral resources and here little developments avail around the mining pits although this exploration has brought about radial distant industrial developments around the confines of the state.

Sources (Ondo state tourist fact finder, 1992 edition.)

5.12. DEDUCTION

Ondo, State, the sunshine state, is at home with nature, its rolling hills, Isolated highlands and other enduring and endearing features makes it a delightful scenario. The overall effect of this is that, Ondo enjoys equable climate that is neither too hot nor too cold all round the year.

CHAPTER SIX

6.0 SITE ANALYSIS

6.1 CRITERIA FOR SITE SELECTION.

The site chosen for the cocoa processing industry Idanre is located at Alade Idanre along Alade – Akure expressway. Geographically it falls within the Southwestern zone of Akure. Alade is at 32 kilometres to Idanre. A major road from Akure South links it, which is under rehabilitation during visit.

6.2 THE LOCATION OF SITE

The site is located at 160km away from Akure south airport but on lowland around Idanre, sloping gradually to Ofosu River with a severe usual comfort of the background Idanre hills. At the approach left side is a cocoa plantation and by right side is an existing sawmill. The environment has been analysed to be feasible and viable in terms of environmental compatibility. Factor influencing the choice of side are:

a. Proximity to raw material
b. Analysis of infrastructures
c. Size of land
d. Relatively accessible.

6.3 SITE CHARACTERITICS

An in–depth study of the site was carried out first by geographical and geophysical maps to have acquaintance with the relief and topography of the site and nature of the soil.

On a second visit to the site to take stock of the existing natural and artificial features of the site. The following facts are established as site characteristics. Proximity to raw materials, Availability of infrastructures such as water supply, transportation routes and accessibility.

1. **Proximity to raw materials: -** The site is located at the largest raw material production zone that will boost its operation all year round and optimise the use of the industrial machine obtainable in the factory.

2 Water supply: -water supply shall upon the existing Ofosu river that flow at the rear of the site but shall be treated and reserved before pumping into steaming machine for processing in the factory.

3. For proper site analysis and investigation certain factors needs to be critically examined to necessitate every consideration as regards the choice of material, construction technique and overall planning. These factors are Accessibility, vegetation, Rainfall temperature, relative humidity, and climatic condition.

6.4 ASSESSIBILITY

The site is directly linked to the major service route that travels from Alade junction via Idanre through Akure metropolis; ingress and egress point of the proposed factory shall be linked to the service route.

6.5 VEGETATION

With special consideration of the site encroachment into tropical rainforest zone, evergreen broad leaved trees of luxuriant growth forms the southern background scene and also on the far right of the site leaving the central parts of the site tufts growth and grassland. During site visit the centralized grassland was used to cultivate maize.

6.6 TEMPERATURE

This influences the actual amount of water vapour present in the air and thus decides the moisture capacity of the air. It decides the rate of evaporation and condensation and therefore governs the degree of stability of the atmosphere. It is expressed in degree Celsius. For each month the average monthly variations are recorded in periods within 1980 – 1994.

6.7 RELATIVE HUMIDITY

This is the actual amount of water vapour in the air compared with the amount of water vapour the air could hold if it were saturated. It is express in percentage.

(1) **Wind- direction:** The most prevalent wind is the southwest monsoon wind, however in the harmattan it is greatly subdued by the Northeast trade winds effect.

(2) Rainfall: The predominant type of rainfall in this rain forest region is convectional, the amount of which is measured in millimetres.

6.8 UTILITIES

The site is well serviced by basic infrastructure such as roads, power, and water. The proposed factory site will enjoy electricity services through existing NEPA pylon lines, water supply shall exploit the existing Ofosu river that flows at the rear of the site or an alternatively dug borehole to store treated water in reservoirs.

6.9 SCENERY

The natural and artificial features that can be seen on site are mainly shrubs as well as grasses, some of these features can be returned for landscaping. Another feature is the gentle slopes on the North south direction towards the Ofosu River the natural slope shall be exploited for sub soil catchments and drainage flows.

