ANALYSIS OF THE EFFECTS OF INDUSTRIAL LANDUSE ON ADJOINING AREAS IN KADUNA TOWN

M. Sc. (U.R.P.) THESIS

BY

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B. Sc. (Hons) Economics
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A Thesis submitted to the Postgraduate School, Ahmadu Bello University, Zaria. In partial fulfillment of the requirements for the award of a Master of Science Degree in Urban and Regional Planning.

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DECLARATION

I hereby affirm that this Thesis has been composed by myself and that it is a record of my research work. It has not been accepted in any previous application for a higher degree.

All the sources of information are especially acknowledged by means of references.

Rabenas — 27/7/95.

Abdullahi, Rabi'u Bena — **Date**

CERTIFICATION

This Thesis entitled : **ANALYSIS OF THE EFFECTS OF INDUSTRIAL LANDUSE ON ADJOINING AREAS IN KADUNA TOWN** by *Abdullahi, Rabi'u Bena* meets the regulations governing the award of Degree of *Master of Science* in Urban and Regional Planning of Ahmadu Bello University, Zaria. And is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This work is dedicated to the following:

To blessed memory of my late grand parents:

Alhaji Garba Garke I - (11/7/92),

Alhaji Jibrin Talle - (22/7/93) and

Hajiya Jamila Yar Abu - (15/6/94)

May Allah grant them eternal peace for their love, kindness and assistance extended to me and the entire family lineage.

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ABSTRACT

Industries in cities are the nexus of economic growth and development. However, some industries are associated with problems owing to the effluent they discharge into the environment.

In an attempt to regulatetf the nuisances created by industries, government enacted industrial location policy. The policy was effected through the establishment of industrial areas inform of estates in Nigerian cities. These areas are planned to promote and ensure an orderly location of industries in the cities. But this measure, as can be seen today, in most of the industrial areas is not as effective as can be expected. The physical planning problems of incompatibility to adjoining landuses, unplanned physical growth and environmental pollution are still manifested in many areas.

It is not clear whether industrial areas were planned to integrate adjoining landuses, or indeed inspite of industrial area planning, adjoining landuses have grown to engulf the existing industrial area or indeed both.

It is therefore, the aim of this study to analyze the effects of industrial landuse development including its problems as related to adjoining landuses, environmental quality and physical growth of Kaduna.

In Kaduna, the existing industrial areas are not comprehensively planned to integrate adjoining landuses. Environmental pollution and existence of slums are manifested in most of the industrial areas. There was no conscious planning effort made to enforce landuse zoning regulations particularly between industries and residential areas.

In Kakuri and Nasarawa industrial areas, there are problems of environmental pollution, locational incompatibility and unplanned residential development. Whereas Kudendan, Unguwa Mu'azu, Kawo and Hayin Banki industrial areas are yet to be fully developed, each has problems of inadequate landuse zoning controls. Industrial area at Hayin Banki has peculiar case of land holdings. Compensation was alleged not to have been paid to those people displaced. Environmental pollution especially air, ground water and farming areas are highly manifested.

The consequence is reflected in the prevalence of indiscriminate pollution of the environment, unplanned residential development not only around but also within industrial areas. By implication, such situation is certainly inflicting cost on provision of city amenities in these areas.

Investigations revealed that, there is no outlined institutional framework to ensure comprehensively planned industrial landuse development. Moreover, absence of policy documents to guide industrial landuse development has compounded the problem.

Solutions to the identified problems of incompatible relationship between industries and adjoining residential development, environmental pollution and unplanned physical growth of the city are classified into two folds; The first is the proposed improvements on the existing institutional framework for the industrial landuse development. Among areas of improvements are identified solutions in each of the industrial areas and define functions for each of the participating organ. Areas of conflicts and duplication of duty are strictly avoided. Also, the need to have multi-disciplinary committee to over see the management of industrial areas to meet modern challenges of environmentalism is stressed and provided.

The second solution lies on the policy aspect. Absence of comprehensive industrial landuse policy that emphasized on physical development instead of economic considerations is envisaged to be realistic. To this end, an interacted policy elements and strategies are outlined to ensure a comprehensively planned industrial landuse development in no distant future for Kaduna urban area.

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CHAPTER ONE

ANALYSIS OF INDUSTRIAL LANDUSE DEVELOPMENT

1.1 INTRODUCTION

1.2 PLAN OF THE RESEARCH

This chapter introduces the main features of the study. The research problem, aim and objectives of the thesis research are stated including the scope and methodology adopted in conducting the research.

1.3 THE RESEARCH PROBLEM

It is generally held that industrial development is the 'pace-setter' for the overall development of an economy. It enhances the rate of productivity which, in turn, increase the rate of exchange, growth and development of the economy.

Industries in cities are the nexus of economic growth and physical development - because they produce goods and services, and attract other industries and commercial activities and take up more space. That is, they act as pull-factor in the growth and development process of the urban areas.

However, despite their contribution to economic and physical growth and development of towns, some industries are associated with problems owing to the effluent they discharge into the environment. The effluents pollute the air, water and land, thereby adversely affecting the physical environment and the overall well being of the urban inhabitants.

In an attempt to regulate the nuisance created by industries, physical planners have evolved and enforced landuse zoning regulations in the towns. This is to ensure efficiency and functionality of the towns. Hence industrial locations is considered as a critical aspect in urban planning.

To this end, an industrial location policy was effected through the establishment of industrial areas in Nigerian cities. These areas are planned to promote and ensure an orderly location of industries in the cities. This is because, it must take into account the site suitability in relation to economic viability, physical compatibility, accessibility, city amenity and aesthetic.

The long standing practice of allocating land for industrial development in the form of industrial areas has always been seen by both government and physical planners, and indeed industrialists in Nigeria, as a measure of providing lasting and effective solution to the physical planning problems associated with industries in cities.

But this measure, as can be seen today, in most of the industrial areas in Nigerian cities, is not as effective as can be expected. The physical planning problems of incompatibility to adjoining landuses, unplanned physical growth and environmental pollution are still manifested in many areas. Moreover, due to the poor planning of industries in cities, there are haphazard growth of industrial establishments and uncontrolled development around the industrial areas.

Studies have been carried out on the issue of industrial location and development in Nigeria. Notable among them are Sokolski (1965), Hakaam (1966), Schatzl (1975), Manfred (1975), Suleiman (1975). These studies were centered on industrialization as an aspect of regional development. The works of Aboyade (1962/68) were equally based on the need for national industrial location and development policy in Nigeria. Other studies by Vagale and Adekoya (1974), Abdu (1981), Yari (1985), Bawa (1990), and Madaki (1990), were concerned with design principles and standards for industrial areas in selected Nigerian cities. These studies have ignored, to a large extent, the aspect of industrial compatibility to adjoining landuses, unplanned physical growth and environmental quality of the city.

It is not clear whether industrial areas were comprehensively planned to integrate adjoining landuses, or inspite of industrial area planning, adjoining landuses have grown to engulf the existing industrial areas, or indeed both. That is, the aspect of industrial landuse development, its compatibility to adjoining landuses, and its impact on physical growth and environmental quality of the city are not adequately examined.

It is therefore, the concern of this study to examine the industrial landuse development and its impact on adjoining landuses, environmental quality and physical growth of Kaduna.

1.4 AIM AND OBJECTIVES

Aim: The aim of this study is to analyze industrial landuse development, including its problems as related to adjoining landuses, environmental quality and physical growth of the city.

Objectives: The above aim is to be accomplished through the following objectives:

(i) Review the general principles of urban industrial landuse planning as well as the spatial and environmental effects of industrial landuse development.

(ii) Examine the existing planning policies and institutional framework for industrial landuse development in Kaduna.

(iii) Analyze the growth and structure of industrial landuse and the physical planning problems in Kaduna.

(iv) Evolve appropriate principles and planning strategies for solving and forestalling the existing problems of industrial landuse development in Kaduna.

(v) Propose improvements in the policies and institutional framework for the effective implementation of recommendations in (iv) above.

1.5 SCOPE OF THE STUDY

The study is about industrial landuse development. Its focus is on urban physical planning problems of industrial activity on the adjoining landuses, environmental quality and physical growth of Kaduna. It is therefore based on physical planning principles in practice of industrial landuse planning.

1.6 METHODOLOGY

The following methods were used in data collection and analyses for the study.

(i) Reconnaissance survey of the industrial areas in Kaduna

was conducted sometime in April, 1993 to observe the existing situation. In the process, physical planning problems associated with each of the industrial area are identified, photographs were taken and sketches drawn.

(ii) Formal interviews with key management personnel in; Bureau of Lands and Surveys, Department of Industries in the State Ministry of Trade, Industries and Tourism, State Planning Authority (KASUPDA) and the State Environmental Protection Agency (KEPA) were held in April, 1994. The interview was guided by a set of open ended questions.

(iii) Relevant literature - published and unpublished, base maps and sketches were used.

(iv) Basic statistical tools - tables and graphs; physical planning techniques such as sketches and photographs were adopted in analyzing the data

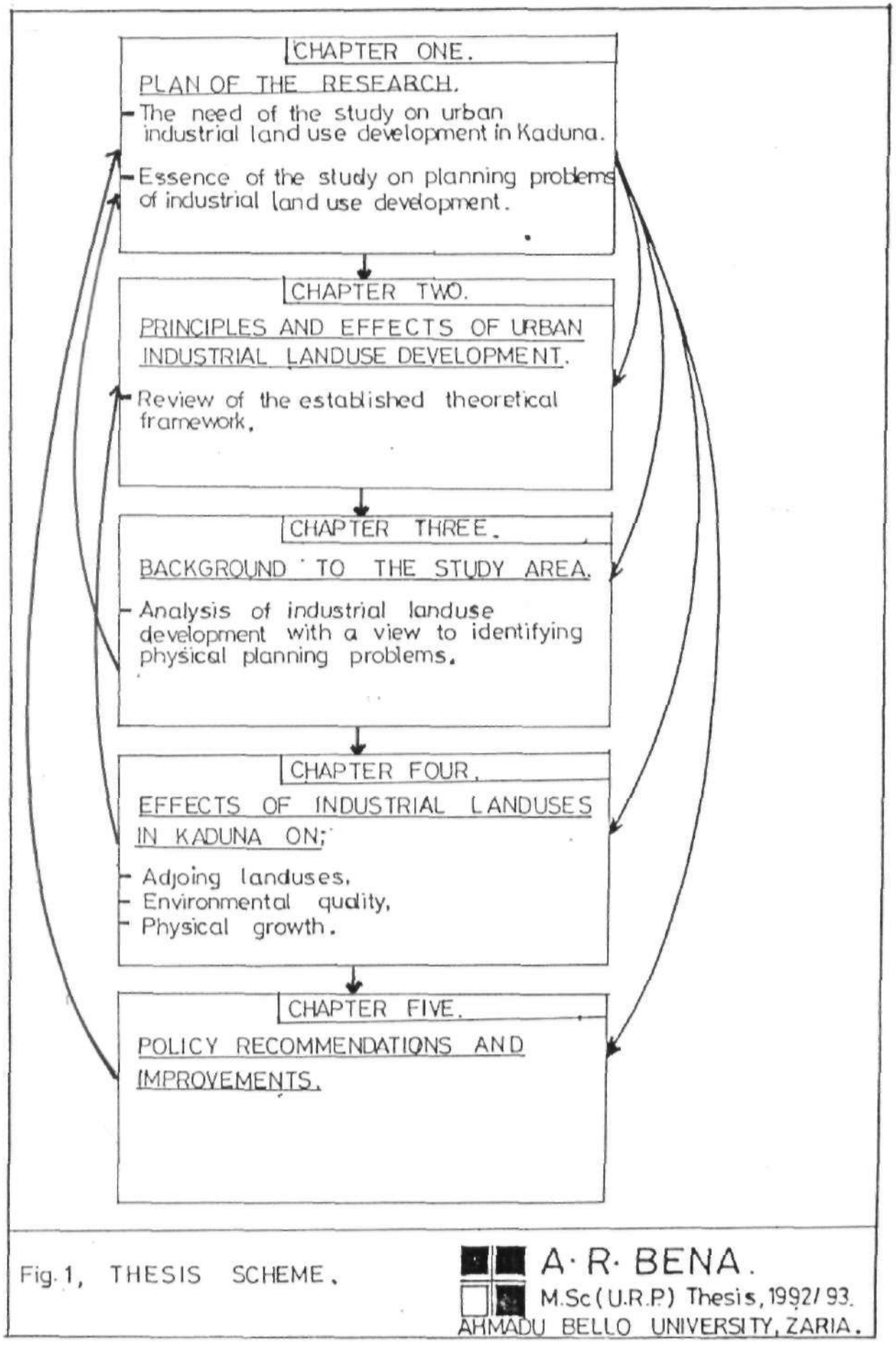

Fig. 1, THESIS SCHEME.

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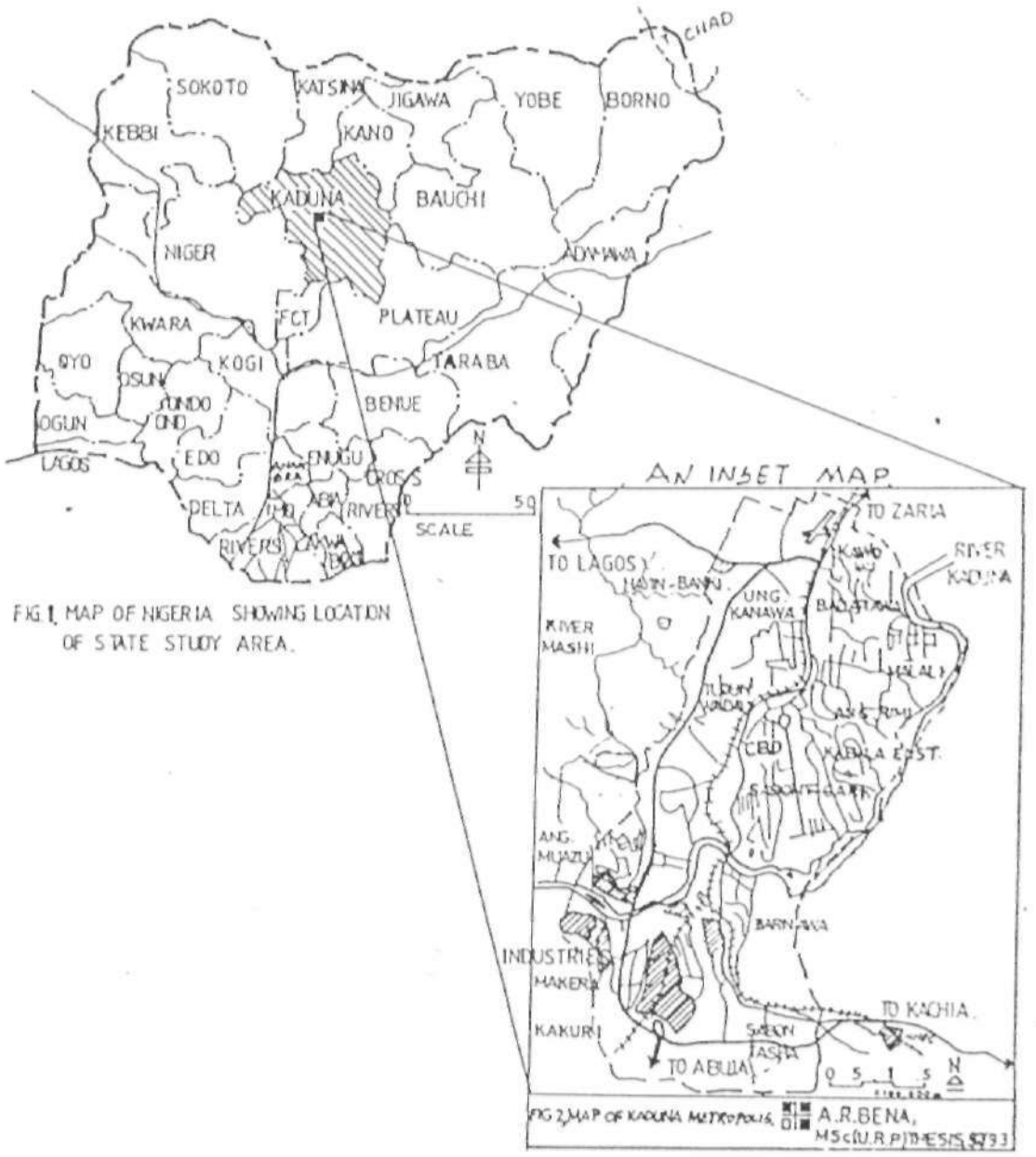

FIG 1. MAP OF NIGERIA SHOWING LOCATION OF STATE STUDY AREA.

FIG 2. MAP OF KADUNA METROPOLIS. A.R.BENA, M.Sc(U.R.P) THESIS 1993

Fig 2, DETAIL LOCATION OF STUDY AREA KADUNA.

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CHAPTER TWO

PRINCIPLES AND EFFECTS OF URBAN INDUSTRIAL LANDUSE DEVELOPMENT: LITERATURE REVIEW

2.1 INTRODUCTION

The main objective in this chapter is to review the general principles of urban industrial landuse planning as well as its spatial and environmental effects.

2.2 THE PRINCIPLES OF URBAN INDUSTRIAL LANDUSE DEVELOPMENT

Urban Landuse planning principles have been developed from the needs and interaction requirements associated with various activities within cities. These principles involve physical, social and economic considerations as well as elements of public interest in determining the location of landuses.[1]

Industrial landuse planning connotes the process of designing and allocation of land for industrial establishments within the overall landuse structure of towns. This process is based largely on location requirements of industries in relation to established guiding principles. Such principles are; The compatibility of industrial landuse to adjoining landuses. If possible the site should be on the lee ward side of any residential development. Otherwise, possibilities of protective belts of open spaces, green area as filter zones and other factors of amenity be provided both within the manufacturing area and in relation to adjoining landuses.

---

[1] Chapin, F.S. Jr. argued in his book, Urban Landuse Planning (1972), 2nd ed., that these principles are not absolute but rather desirable in order to enhance convenience, health and safety.

Second principle provide that, site for industrial development should be within easy commuting to residential areas of labour force, and to transit. It should also be in close proximity to major thorough fare routes directly connected with housing areas. This implies that, there should be separation between industries and residential areas. Such detachment must be conveniently made in order to attract labour force from the residents. This provision appears to be the basis for planning authorities to allow residential developments to be adjacent to industries in Nigeria. But the adverse effect of the industries on the residents is usually ignored.

The third principle is based on availability of utilities such as water electricity supply, sanitary sewer and drainage at or near the site is necessary. Ideally, it is desirable to have more than one source of supply of utilities especially water and electricity in order to ensure continuity of service in case of interruption of one source. The provision of utilities is perhaps the most instrumental element for rapid industrial development of an economy.

Accordingly, the site should be served by an adequate road system and possibly railway sidings. It should also have direct access to commercial transportation facilities, and in some areas cargo airport. Basically, the accessibility should be in such away that it does not necessarily have to pass through residential areas.

Boley[2] reiterated that easy accessibility to main thorough fare is a major consideration in the siting of industrial landuse especially those industries serving the metropolitan market. Thus the use of township

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[2] Boley, E.R., Industrial Districts: Policies in Practice. U.L.I. Bulletin no. 44, Washington, 1962.

routes (by-pass) at urban fringe as the main consideration in siting industries in Nigerian cities is therefore appropriate.

Fifth principle provide that industrial area should be well drained and sufficiently level to allow for large areas of flat surface. Sloping grade in the area should not be more than 5 percent, especially as it relates to grading, drainage, railway line, road system and utility lines. The chemical composition of the soil should be adequate for industrial requirements.

In essence, these principles were designed to protect industrial landuse from other non-conforming landuses and vice-versa. With a view to accomplishing the essence, an industrial classification standards (groupings) was designed and adopted for use throughout the world by the United Nations. Table 1.0 shows the industrial classification system that has been adopted in Nigeria based on environmental health and safety.

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TABLE 1.0 FUNCTIONAL INDUSTRIAL CLASSIFICATION

Cate-gory	Type of Industries	Pollutants	Effects
A	Food, Beverages and Tobacco	Smoke, Noxious gases and fumes, water effluents and litter	Irritation of the eyes, damage of under ground water and damage to Lungs. Defective packaging materials, broken bottles coloured effluents.
B	Metal and Mining	Acidic fumes, toxic metals, oil and grease, sludges.	Inhalation of unpleasant odour, fumes and acidic toxic wastes could lead to various body dysfunction and subsequent death.
C	Breweries, Distilleries and blending of spirits	Fumes from alkaline effluents, high chemical discharge, toxic waste, oil spills and defective packaging materials.	Excessive fumes, smoke and foul gases capable of endangering the lives of human lives and ecological organisms.
D	Textile Mills, Garments and leather products.	Organic vapour, oil and grease coloured effluents. High suspended textile wastes, solid wastes from hide and cloth washings	Increase the level of pollutants in the air, liquid wastes affects surface and underground waters.
E	Chemical and Allied Products.	Fumes from particulate to floride, high volume gypsun and contents of Chemical discharges.	Pollution of both air and water are as a result of manufacturing processes of industrial products could lead to death.
F	Pulp, Paper and Paper Products.	Grit and particulate offensive odour from chemical mixture, noise from printing, wastes and packaging materials, chemical and oily discharge.	When exposed, human vision is distorted, lungs cancer and cardio viscular disease.
G	Timber and furniture products.	High concentration of saw dust with excessive machine noise. High volume of saw dust, sludge and acidic waste water spent liquor and offensive odour producing wastes.	Affect visibility and aesthetic. Pollutes surface water and increase degradation of the environment. It fasten deforestation.
H	Rubber, Plastics and Allied Products	Fumes and foul gases with suspended solids, toxic metals and waste latex.	Effluents could lead to damage of bones due to lead and zinc contents when extensively emitted.
I	Other service industries	Oily wastes, rags, welding fumes, solvents etc.	Contribute to overall pollutants in the environment.

Sources: FEPA (Nigeria) 1991, Adapted after UNIDO (1968)

The classification provided above were based largely on type of activity product and effluent discharge by industries. But the adoption

The classification provided above were based largely on type of activity, product and effluent discharge by industries. But the adoption of the system is generally left to individual country based on its topography, requirements and policy preference.

2.3 SPATIAL AND ENVIRONMENTAL EFFECTS OF INDUSTRIES

Basically, there are two types of effects industries exert on human and the environment, viz. positive and negative, or beneficial and detrimental effects. The positive effects are socio-economic in nature - employment, increase in volume of goods and services and physical development of cities. But these positive effects exist alongside the social cost or negative effects - industrial waste and environmental pollution.

In this context, emphasis is on examining the effects of industrial landuse development on adjoining landuses, physical growth and environmental pollution.

2.3.1 Effects of Industrial Landuse on Adjoining Landuses

The effects of industrial landuse on adjoining landuses is seen within the context of compatibility (health and safety), and aesthetics. The concept of urban landuse planning as seen by planners is the rationalization of land to various uses which must be done in order to improve the physical environment , strengthen economic base, conserve ecological equilibrium and foster social values. In essence therefore, as described by Berns[3], the relationship between them should be mutually reinforcing (compatible).

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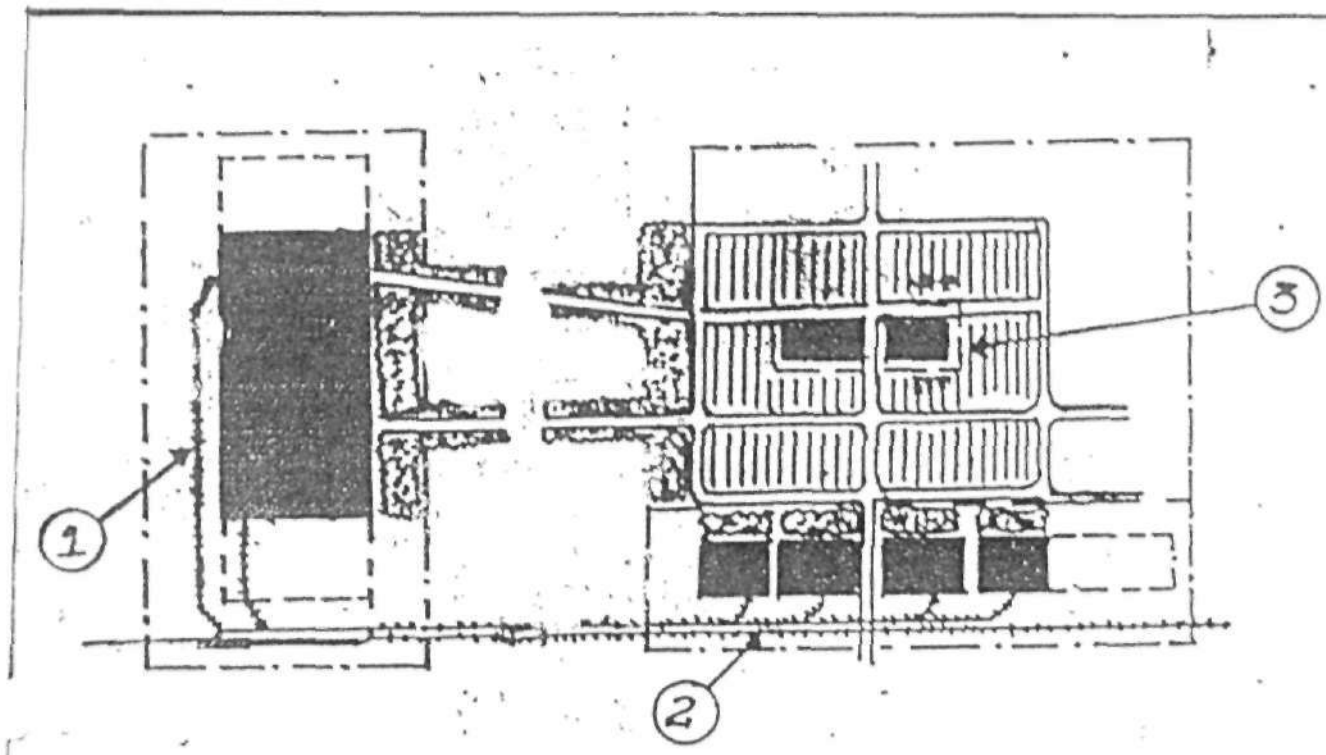
[3] Berns, in, Handbook for Environmental Planning, McEvoyd James (ed), 1977. John Wiley & Sons Inc. Canada.



LEGEND

Industrial Area

Residential Area

Buffer Zone "green belts

(1) Industrial location (estates) at a distance from residential areas

(2) " " on the outskirts of " "

(3) " " within residential areas.

roads

Railway'network

SOURCE: Adapted from; A. Agbabiaka (1974),

Fig.3, SHOWING AN ORTHODOX 'IDEAL' LOCATION OF INDUSTRIAL AREAS IN 3 OPTIONAL SITUATIONS.

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Industrial landuse is characterized by heavy traffic flow, noise and pollution. As observed by Hamilton[4], industrial landuse planning must ensure the availability of land, sufficient labour within easy accessible area: And the preservation of amenity as stipulated by government regulations regarding site relationships with either landuses, atmospheric pollution, noise and danger.

According to Goss[5], certain types of industry must obviously be excluded from residential areas due to technical problems involved; such as noise, air pollution, siting and appearance. To this end, residential development must not be allowed too close to industries. As a matter of principles therefore, industrial site should be on the leeward side to any residential development. It is however permissible, according to Burkes, for industries to be located close to or within residential areas in as much as the structural arrangement (see figure 3.0) is favourable to compatibility.

Such industries must be whose effluent - like noise is tolerable either in the day time or at night, the air pollution is less severe to human and animal health, liquid waste is non-toxic and strategically channeled.

Therefore, it becomes the responsibility of physical planners to control the general appearance of industry, the way it is located and links with surrounding areas and the town as a whole. Although, some industries must locate close to one another, due to external economies, yet the concentration must not be detrimental to adjoining landuses and quality of the environment.

---

[4] Hamilton, I.E. and Linge, (ed). 1979 Spatial Analysis, Industry and the Industrial Environment. John Wiley & Sons. Ltd., London.
[5] Goss, A. Opcit P. 147

2.3.2 Effects of Industrial Landuse on Spatial growth of Cities

Industrial landuse requirements are wider than any single urban landuse activity. By their very nature, industries require large space for factories, circulation, stores, large supply of community facilities (like roads, security, schools, housing etc.), utilities (like water supply, electricity and gas et al), for their day to day activities.

The effect industries have on spatial growth of cities could be traced to the industrial revolution of 1800s. As observed by Hicks[6], during the 19 century, immigrants from abroad and migrants of the United States from rural areas contributed to the rapid growth of industrial era settlement of the North East and Mid-west.

According to Jacobson[7], the era of industrial revolution introduced the concentration of skills (manpower) and crafts (industries) in the large urban centres, and, in effect led to the draining of the skilled labour from the former villages and town industries of much smaller scale.

Moreover, Goss[8] observed that, the general picture of manufacturing in Britain, and its relationship with towns and cities, is a measure of the neglect of all aspects of the relationship between industry and community. The resultant effect, he noted is that hundreds acres of beautiful countryside have been overwhelmed by ill considered badly planned and un-neighbourly industrial buildings. The consequence of this situation is the emergence of slums around the industrial sites.

---

6 Hicks, D.A., In Ubran land Policy for the 1980s, George Lefcoe (ed)., 1983. Lexington Books, Massachusetts. P21.
7 Jacobson, L. and Prakash, V. (ed); Urbanization and National Development Sage Publications, California. 1971.
8 Goss, A. British Industry and Town Planning. Fountain Press London. 1962.