6.10. ANY ENVIRONMENT PROBLEM

The site which is situated at Alade – Idanre along Alade – Akure expressway; Ondo state does not have environmental problems. This is due to the fact that we do not have any industry around that could cause pollution.

CHAPTER SEVEN

7.0. DESIGN CONCEPT AND CONSTRUCTION

7.1 CONCEPT AND DESIGN

This is the most difficult task in design process most especially when deciding on what idea or form or concept to adopt to solve a give problem. Hence the rationale behind a design solution is a major decision to be taken by the architect in the evolution of a workable design.

The food processing factory with cocoa as its primary raw material, the concept centers around the functional flow diagrams that's shows the processes or stages the raw cocoa is taken through before its gets to its final stage which is the cocoa powder and cocoa butter.

There are some guiding principle which led to the design, the guiding principles are:

1. Functions
2. Symbolism
3. Educational

1. FUNCTION

The need for the factory to perform its primary function as a processing industry. It must be able to symbolize an industry when one gets into its environment and its location within an industrial layout will also help in symbolizing this.

2. EDUCATIONAL

The industry or factory should be a continuously educative place in terms of cocoa processing.

7.2 THE DESIGN

The raw materials store, Bean silos, pre-cleaning sections, micronising and winnowed section, the roaster section, cocoa butter and cocoa power section are all combined together to form a factory.

The industry is divided into two sections, the less restricted area (LRA) and the highly restricted area (HRA) the less restricted area consist of the.

1. The Administrative office,
2. The welfare building,
3. The laundry building,
4. Fire station

Movement within these areas does not require supervision.

The highly restricted areas include the following the production hall.

Site planning concept

To make the proposed site efficient and serviceable, the planning concept shall emphasize proper zoning of facilities, effective circulation of both vehicular and pedestrian users to encourage efficient energy conservation and mitigating fire outbreaks and noise control within and around the production site.

7.3 MATERIALS AND CONSTRUCTION

In the choosing of materials to be used for the construction of cocoa industry, the choice of the materials for such work would be based on good standard requirements and efficiency:

There are various factors that affect the methods of construction for a particular structure example of such factors include.

1. Soil type
2. Locality
3. Cost of materials to be utilised
4. Services required
5. Project standards to be achieved

1. MATERIALS

Factors that determine the choice of materials are cost, availability, all these factors have been put into consideration in the utilisation of the possible materials in the construction site.

2. METAL

Metal could be classified into ferrous and nonferrous metal ferrous include steel which is heavy or light, used as a structure framing as well as a wide range of building products such as windows, doors hardware and fastening. Non-ferrous metals include aluminium, copper, and lead to mention but a few.

The are relatively soft yet strong, lightweight workable also used as extruded forms as in aluminum windows doors, roofs, hardware, copper which is also metal, can be used as electrical and flashing as sheet. While lead is used as a plumbing materials.

3. CONCRETE

This is utilized in the construction industry for foundations, floors, as slabs and roofs. Its utilization for any of the areas mentioned above depends on the specification standard for that particular project. Its plasticity and workability permits its use for almost any form of structure whether they are circular, square rectangular or free flowing curves.

It comes in varying types it could be pre-cast, cast in- site and reinforced. It is made from mixture of cement, fine aggregate, course aggregate and water which sets to form a hand store like materials, while set it is weak in compression but strong in tension.

4. GLASS

This is an amorphous material which is characterized by its transparency, brittleness hardness, and chemical composition and they come in different forms, sheet block, facing glass its utilization is dependent on its purpose of use. It will be used for doors windows, showcases, walls, floors and roof as roof light.

5. WALLS

Walls are vertical element acting as barrier to the element. They could be load bearing or no-load bearing. For the industry I'll be using a non load bearing cement sandcrete walls which will be bounded into flanges of I section stanchion. Steel columns with wind bracing at strategic intervals. The stanchion columns are also used to support the roof stricture.

6. ROOFS

Steel stresses will be assembled forming simple gable falling freely to the ground and draining into subsoil catchment area. Skeletal framework on roof is cladded with industrial long span roofing sheet in its natural aluminum anodized colour.