Alan portray this effect by adding that, the growth (in industries) have resulted in an appearance of ill-concerned high density housing areas adjacent to and intermingled with factories and other features of industrial expansion. As observed by Bena[9] industries posses a pulling force, which attract particularly commercial and residential landuses around it. Individual firms want to produce a convenient environment for their workers, as such they will not stop or discourage them to live around the factory side. This has resulted to the emergence of low standard buildings inform of squatter settlement and informal activities around them. Consequently, a gradual physical expansion of the cities ensued.

2.3.3 Effects of Industrial Landuse on the Environment

Industrial landuse development has devastating consequences on environmental quality. As noted by Holmes[10] --- two decades ago, the impact of industry on the environment was not a general talking point. But today industrial development has brought devastating consequences on the quality of the environment.

Hitherto, physical planners as observed by Bena[11] were more concerned with industrial location on the periphery of the urban areas inform of industrial estates, but have virtually turn their backs from the level of pollution the industries emit to the urban environment.

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[9] A.R. Bena, Industrial Location in Nigerian Cities. Unpubished (U.R.P.) Urban Field Seminar Paper. A.B.U., Zaria Feb. 1994.
[10] Holmes, N. (ed), 1976, Environment & the Industrial society Hodder & Stoughton, London.
[11] A. R. Bena Opcit p. 10

Holmes, added, it is often remarked, quite correctly that industry in general tends to be dirty throwing out most of its wastes products into the environment. These wastes promote the ill-being of human, animals and ecological organisms.

Industrial effluent in the form of hazardous waste affects or pollutes living organisms in several ways. According to Edington,[12] harmful materials of industrial origin can enter the human body by a variety of routes, in drinking water, food, inhaled air and through the skin . It is identified further that,[13] horses, cattle, sheep and other domestic animals are being poisoned by eating grass contaminated by copper and sulphur dioxide which were emitted from fertilizer, petro-chemical, textiles and copper smelting factories.

Moreover, some of the industrial hazards are virtually restricted to industrial working environments such as dust. Some localized health effects are also attributable to the inhalation of pollutants from the industrial environment.

As cited in Edington,[14] establishment of a super-phosphate fertilizer factory about a kilometer away from a fruit farm in Ontario resulted not only to the poor growth of the crops but also to the ill-health in the farmer and his family. Similar incidents like damage to crops watered from nearby industries whose effluents are discharged into streams and rivers were reported. In Nigeria for example,[15] cases of industrial pollution and accidents were cited. Such cases includes human poisoning by Gamalin 20 from cocoa production, and discharge of water containing high ammonia level

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12 Edington, J.M. & Ann, M.A.., Ecology and Environmental Planning. Chapman and Hall Ltd., London. 1977.
13 Ibid. P 66
14 Ibid p. 75
15 Federal Republic of Nigeria: Guidelines and Standards for Environmental Control in Nigeria. 1991 pp 70-74.

into Okrika river from NAFCON - a fertilizer manufacturing company near Port-Harcourt, which caused massive fish kill and socio-economic problems for the fishery industry. There are also cases of ground water pollution around Ikeja Industrial areas in 1979.

Consequently, industrial pollution presented itself as a threat to livability, functionality and efficiency of the urban inhabitants and the environment. It then becomes the responsibility of physical planners to devise ways of minimizing these effluents in the course of planning industrial landuse development. As advised by Goss[16], if modern industry is to be more satisfactorily integrated into (other) urban landuses, there will be need to further study given to some of the technical problems involved such as noise, air, water, and land pollution, siting and physical growth of cities.

CHAPTER THREE

BACKGROUND TO THE STUDY AREA

3.1 INTRODUCTION

The objective in this chapter is to examine the existing physical planning policies and institutional framework for industrial landuse development in Kaduna.

3.2 BACKGROUND TO THE STUDY AREA

According to Owoleye (1961)[1], the story of Kaduna is part of the history of Northern Nigeria. On January 1, 1900 Northern Nigeria was created with governor Sir Lugard as it administrator.

The choice of Kaduna as the military and administrative headquarters of the then Northern Nigeria is favoured by its location characteristics. Kaduna is located on latitude 10° 30' N and longitude 7° 28' E, with height of 2,118ft (634.5m) above sea level. The temperature is also mild compared to other parts of the region. The entire region is drained by the Kaduna river which is a major tributary of the River Niger.

Moreover, the settlement is the major junction where the railway line coming from Lagos to Kano in the North and Lagos to Enugu in the Eastern part of the country meets, hence the railway junction station at Sabon-Tasha in Kaduna South. Administratively[2], Kaduna was set up in 'Gwari country' in the heart of Zazzau and was isolated from existing more traditional towns and would therefore be free from local complication as well as pollution of native towns. These factors favour the rapid growth and development of Kaduna.

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[1] Owoleye, D., in, Nigeira Magazine, Vol. 70. Sept. 1961. P. 306

[2] Bello S.; and Oyedele, E. The city of Kaduna; in, cities of savannah. Garba Ashiwaju, et al. (ed). Nigeria Magazine, Lagos. (1965)

The town of Kaduna has witnessed rapid population explosion as shown in Table 2.0 below.

TABLE 2.0 : POPULATION GROWTH OF KADUNA

YEAR	POPULATION	% INCREASE
1929	14,000	-
1952	38,794	177
1956	41,000	5.7
1961	46,000	13.4
1963	149,910	222.4
1973	250,000	66.8
,1985	276,000	10.4
1991	337,639	22.3

Sources: 1. **Government Publications, Kaduna. (1956, 1960 and 1986).**
2. **National Population Commission, Kaduna (1993)**

The population explosion in the town as observed by Medugbon,* was from both within the locality and outside the region including some west African countries. Presently, the state edict No. 1, 1990 provided for Kaduna Urban Area a 40 kilometres radius (as shown in Figure 2.0 above). The area so designated comprises the old Kaduna Capital Territory, and some parts of Chikun and Igabi local government areas.

3.3 EXISTING POLICIES FOR INDUSTRIAL LANDUSE DEVELOPMENT

Kaduna has developed from a small trading position into one of the most important industrial centres in Nigeria today.

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* Medugbon, K.O., Kaduna - Nigeria: The vicissitudes of a capital city unpublished Thesis, Dept. of Geography, A.B.U., Zaria, 1975.

From its inception, the then Northern Regional Government has demonstrated her support towards industrial development of the region. In 1956 for instance, the government instructed that local authorities must encourage industrial development by providing certain initial facilities in making available areas where industries can be set up.[3]

Such instructions could therefore be seen as the threshold for policy on industrial landuse planning and development. The guidelines also specify the type of facilities to be provided in the areas - such as access roads, drainage, sanitation and railway sidings.

Industrial landuse development in Kaduna town could be traced as far back as 1956 when the first textile manufacturing factory - Kaduna Textiles Limited was established. Subsequently, other manufacturing and such industries began to concentrate around it. Consequently, the southern part of the town - across the river (see figure 5.0) was laid as an industrial area established on ad hoc basis. That is, there was no properly articulated spatial policy for industrial development in Kaduna prior to 1965 when Maxlock and Partners were commissioned to prepare a survey and Master Plan for the town.[4]

According to the report, which was largely influenced by colonial perception of a city - a careful laid out plan to reflect class segregation, led the following policy to be recommended.

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3 Northern Regional Development Corporation; Annual Report, 1956/57. Gaskiya Corporation, Zaria.

4 A London based planning Consulting Firm - Maxlock and Partners were engaged to prepare a Master Plan (1967-2017) for Kaduna. The report was prepared and submitted to the government in 1967. It henceforth became the policy document, to guide physical development of the town.

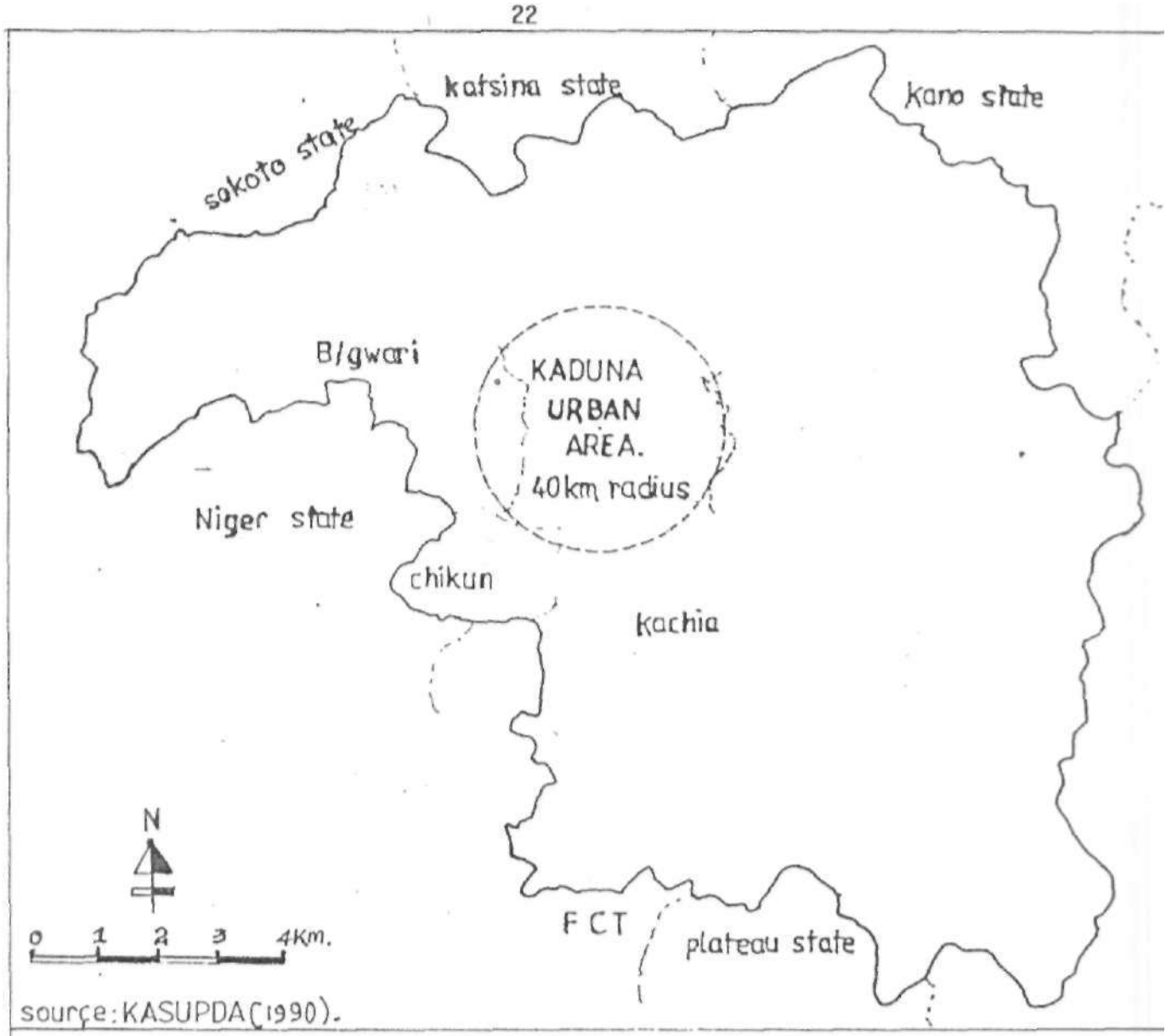

Fig-4, KADUNA STATE: SHOWING KADUNA URBAN AREA.

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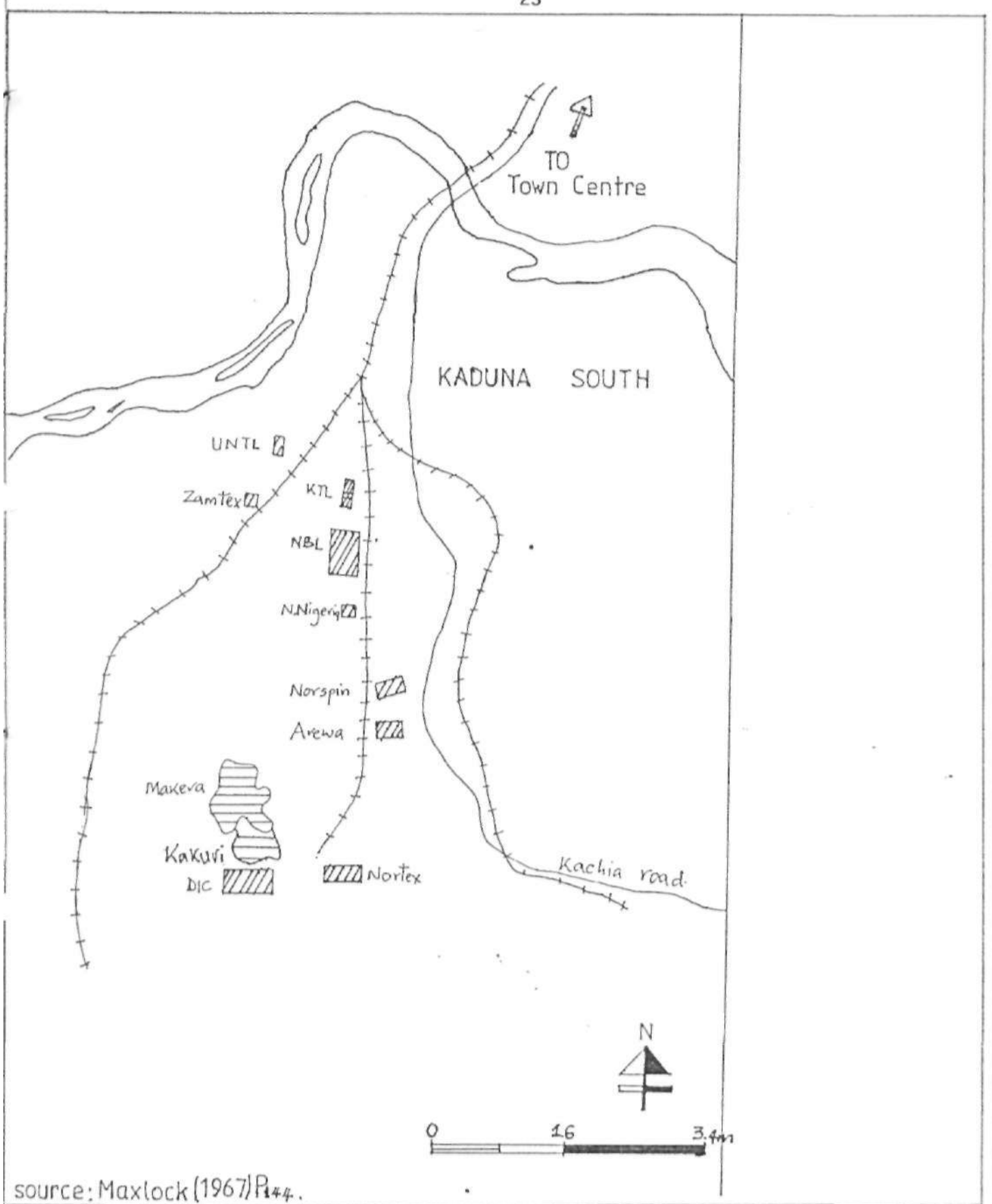

source: Maxlock (1967) P144.

Fig-5, KADUNA : Industrial Areas, 1965

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(a) Industry be encouraged to spread itself more evenly throughout the town.

(b) Constant check should be kept to maintain a proper balance of landuses as between industry and housing.

(c) Places of work should no longer continue to be divorced from places of living.

(d) The growth of service and assembly industries is bound to be fairly high and should be encouraged because it is labour intensive.

As a result new land would be needed for industries such as new textiles small assembling industries and single large assembly or production plant. Prior to 1962 when the above policy was recommended and endorsed by the government, the ad hoc practice was influenced to a large extent by economic reasons. As noted in the report, the natural place for industry to expand is south wards from the (then) existing centre in Kaduna South. This is probably due to the external economies to be enjoyed by other industries and availability of infrastructure in the area. Such trend placed an ever increasing strain on infrastructure and perpetuate the (then inbalanced) location of housing and places of work, that is, the industrial establishments. With a view to changing the trend, the report recommended eight suitable areas located at various location, for future industrial development. The proposed sites were hence followed (see fig.6) though with some amendments in preparing layout plans for industries.

On this basis we can infer that, Maxlock report is the only policy document guiding industrial development in Kaduna. However, the state edict were enacted to complement the report by specifying the elements and institutional framework to implement.

The major short-comings of the policy are its failure to recognize the consequences of industries on the urban inhabitants and quality of the environment. It has never mentioned in any way aspects of industrial waste generation, disposal and management. It also failed to recommend the institutional framework to over see the implementation of the policy recommended. These shortcomings have manifested themselves in the form of location incompatibility between industry and housing, environmental pollution and unplanned physical growth of the town as a whole.

3.4 INSTITUTIONAL FRAMEWORK FOR INDUSTRIAL LANDUSE DEVELOPMENT

The Management of industrial landuse - in terms of planning and development has been a decision taken at governmental level.*

In Kaduna, industrial areas are established and managed by the Government through her agencies. As provided in the edicts and policy pronouncements contained in the gazettes, bureau of lands and survey, planning authority and Ministry of Trade, Industries and Tourism played different roles in acquisition,.development and Maintenance of industrial areas. Bureau of lands and survey as the custodian of land in the state is to process all applications for industrial land. It is also responsible for the preparation of survey plans and assessment of compensation for industrial plots.

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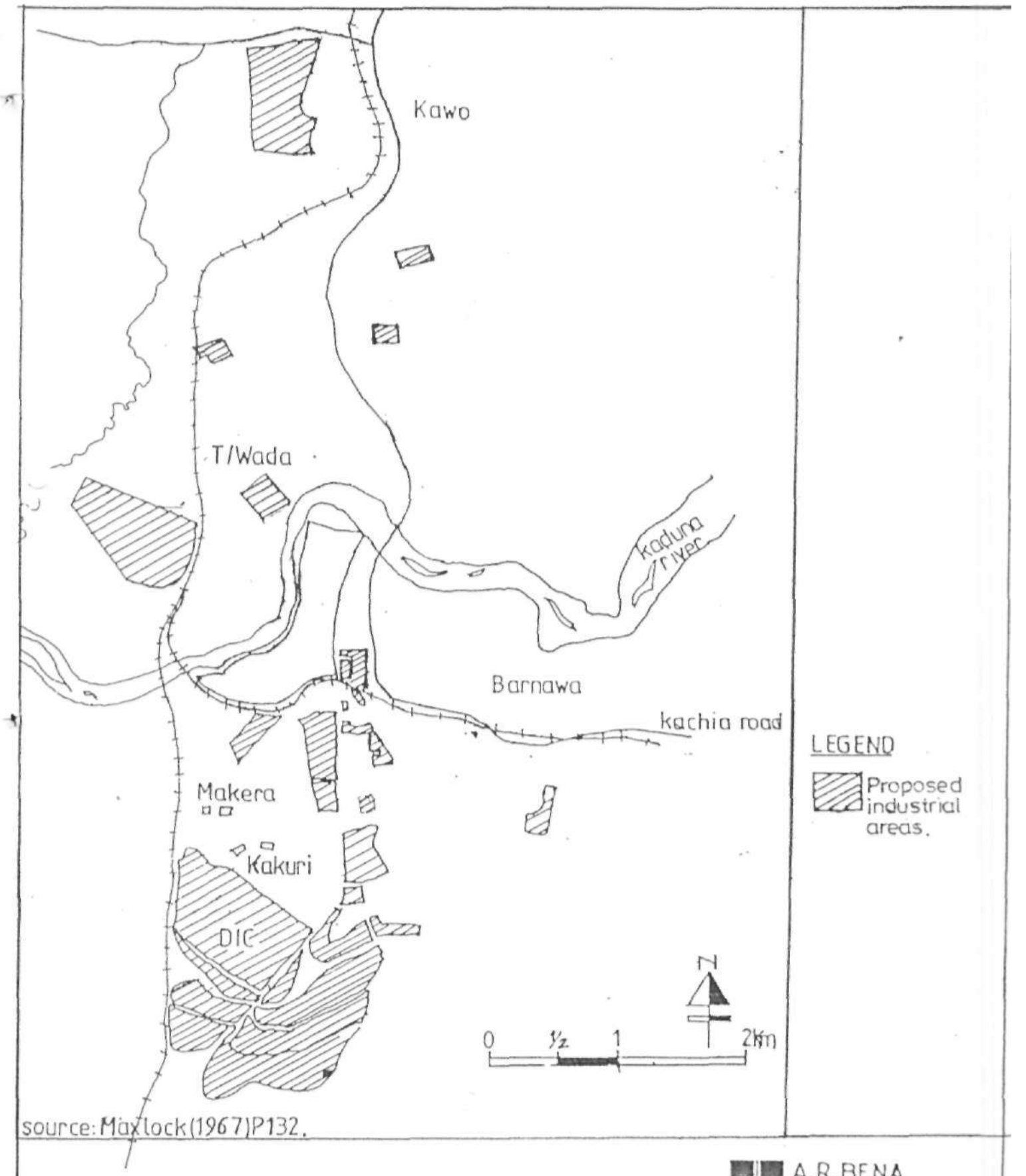
* In 1964 for instance, a regional seminar was held under the auspoces of the United Nations On Industrial Estates in East and Central Africa at Addis Ababa. The consensus reached was that industrial area project would in general be sponsored and organised by Governments.



source: Maxlock (1967) P132.

Fig.6, KADUNA: Proposed sites for industrial development, (kaduna master plan 1967–2017).

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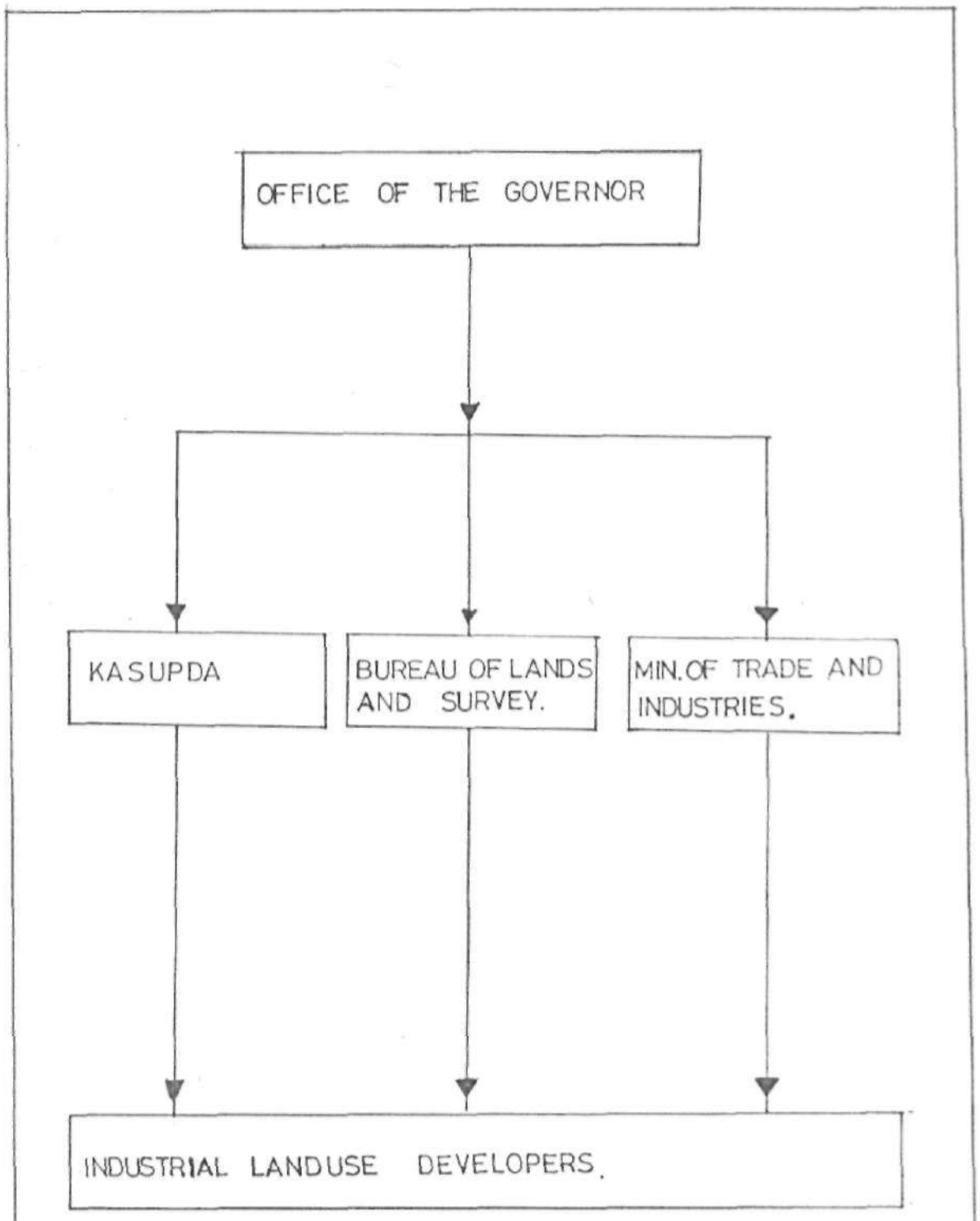
The state planning authority (KASUPDA) is also bestowed with the functions of preparation and review of industrial landuses as well as control the use and development of industrial land. It is also to prepare and provide layout for industries and set standards for industrial wastes.

Moreover, the state ministry of Trade, Industry and Tourism is authorized to assist in the preparation of industrial proposals put up by industrialists. Also it is to assist other organ in the establishment and development of industrial areas for industrial establishments.

The outlined institutional frame work (below) has some areas of inadequacies. One of such areas is the preparation of industrial layout plans especially between planning authority and Ministry of Trade. For example, industrial areas at Unguwan Mu'azu and Mando - Abuja road were established by the Ministry but their development is under the planning authority.

The consequence of such inconsistency in role assignment is the haphazard establishment of industrial areas with little regard to the landuse plan of the town. Therefore, the absence of a coherent policy is impediment to the orderly industrial landuse development in the town. Such discrepancies must have facilitated the prevalence of physical planning problems associated with industrial areas in Kaduna.



KEY

→ Directives / Flow of authority.

Source: Fieldwork (1994).

Fig. 7, INSTITUTIONAL FRAMEWORK FOR INDUSTRIAL LANDUSE DEVELOPMENT.

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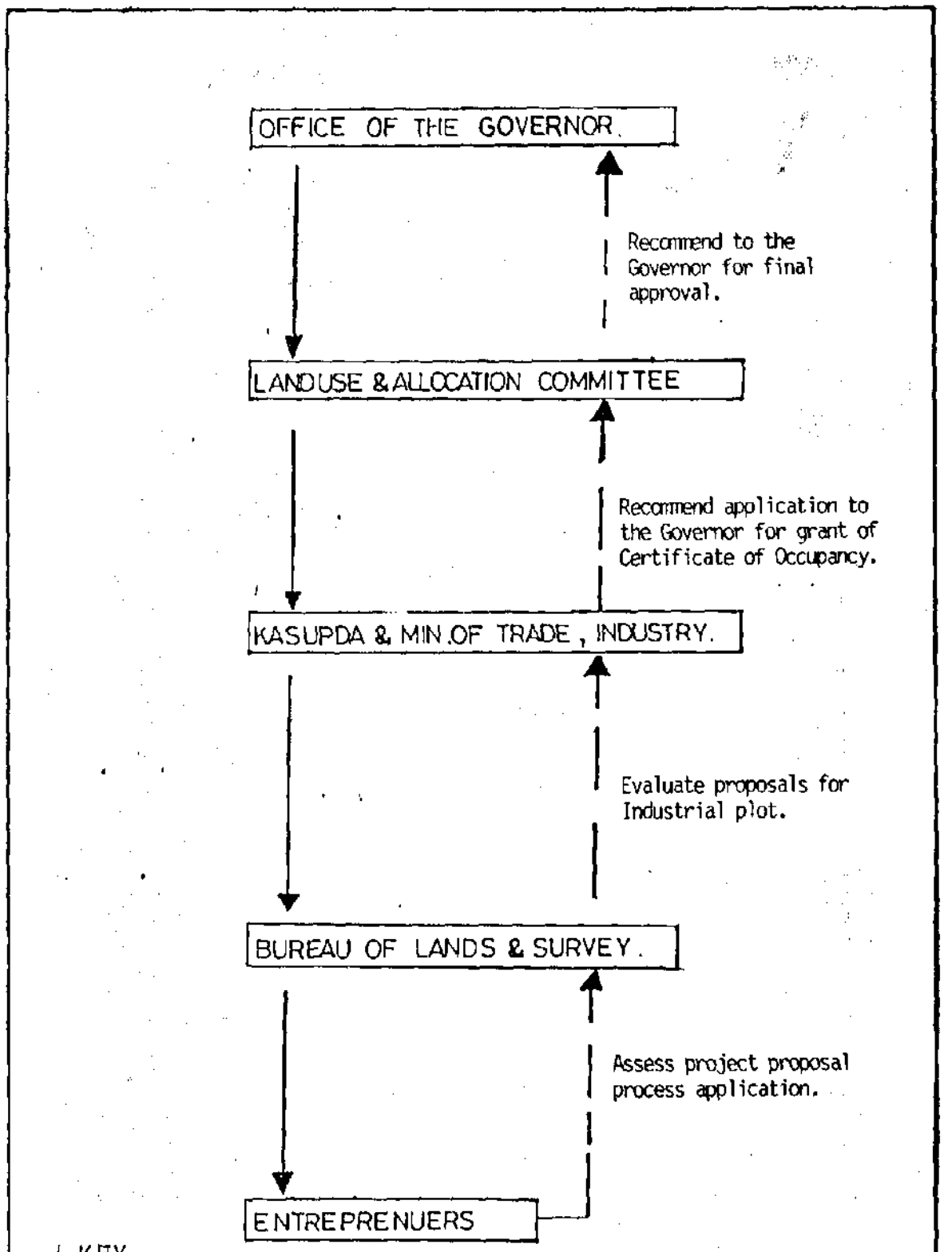

Source: Fieldwork (1994)

Fig8. PROCESS OF INDUSTRIA LAND ALLOCATION IN KADUNA.