7. FLOORING MATERIALS

In-situ mass concrete floor finished with granolithic parviour will be used on the factory floors while terrazzo floors will be used in other areas provided within the site.

7.4 SPACE REQUIREMENT

The factors that determine allocation of spaces are:-

(1) The nature of activities to be carried out in the space.

(2) The equipment to be accommodated

(3) The established standard

For effective space allocation and smooth flow within the industry, there are established rules, standard or principle on which this cocoa processing factory is judged and designed is traceable to the outlined performance specifications and design notes are spelt below:

1. Requirements of the process, which is further melted into the following outlines:
   i. Adaptability
   ii. Plan shape
   iii. Physical environment
   iv. Structural dimensions
   v. Provision of services
   vi. Movement of materials and equipment
   vii. Support for production loads, and

7.4.1 REQUIREMENT OF SPACES FOR PROCESSES

i. ADAPTABILITY

Factory building is to be designed for a general-purpose use and this characteristic maintained wherever possible, e.g. in stores, production warehousing and in production space itself. Locating of building on site is to give room for future expansion preferably on two directions. Single storey factory to be designed as a large open space.

Standardized, mainly dry construction, which can be easily extended or modified, is use. Framework should be able to carry a variety of alternative roof, wall claddings, services and handling equipments.

External walls not on or near site boundaries to be designed for easy demolition.

ii. PLAN SHAPE

Not critical except where linear flow-processes is employed but rectangular form maximized usable area and facilitates extension. Squared plans reduce internal travel distances where no particular traffic routes are dictated by process. If rectangular shape is considered ratio 3:2 of the sides is used but an average is ration 2:1.

iii. PHYSICAL ENVIRONMENT

Workplace environment and energy efficiency is very important and process requirements are not usually critical here. In general the production process will not require special dust-free conditions, nor will it create a dusty or dirty atmosphere but toxic or corrosive hazards exists within the general production space, it should be isolated by local compartmentation and extraction equipment. High standard of hygiene or cleanliness is expected in some high technology factories.

iv. STRUCTURAL DIMENSIONS

Aim is to optimize convenience of production layouts provided by open space spans and bay spacing can be 18mx12m or 18m x 18m internal clear

height minimum is 6m. Main entrance doors (ground level loading) are 5m. Clear height can be and critical, for once built can only be modified with difficulty. Height is needed for high stacking, overhead conveyors etc.

Space for services needed is accommodated above clear height level

v. PROVISION FOR SERVICES

Facility to take any productions service such as stockpiles, conveyor pylon lines, cooling towards, boilers to any point within production area should be without minimum disturbance to building, and therefore production. Production and building services to be carried out in roof space above clear height with vertical droppers as required to machine position.

Drainage locked up below the floor, although alternative means can be considered. A permanent grid runs beneath the floor (a minimum of say, one run in the middle of each 18m span will minimize disturbance.

vi. PROVISION FOR MOVEMENT OF MATERIALS AND EQUIPMENT

The use of forklift trucks or similar wheeled materials-handing equipment will be general; overhead conveyors may be used. Cranes more usual in engineering than other industries. Heaviest floor loading likely to result from use of fork lifts trucks (36KN) and point loads from stacked storage cages and pallet racking.

Separate foundations will be provided for any special heavy equipment, especially the vibrating type. Wherever possible upper surface of such foundation will be at or below finished floor level. Reinforced concrete with integral granolithic finish will be used.

Although deterioration of the floor finishers is a common phenomenon is industrial buildings. Durable floors can be obtained but required suitable base, good workmanship and close supervision. Finishes that resist chemical attacks or oils used in certain processes.

CONCLUSION

In conclusion, the Cocoa processing industry Idanre, Nigeria, will bring about an industry that will be built at providing an enviable and conducive working environment that will attract both insider and outsiders to the state.

It will also make Idanre one of the economic fronts line town in Ondo state and Nigeria, while making efficient use of the Cocoa plantation within the state and Idanre.

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