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CHAPTER FOUR

DATA ANALYSIS

4.1 GROWTH AND STRUCTURE OF INDUSTRIAL LANDUSE IN KADUNA

Attempt is made in this chapter to examine the growth and structure of industrial landuse as well as the physical planning problems associated with it.

4.2 GROWTH OF INDUSTRIAL LANDUSE

The availability of vast land and its topography in the southern part of the town across the river has facilitated rapid industrial development. As noted by Medugbon,[1] an influx of industrial projects into Kaduna made it necessary for the Government to enlarge and establish more industrial areas from 270 acres in 1956 to about 2,686 hectares in 1994.

TABLE 3.0 : EXISTING INDUSTRIAL AREAS IN KADUNA

Location	Year Establish	Total Areas (ha)
Kakuri	1956	850
Mando	1978/81	156
Kudendan	1979/81	700
Kachia Road	1979	160
Tudun Wada	1985	100
H/Banki	1977	250
Nasarawa I	1980	320
Abuja Road junction	1980	N.A
Nasarawa II	1982	125

Source : Bureau of Lands and Surveys, Kaduna (1994).

Note: N.A = Not Available

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1 Medugon, A.K. Opcit, P. 351

The growth of industrial landuse (see above table) is better expressed in terms of increase in the number of industrial areas*. However, considerable growth took place between 1977 and 1985 when most of the industrial areas were established. Thus, from 1913 to late 1970, a total of 850 hectares were allocated for industrial development. During the period 1980 to 1990, about 1,756 hectares were added for industries due to the growth in manufacturing establishments.

Moreover, the growth could be linked to the increasing administrative and commercial functions of the town. The consequence (see figures 9 &10) of this development is reflected in the establishment of more industrial areas in other part of the town. Even though such spread is in line with the philosophy of the Master Plan, yet the development is characterized by a negative effect of increasing strain on transportation network, infrastructure and perpetuate the imbalance location of housing and industries.

As a measure to enhance balanced physical growth and development of the town, the present location of industrial areas are only appropriate when integrated to adjoining landuses and the town structure as a whole.

The current ground rent charges on industrial plot is N5,000.00 per $100m^2$ per annum, while development levy ranges from N3 per meter square to N5 per metre square for different categories of industries.

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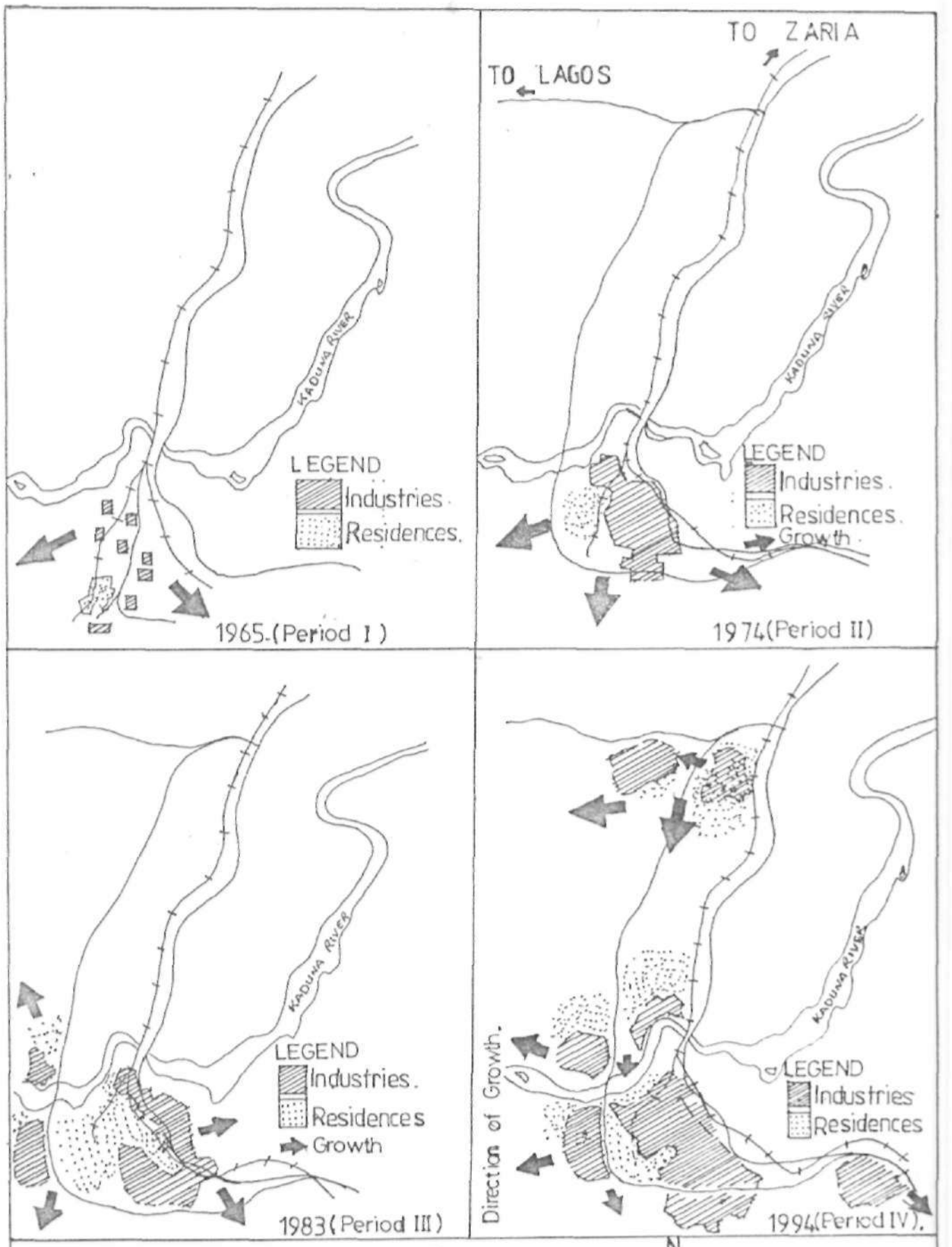
* In 1956, the then Northern Regional Government granted the sun of $15,000 to Kaduna Capital Development Authority to develop the only Kaduna South Industrial Area. In effect, a total of 270 acres was increased to 324 hectres by 1963.



Sources: Max Lock(1967), Kad Poly(1974), Field Survey(1994).

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Scale 1:250,000

Fig9, GROWTH OF INDUSTRIAL LAND USE IN KADUNA [1965-1994].

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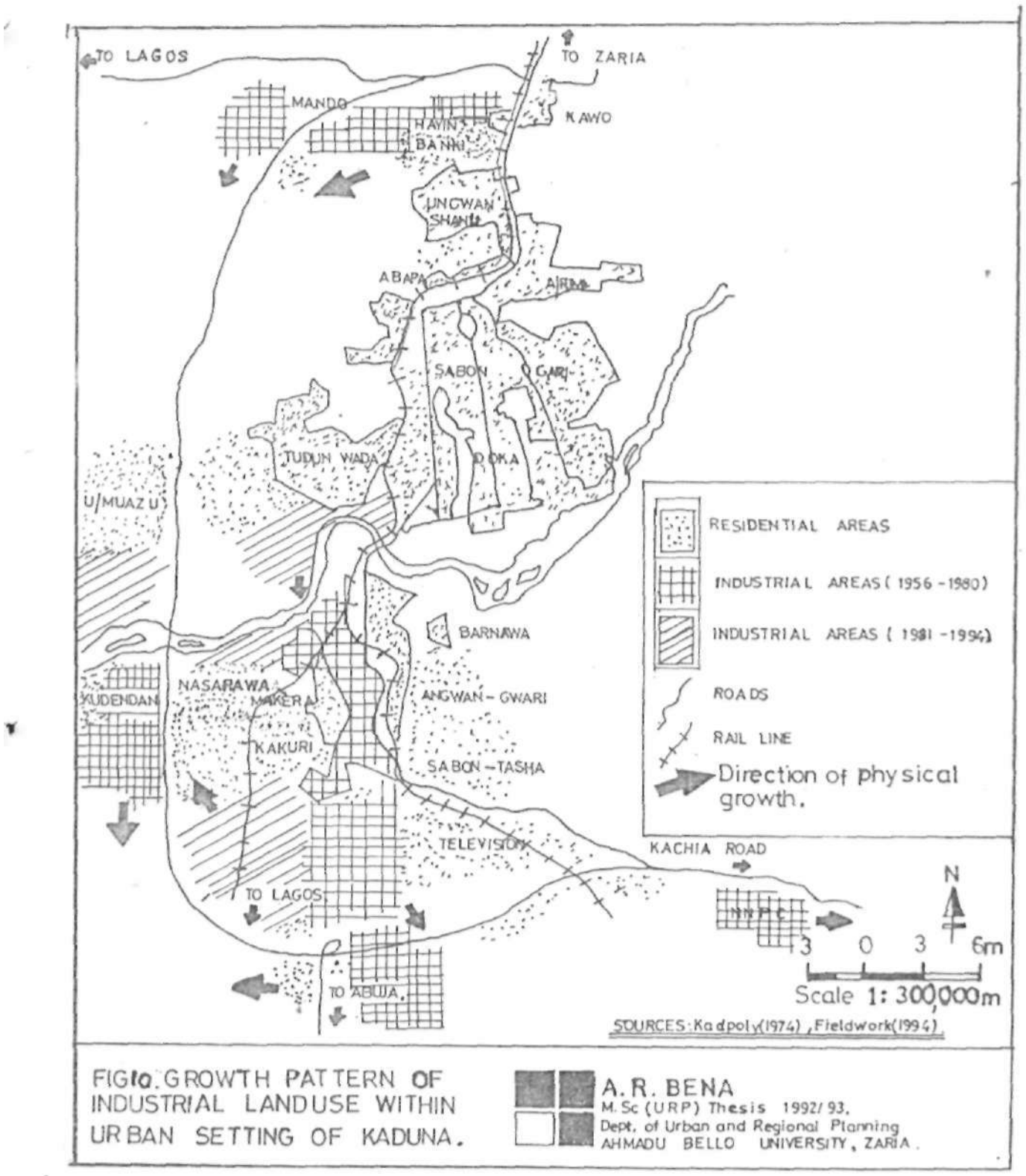

FIG 1a. GROWTH PATTERN OF INDUSTRIAL LANDUSE WITHIN URBAN SETTING OF KADUNA.

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TABLE 4.0 : EXISTING INDUSTRIAL AREAS IN KADUNA BY ACTIVITY AND EFFLUENT

S/ NO	INDUSTRIAL AREA	TYPES OF INDUSTRIES	NO. OF ESTAB.	NATURE OF ACTIVITY	EFFLUENTS
1.	Kakuri	-Textile Manufacturing	4	Manufacturing textiles materials.	Noxious gases, chemical wastes, fumes.
		-Steel smelting and	6	Manufacturing of structural steel & construction	Noise and fumes
		- Industrial Gases and paints.	2	Gases Manufacturers & Paints.	Fumes, noxious gases and offensive odour
		- Vehicle Manufacturing	1	Car manufacturing & Assembly	Noise and fumes
		- Defence equipments	1	Manufacture of military hardwares.	Noise, fumes and wastes
		- Plastic and Rubber materials	2	Manufacture of plastic materials	Noise, fumes and offensive odour
		- Brewery and beverages	1	Brewer and Beverages	Noxious gases, fumes and waste.
		- Other industries and services.	4	Manufacture of Pafco products, Mazavita etc & services, stationeries.	Noise, fumes and grit
2	Nasarawa	-Textile Manufacturing	2	Manufacture of Textiles & allied Product.	Noxious gases, chemical & liquid wastes offensive odour & fumes
		- Fertilizer & sulphuric acid	1	Manufacture of fertilizer & chemical	Chemical wastes, offensive odour & fumes.
		- Steel & Metal works	1	Manufacture of Aluminium & steel structures.	Noxious gases, odour and noise
		-Chemical, foam and ceramic	1	Manufacture of foam products, pesticides.	Noxious gases, smoke and noise.
		-Machine tools and accessories	2	Manufacture of Bolts, nuts, nails, motor vehicle components & roofing accessories	Noise, noxious gases, fumes & offensive odour.
		-Warehouse and block making.	3	Frozen fish & fast food depots and building Blocks & fabricated blocks.	Noise, dust and fumes
3	Kudendan	- Brewery & Beverages	1	Brewers of Beer & soft drinks	Noxious gases & fumes
		- Flour Mills	1	Manufacture of pafico products, semolina, Mazavita & etc.	Noise & dust and slop (residue from beer)
		- Glass Products and allied services	3	Manufacture of glass, bottles, and allied products.	Noise, noxious gases, fumes offensive odour
		- Rubber and battery	2	Plastic containers, tyres & retreads. Drycells battery.	Noxious gases, smoke and chemical wastes.
		- Printing and binding	1	Publishing, binding of newspapers, magazines etc.	Noise, dust and fumes.
4.	U/Muazu and T/Wada	- Flour Mills	1	Manufacture & Packaging of grains.	Noise and dust
		- Textile manufacturing	1	Manufacture of blanket and toiletries	Noise and dust
		- Communications	1	Telecommunication cables, satellite.	Noise.
5.	Kachia Road	Petro - chemicals	2	Oil refining and lubricants	Oily chemical sludges, gaseous particulate, unpleasant odour and oil spillage.
6.	Abuja Road junction	Furniture and allied products.	2	Manufacture of carpets.	Noxious gases, liquid wastes and offensive odour.

Source: Fieldwork, (1994)

4.3 STRUCTURE OF INDUSTRIAL LANDUSE

In Kaduna, the location arrangement of industries has not been planned within the context of compatibility, city growth and environmental quality.

What has occurred as a consequence is the incompatible relationship between industries and housing, unplanned growth of the town - prevalence of slums and environmental pollution as a result of industrial effluents emitted.

Moreover, the approved plot sizes being adopted in preparing layout-plans is far inadequate. For example allocation of 1.0 hectare to 6.0 hectares range to all types of industrial establishments has stimulated the unplanned structure of the industrial landuse. There are some industrial plots in Kakuri though allocated for over ten years but are not developed due to too much land holding even for the so called 'future' expansion. Further structural complication is reflected in the types of industries accommodated in each of the areas. There is no single industrial area that accommodate industries that are of the same category either in terms of health, safety or environmental quality. For instance, industrial establishments such as textiles, steel smelting and aluminium, brewery, rubber and plastic, paper products and printing are found in one industrial area - Kakuri.

Other aspect of structural imbalance of industrial landuse development is the factory arrangement. Most of the factories have the noisiest part located in the inner part of the site. Ironically most of such factories have residential development as the adjoining landuse.

Typical examples are industries at Kakuri and Nasarawa which are adjoined by Kakuri, Makera and Nasarawa settlements. The consequences found are excessive offensive odour, noise of machines, grit and particulate (see plates 3 and 4)

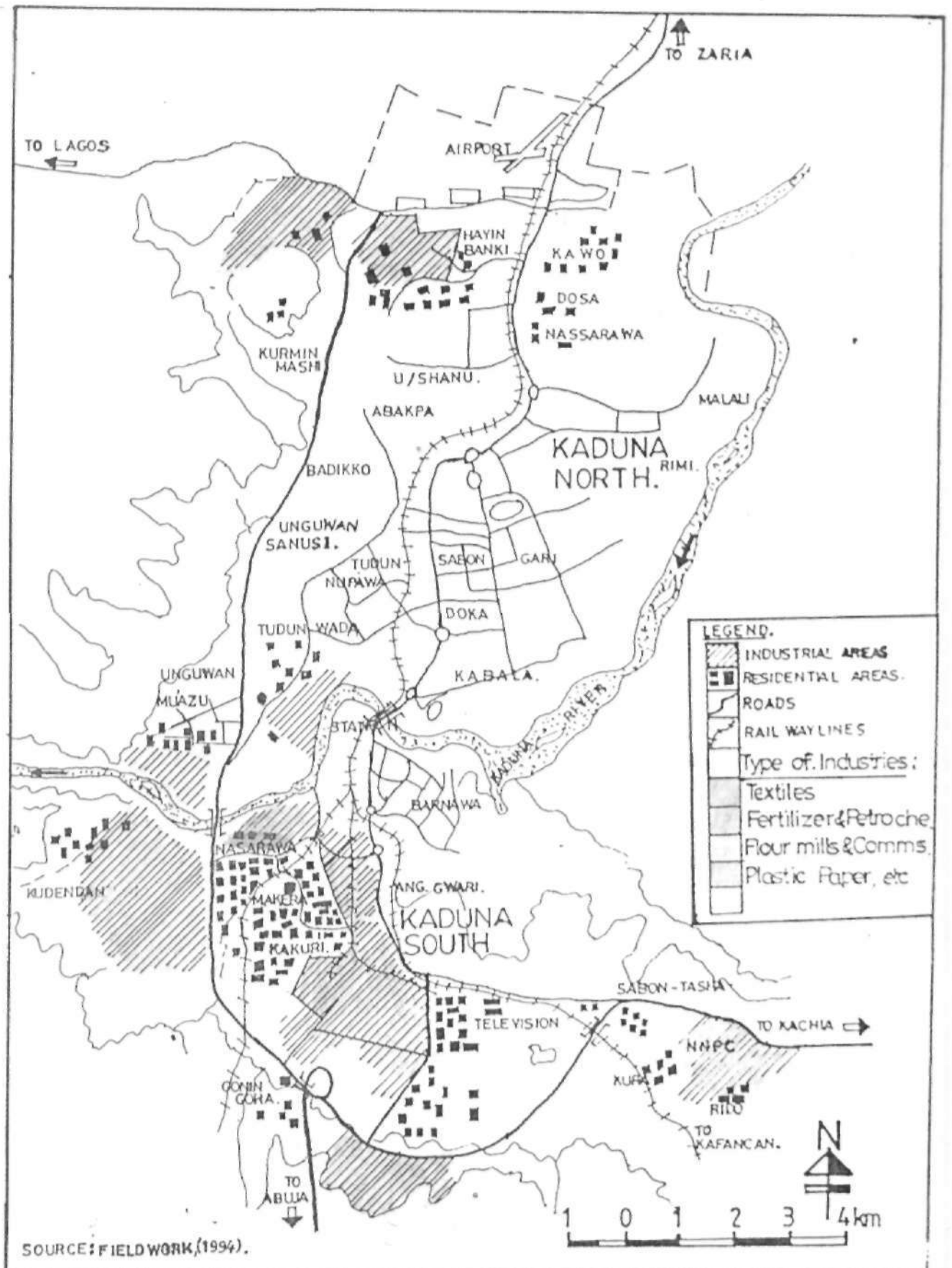
The impact of industrial sites on city form could be seen in terms of influence it exert on the shape of Kaduna. Though the city growth is linear toward southern part, industries tends to pull growth to the west at Kakuri - Makera end. Similar development is taken place at Kudendan along the western by-pass. More impact is anticipated across Abuja - road junctions to the south-east, when the proposed eastern by-pass is completed.

Consequently, the structural impact of industrial landuse is best seen within the stress on city amenities and unhealthy industrial environment. It is therefore obvious that if functional structure of industrial composition is maintained, safe, healthy and location compatibility and environmental quality will follow suit.

4.4 PROBLEMS OF INDUSTRIAL AREAS

A detailed survey in each of the industrial areas was conducted to ascertain the physical planning problems of incompatibility, unplanned growth and environmental degradation.

Below is the detailed analysis of the major industrial areas that posed these serious planning problems.



SOURCE: FIELD WORK, (1994).

FIG.11. KADUNA: LOCATION OF INDUSTRIAL AREAS IN RELATION TO ADJOINING LANDUSES.

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DEPARTMENT OF URBAN AND REGIONAL PLANING, AHMADU BELLO UNIVERSITY, ZARIA.

4.4.1 Kakuri Industrial Area

The site is located in the area south of Kaduna river. It is about 475m above sea level with road, rail access, water and electricity. The total area is about 850 hectares and was planned to accommodate heavy manufacturing establishments.

(i) Location Compatibility

Investigations have indicated that the site is bounded to the west by Kakuri and Makera settlements. To the East it is bounded by the main Kachia road with few residences. The Northern end is bounded by institutional development - staff training and development centre and chanchangi motors' yard, whilst to the south is the Kakuri stream. The major problem of location incompatibility is the close proximity to adjoining residential development. Such incompatibility could be seen within the context of heavy flow of industrial traffic, noise of machines, unpleasant odour and fumes emitted by industries - especially textiles and aluminium factories. The situation is aggravated by the direction of prevailing wind which is detrimental to the living area.

Although the settlement was not adequately planned, it has grown in parri-passu with the growth of industries. However, conscious planning efforts were not put in place to guide residential development to be compatible with adjoining industrial activities.

Therefore, nature of the industries, direction of dominant wind as well as the sewer line laid through residence made the two landuses to be

incompatible. In consequence industrial pollution is endangering the lives of the inhabitants living around the area.

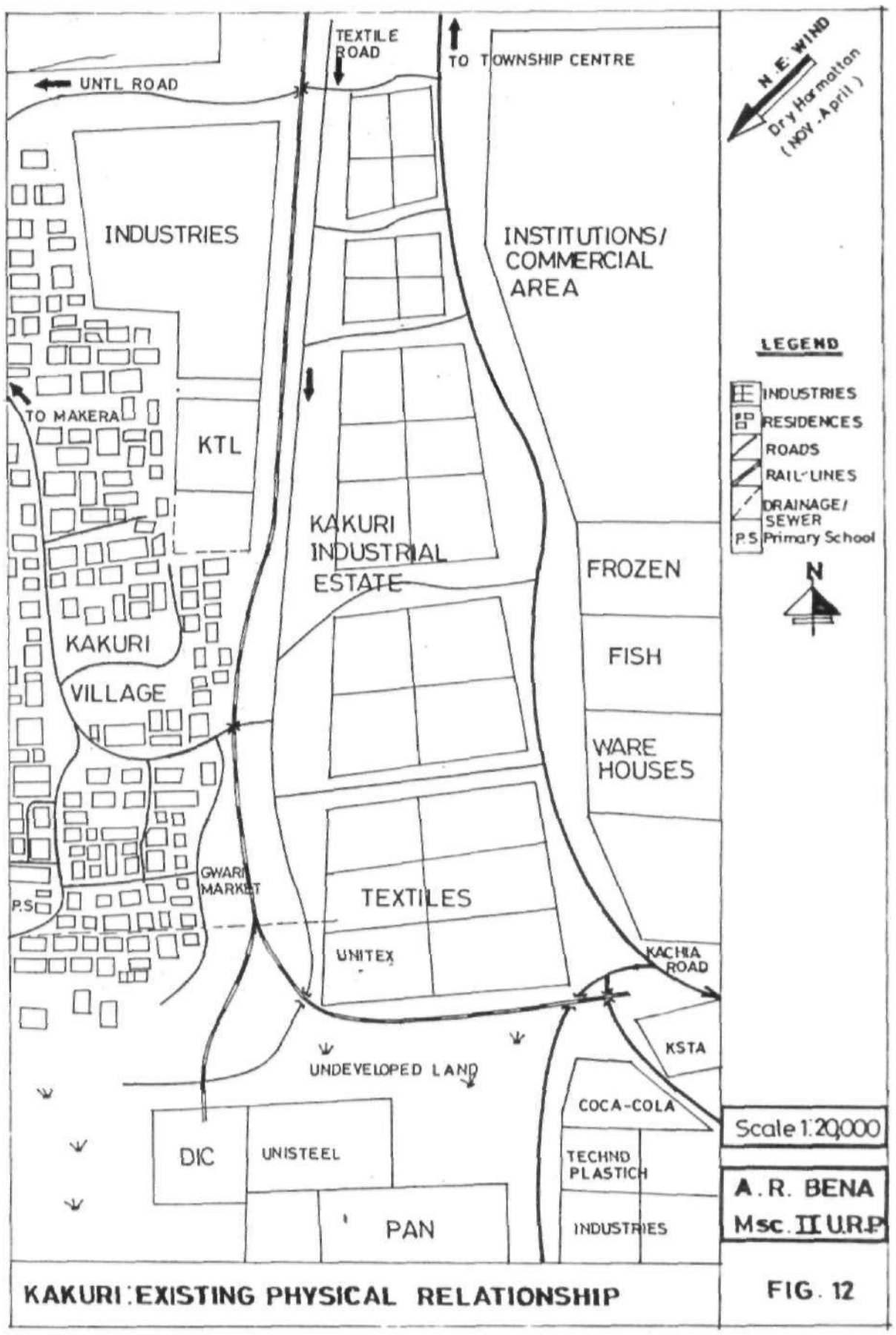
(ii) Physical Growth

It is obvious that industrial development has influenced unplanned growth of residences in Kakuri. Although there was no data to show the periodic expansion of the settlement, investigations revealed that areas very close to industries house most of the industrial workers. As such the residential area expand along with establishment of industries.

Moreover, the settlement was said to have grown rapidly in the last fifteen years following mass exodus of people in search of job opportunities. There was no element of planning control in the area, which implies people erecting structures without consulting the planning authority. Circulation system within the area is poor - an indication of unplanned development. In consequence the urban infrastructure meant to serve industries were 'pulled' towards residence which is adding cost on the provision.

(iii) Environmental Pollution

The major effluents emitted by industries in the area are: odour, noise and gaseous smoke. Investigations conducted revealed that, the major sources of these effluents are steel, metal and textiles factories as indicated in the accompanying figures and plates. It is evident from plates 3 and 4, that poor sewer system laid through the residential area of Kakuri Gwari ward is corroding building structures, contaminating ground water because of potential leakage, and air pollution.



KAKURI: EXISTING PHYSICAL RELATIONSHIP

FIG. 12



Plate 1 : *Industrial Sewer System at Kakuri*
The sewer laid in between residences at Kakuri has caused corrosion and dilapidate the residential structure. It obstructs pedestrian circulation and pollutes the residential environment.



Plate 2 : *Industrial Liquid waste at Kakuri*
The liquid waste discharged by the industries as shown in the plate are absolutely harmful to both human beings, animals, and ecological organisms. The silt pollutes the environment. A terminal of the sewer line from Arewa Textile factory.



Plate 3 : Industrial waste 'see page' at Kakuri/Makera
Evidence of poor structural arrangement of factory buildings and poor fencing. Thus, lack enforcement of performance standards have facilitated negative consequences on the environment and human well-being.



Plate : 4 Industrial waste in some factories at Kakuri
Dumping of industrial waste close to the fence pollutes the adjoining environment. It also shows elements of incompatibility to adjoining residential development.

Moreover, the fumes emitted by industries are been blown towards the residents by the direction of prevailing wind as indicated in figures above.

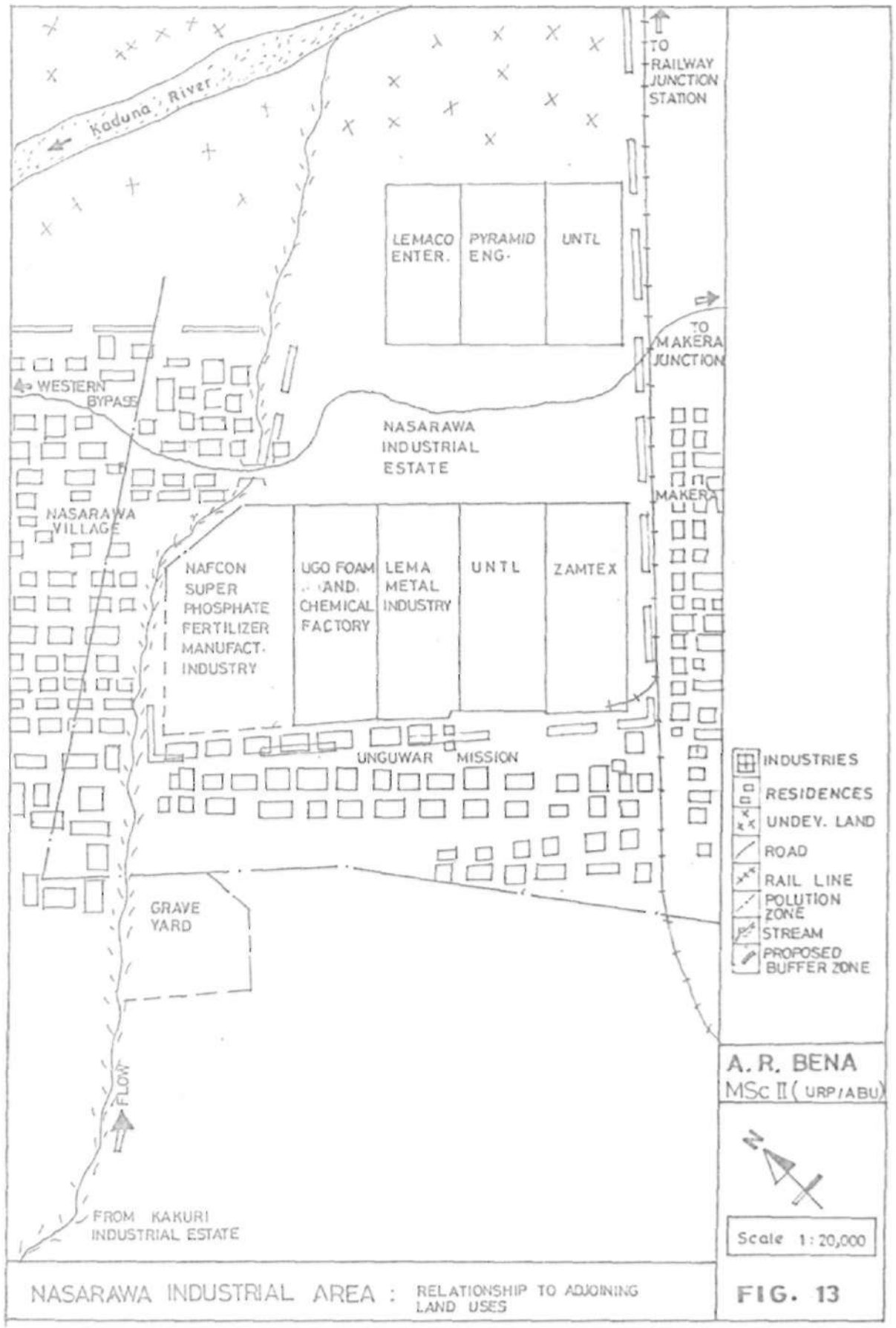
4.4.2 Nasarawa Industrial Area

The site is located on the North-west part of Kakuri industrial area. It is bounded to the west by the residences of Nasarawa, while to the North is adjoined by Kaduna river. Makera and Kakuri settlements bounded the site at the East and Southern end. In other words, the industrial area is enclosed by residential development as indicated in the figure below.

(i) Location Compatibility

Prior to the establishment of industries, the settlements of Nasarawa and Makera have been in existence. The trend in the growth of these settlements was facilitated by the establishment of railway junction station in 1920 and subsequent location of industries in 1956.

Therefore, Nasarawa industrial area established in 1980 is absolutely new development. The site though suitable for industries is not adequately planned to be compatible to residential development. For example, industrial traffic flow from the western by-pass in to the site is obstructed by residential development. This signifies poor planning of the industrial area. Also, absence of buffer zone or given belt area and similar landuse zoning regulations have contributed to the current residential encroachment on industrial land.



NASARAWA INDUSTRIAL AREA : RELATIONSHIP TO ADJOINING LAND USES

FIG. 13



Plate 5 : Proximity of residences to Industrial Premises in Nasarawa
The figure above describes absence of zoning standards. The consequence of which is seen trespassing where exit gate of an industry passes through residential property. Thus unplanned development.



Plate 6 : Effects of industrial liquid waste on adjoining environment landuses
The chemical contents of the industrial waste emptied into a stream at Nasarawa has corroded the residential buildings, example point (a) was moved to point (b) due to chemical waste coming out from fertilizer factory at point (c)

(ii) Physical Growth

It is obvious that growth in industrial establishment has strong influence on residential development. Hence, the gradual establishment of residences in the form of slums around the industries (see Plates 5 and 6 and the figure).

Therefore, residential area of Nasarawa as a whole grow with the increase in the number of industrial establishments. Such development tends to increase the land for residential development which in turn increase the physical extent of the town.

(iii) Environmental Pollution

Investigations conducted revealed that industrial pollutants - particularly offensive odour, fumes and chemical waste are endangering the lives of the people living in Nasarawa and Makera areas. The foul smell and chemical waste emitted by super phosphate fertilizer factory and textile industries are the most obvious pollutants.

It is discovered that, the acidic contents of the stream water has corroded the building structures around the bank (see Plates 5 and 6) and pollutes the underground water thus making it harmful for domestic consumption. Moreover, it was alleged that domestic animals - cattle, goats, pigs and chickens especially are being poisoned by eating grass contaminated by sulphuric acid being emitted by the fertilizer factory at Nasarawa industrial area.

4.4.3 Kudendan Industrial Area

The area is located along western by pass. Established in 1977 following a planning report.* It covers a total area of 397.5 hectares. Out of this figure, about 200 hectares were planned to accommodate eighty-eight different types of industries with different plot sizes.

As indicated in figure 14, few residential structures inform of slums are found within the industrial area. This encroachment is the major problem impeding proper development of the area. Absence of development control is contributing to the persistence of the problem. Therefore, it is envisaged that if proper planning measures are not effectively enforced in the area, problems of incompatibility, environmental pollution and unplanned physical growth of the town in that direction will emerge.

4.3.4 Unguwan Mua'zu Industrial Area

The site is located along western by-pass on the north-east of Kudendan Industrial Area. Established in 1985, by the State Ministry of Trade, Industry and Tourism. It covers a total area of 150 hectares. Investigations shows that, the few existing industries are in close proximity to residential development. This situation shows absence of planning efforts - development control. In consequence, evasion of industrial land by residential development will emerge. Absence of development control and zoning regulations account for the prevalence of incompatible industrial - residential relations.

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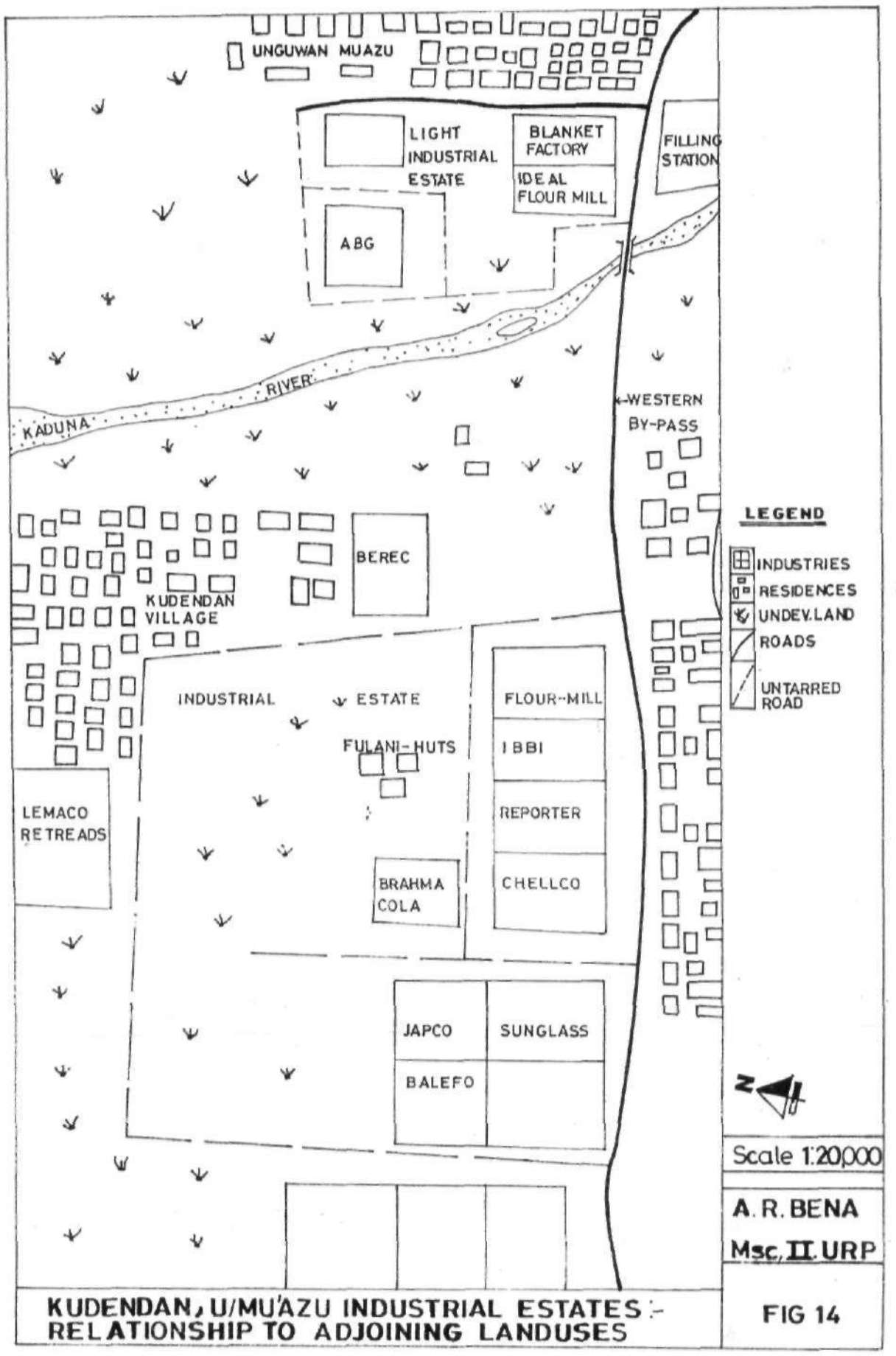
* Messrs. H.S. Samaila & Associates was commissioned in 1977 to prepare a plan for the area. The recommendations led to the establishment of the industrial area.


UNGUWAN MUAZU
LIGHT INDUSTRIAL ESTATE
BLANKET FACTORY
IDEAL FLOUR MILL
FILLING STATION
ABG
RIVER
KADUNA
WESTERN BY-PASS
BEREC
KUDENDAN VILLAGE
INDUSTRIAL ESTATE
FULANI-HUTS
FLOUR-MILL
IBBI
REPORTER
CHELLCO
LEMACO RETREADS
BRAHMA COLA
JAPCO
SUNGLASS
BALEFO
LEGEND
INDUSTRIES
RESIDENCES
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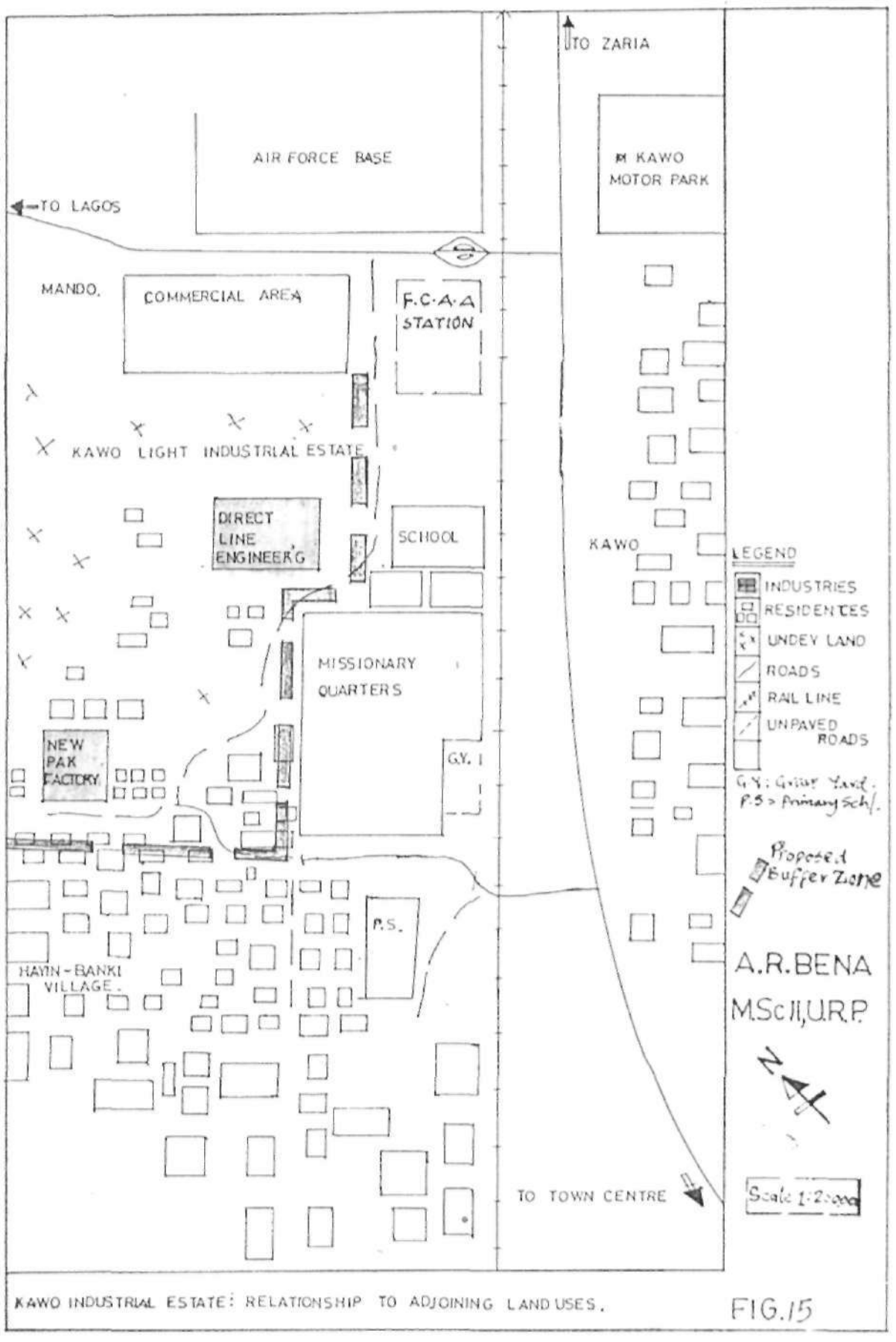
UNTARRED ROAD
N
Scale 1:20,000
A. R. BENA
Msc, II URP
KUDENDAN, U/MU'AZU INDUSTRIAL ESTATES :- RELATIONSHIP TO ADJOINING LANDUSES
FIG 14



KAWO INDUSTRIAL ESTATE: RELATIONSHIP TO ADJOINING LAND USES. FIG.15

4.3.5 Hayin Banki (Kawo) Industrial Area

The decision to establish the industrial area was made by Kaduna state Government in 1977 following slum clearance exercise in that part of the town. It covers total area of 280 hectares. The site is to accommodate twenty-one light and medium scale industries.

Investigations revealed that land holding is posing a problem to the development of the area. Non-payment of compensation is limiting against industrial take off in the area. By the time of compiling this report, there are two industrial establishments - the New park and direct line Engineering Firm.

The physical planning problems identified in the area are; poor accessibility, poor flexibility within the area and absence of development control and enforcement of zoning regulations.

4.4.6 Tudun Wada (South-East) Industrial Area

The Tudun Wada industrial area was established in 1985 following the growing demand for medium size industrial plots in Kaduna. It is further considered to be integrated with the industrial area at Unguwan Mua'zu. The area has a total of about 250 hectares - planned to accommodate forty-four manufacturing establishment. Though located at Eastern part of residential development, the area is well drained to the south by river Kaduna. The western by-pass provides a south-west accessibility to the site.

However, there are elements of incompatibility arising from residential development within industrial land. The consequence in the long run will be industrial pollution and development of slums.

4.4.7 Mando Industrial Area

The site for industrial development is located along Abuja - western by-pass. It is established in 1978 while the layout plan was revised and amended in 1981.

However, there is need to provide adequate accessibility, utilities and services in the area. There is obvious need to enforce development control and design standards for successful development of the industrial area within the context of compatibility, planned growth and environmental quality.

It is imperative to add that since the area is close to Hayin Banki industrial area, the two could be integrated and planned to be in conformity to the adjoined Military barrack and other settlements around.

4.4.8 Abuja Road Junction Industrial Area

The decision to establish this industrial area was effected in 1980 as part of the plan to accommodate the projected industrial area coverage of 1010 hectares of the urban Land.*

The site is located on the Northern part of Abuja - Kaduna road west whilst of Kakuri Industrial area. The land is suitable for factory building due to its rolling topography and drain towards Rido stream.

Moreover, the total area is about 250 hectares with few industries on site, with a seemingly defined boundary line to adjoining Mararaba settlement.

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* In both Master Plan report prepared by Maxlock, and the revised proposals for the year 2015 prepared by Dept. of urban & Regional Planning, A.B.U., (1984) have all contended with the target land coverage for Industrial development.



Plate 7: Petroleum Refinery. Fumes emitted an indication of air pollution

Petroleum Product spillage from the refinery into Romi and Rido Rivers had occurred unabated. Well waters in Rido village as well as the Rido and Romi Rivers were grossly polluted.

The foreseen problems associated with the area are encroachment into industrial land by residential development - due to absence of development control, environmental pollution - oil spillage into the stream.

Therefore, it is due for the planning authority to enforce planning standard and performance regulations on the industries and around the industrial area.

4.4.9 Kachia Road Industrial Area (NNPC)

The site is located at kilometer 16 along Kachia road, southern part at the outskirt of sabon Tasha settlement.

The area was established in 1985 as a result of incessant complaints against 'Oil spillage' emitted by the refinery since 1979.

The location incompatibility exists in relation to the farming activity around the refinery and oil spillage in to the Rido stream. There are cases of pollution on crops and fishes which is attributed to the only refinery in the area.

Investigations have revealed that all farming activities around the refinery and indeed within the 6 kilometer area determined for industries are prohibited. Also it was discovered that pollution within the area are being controlled by the industries - hence the erection of environmental pollution unit in the refinery. The unit is currently monitoring the intensity of effluents emitted by the refinery with a view to curtailing its adverse effects on the environment.

Moreover the fumes smoke produced by the refinery as shown in Plate (7) is easily blown away from Sabon Tasha area.

With such features, the area is best suited for all petro-chemicals and allied obnoxious industries in Kaduna - provided adequate measures are provided and enforced.

However, there is need for adequate planning of the site in terms of accessibility, circulation, and enforcement of zoning regulations and development control.

4.5 SUMMARY OF FINDINGS

The establishment of industrial areas has been used particularly in the study area as a device to accommodate industries with a view to promoting industrialization and employment opportunities. This aim is been accomplished by the evident growth in industries and increasing demand for industrial land. It is discovered that, the existing industrial areas are not comprehensively planned to integrate adjoining landuses - which is largely residential. Environmental pollution and existence of slums are manifested in most of the industrial areas. Moreover, none of the industrial areas contain within it buffer zone that will serve as a break in between industries and adjoining landuses. Essentially, buffer zone areas are primarily to prevent unplanned development especially incompatible landuses around the industries.

The consequence is reflected in the indiscriminate residential developments around the industries. And the structure of the town was influenced into linear shape by industrial development. By implication such unplanned development is certainly inflicting cost on provision of infrastructure to the area where growth is taken place.

*Certainly, the establishment of industrial areas along the western by-*pass is gradually pulling unplanned residential development - acting as growth centre in the town. Similar result is envisaged when the

eastern by-pass is constructed thus changing the structure of the town from the present linear pattern to another shape - radial concentric or centripetal form.

With this is mind, it is necessary for the government to steer up the institutional framework to monitor and control such development to be in line with the overall landuse plan of the town. Thus, the philosophy of town planning which is mainly concerned with the siting of industry in its relation to the town as a whole does not seems to be appreciated in Kaduna.

4.6 CONCLUSIONS

The Kaduna State Government is conscious of the fact that industries are engine of growth and physical development of cities. Hence the provision of many hectares of land at various locations for industrial landuse development.

At general level, none of these areas are comprehensively planned within the context of compatibility, planned development and environmental quality of the town. The paradoxical situation is attributed largely to inappropriate physical planning principles and strategies often applied in handling industrial landuse development.

Moreover, absence of policy documents to guide industrial landuse planning and development has compounded the problem.

Therefore, there is obvious need to have adequate institutional framework and effective policy documents to guide industrial landuse development in Kaduna.

CHAPTER FIVE

IMPROVEMENTS AND POLICY RECOMMENDATIONS

5.1 INTRODUCTION

Absence of articulate policy documents to guide industrial Landuse Planning and development in Kaduna Urban area has facilitated the emergence of physical planning problems that are associated with industries.

In view of such inadequacies, the following proposals are made with a view to setting policy framework for an effective industrial landuse planning and development.

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5.2 POLICY RECOMMENDATIONS

With due regards to the statusquo, the following recommendations call for conceptual and structural changes in the planning, development and Management of industrial Landuse in Kaduna.

(i) Government must ensure consistency in the policy formulations and role assignment concerning industrial landuse planning and development. For instance, the state edict No. 1, 1990 though has empowered the planning authority to acquire land for industrial development, yet Ministry of Trade, Industry and Tourism was also found to be engaged in the same function. Such duplication of roles facilitate element of poor planning administration.

(ii) In view of the above situation, Government should implement the provision of decree No. 88 of 1992. The decree empowered the planning authority to oversee all forms of physical development. As such government should provide

necessary plat form and ensure absence of undue interference from any department.

(iii) Residential development around industrial areas that are unplanned and incompatible that are identified in this study be removed. Such demolition and restrictions be enforced within the provision of the planning law.

(iv) The Planning Authority be encouraged to enforce performance standards on Industries. It should liase with the Environmental Protection Agency to ensure control of the Nuisance created by industrial activities.

(v) It is important for the Government to encourage industries particularly those that are found to be in unsuitable locations - due to nuisances emitted by them, to move to a more suitable site within industrial areas. Such industrial movement is aimed at removing obnoxious industries away from residences. Government should give legal backing to the adoption of these recommendations in order to control and forestall the existing physical planning problems associated with industrial landuse in Kaduna.

5.3 PROPOSED IMPROVEMENTS ON THE EXISTING PRINCIPLES FOR INDUSTRIAL LANDUSE DEVELOPMENT

Principles proposed in this study are produced within the established physical planning principles and integrated with what is obtained in Kaduna.

A. The sites for industrial development need to be revised, re-evaluated and re-planned to be in conformity with adjoining landuses

especially residential. Such integration is to be done by considering the following.

(i) Enforcement of performance standards on industries in order to control the volume and composition of the effluents discharge especially at Kakuri - Makera, Nasarawa areas.

(ii) Re-structure industries by way of functional design of factory buildings to put away the noisy parts appropriately to enhance compatibility to adjoining landuses. With such arrangement, industries could be well accommodated within residential areas.

B. Industrial areas be provided with improved accessibility by roads, while where possible rail sidings be extended especially to industrial areas at Kudendan and Unguwan Mua'zu. Whereas industrial areas at Nasarawa and Hayin Banki are directly connected with housing areas which obstruct free flow of industrial traffic.

The solution lies in providing an adequate circulation system that does not necessarily pass through residential areas (as indicated in figure 3 above).

C. The less developed industrial areas such as Kudendan, Unguwan Muazu, Tudun Wada, Hayin Banki and Kachia road should be re-planned within the context of compatibility and planned growth of the town.

It then becomes necessary to study in detail the relationship between industrial areas on one hand, residential development and farming activity on the other hand with respect to direction of prevailing wind,

industrial effluents, generation of traffic noise, and other nuisances associated by industrial activity.

D. Establish a comprehensive industrial waste treatment plant in each of the industrial areas. The essence is to curtail the problem of indiscriminate channeling of industrial waste and encourage saulage and recycling process. On the interim, one sewage treatment plant for Kakuri and Nasarawa industrial areas could be provided as a sample.

With the above policy elements proposed, the following strategies are designed to accomplish success in the industrial landuse planning in Kaduna.

5.4 STRATEGIES FOR POLICY IMPLEMENTATION

(i) Physical Planning regulations - development control and zoning be effectively enforced on any form of physical development within and around industrial areas.

However, political interest of policy makers do abuse physical development plans, such impediments be minimized. Physical planners be put on alert to advocate physical planning ethics. In essence appropriate landuse control around industrial areas, and indeed within such areas must as a matter of necessity be rigidly exercised.

(ii) Selection of sites for noxious industries such as oil refining, textiles and fertilizer plants must be done intensively. To this end,

the present industrial groupings need to be changed in order to reflect nature and types of effluent industries have before they are grouped together. There is need to adopt quantitative measurement of their performance in order to classify them.

In consequence, the following classification of industries in Kaduna are proposed based on allied requirements, environmental health and safety (see table 5.0).

(iii) The third strategy is the establishment of Industrial Landuse Development and Management Committee - (ILDMC). With a view to overcome the deficiencies identified with the existing institutional framework. *This committee shall comprise members drawn from the* following bodies:

- KASUPDA, KEPA, Bureau of Land and Survey, NEP Plc, Water Board, State Chamber of Commerce, Industries and Agriculture (NACCIMA), Manufacturers Association of Nigeria and Raw Materials Research and Development Council (RMRDC).

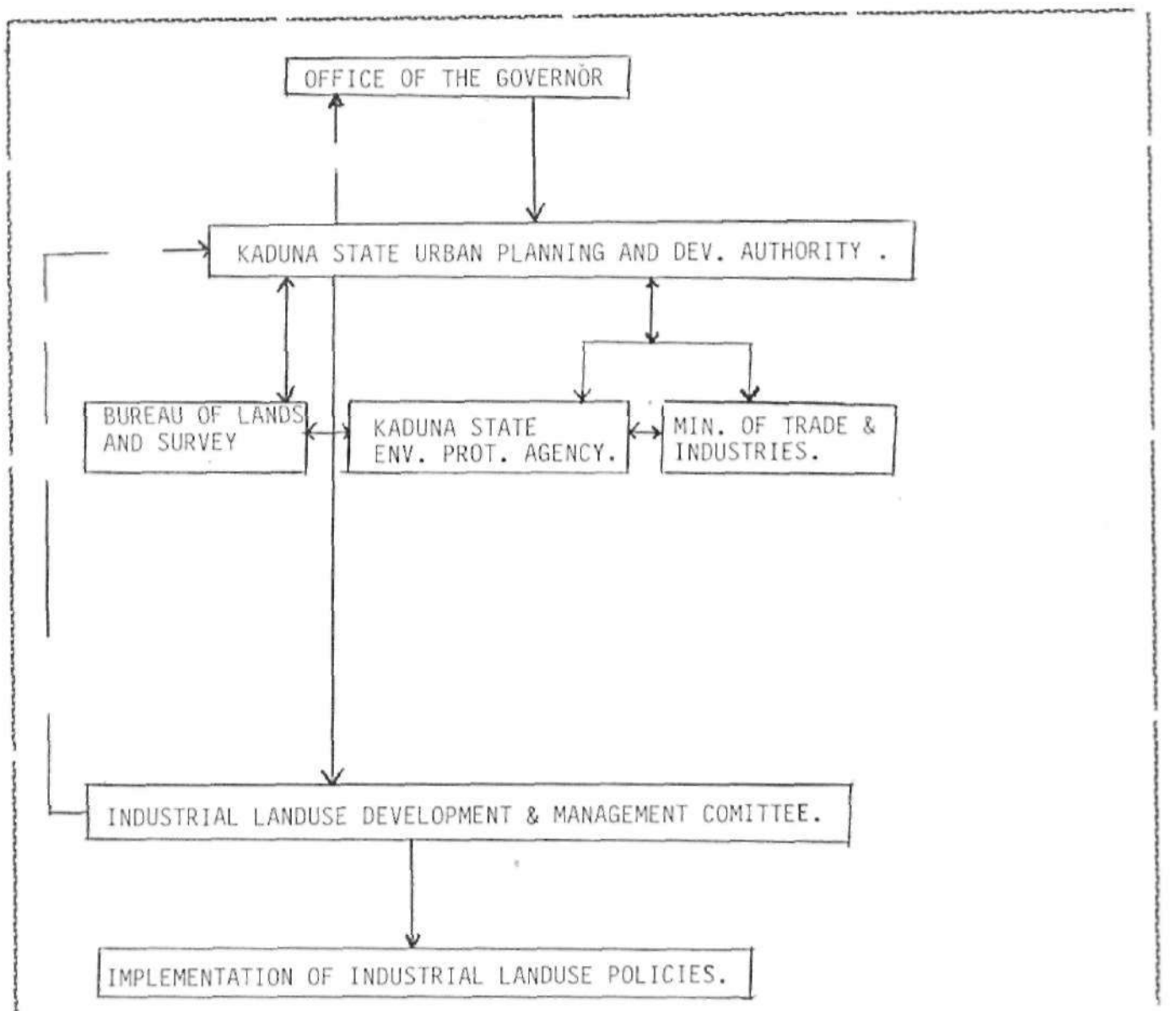
The terms of reference for the committee is to be drawn up by the planning board which must be within the physical planning and sanitary engineering aspects of industrial development.
Among the objectives of the committee shall include the following:

(i) To oversee the planning, programming and execution of *industrial landuse development in Kaduna.*

(ii) To monitor industrial activities in terms of development and discharge of effluents.

(iii) To recommend ways of recouping capital invested in the development and maintenance of industrial areas to the planning board.

(iv) To provide proper plat form by way of inviting private sector to finance the development and maintenance of industrial areas as another way of facilitating industrial development in Kaduna.



KEY.

⟶ Flow of Directives / Authority.

⟷ Consultation.

--→ Feedback.

Fig. 16, Proposed Institutional Framework for Implementation of Industrial Landuse Policies in Kaduna.

TABLE 5.0 PROPOSED GROUPING OF INDUSTRIES AND LOCATIONS IN KADUNA

CATE - GORY	GROUP OF INDUSTRIES	LOCATION
A	Manufacture of food products and beverages , Meat and Fish products, Fruits vegetables and edible oils. Grain Milling, Confectioneries, Bakery.	Unguwan Mu'azu
B	Brewing and Blending of alcoholic drinks, Tobacco products. Textiles, Steel and Aluminium products, Motor vehicles, cycles, bicycles and miscellaneous activities.	Kakuri and Nasarawa
C	Manufacture of Rubber, Plastic, non-metallic mineral products. Foot wear, domestic utensils and appliances. Manufacture of leather products, tyres and tubes, retreading etc.	Tudun Wada and Kawo
D	Manufacture of Glass, wood and hard ware products. Glass materials, Ceramic and tiles products. Clay and concrete products. Furniture and fixtures fabrication and miscellaneous manufacturing activities.	Kudendan and Mando
E	Petro-chemical Refining and Allied Products. Manufacture of lubricants, gas refined petroleum products and basic chemicals, pesticides, fertilizer, foams, carpets, paints and etc.	Kachia Road and Abuja road junction.
F	Service and paper products Manufacturing Industries. Construction of paper containers and paper products. Printing, Binding and Publishing activities. Post and Telecommunication, real estate and computer related activities. Watches manufacturing activities.	Hayin Banki

With the above proposed industrial grouping and locations, when complimented with adequate planning, and functional design of the industrial structure, industrial landuse planning in Kaduna will produce a harmonious landuse arrangement, planned growth and enhance quality of the environment.

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