UNESCO's Project on Managing the Urban Future Population Division

VULNERABILITY AND RESILIENCE

Greater Khartoum Case Study

By

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Note : This paper is co-written by a member of the study team on Khartoum and is distributed as support material to the original paper.

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1. INTRODUCTION :

There is an increasing concern about the impact of rapid population growth on the social and economic progress, and the overall welfare of the people in developing countries. The fast growing population is accompanied by significantly higher growth rates of urban dwellers, in almost all African countries.

The growth of African towns and cities, whether as a direct result of industrialization or of mere rural exodus for other reasons, has always been found to produce social and economic problems in every country of the continent. These problems may differ only in degree from one country to another, but are certainly common to all.

In the Sudan urbanization has not been entirely a modern development. In Northern Sudan urban centres flourished long before European contact. In fact after the Arabization and Islamization of the northern part of the country, commerce and trade flourished and commercial bonds became well established between centres on the caravan routes. Access to different parts of the country created the potential for the rise of new

towns and the expansion of old ones along the caravan routes, with commerce and administration as the two main functions of these settlements.

However the present pattern and conditions of urbanization owe much of their features to the colonial period. With the introduction of modern means of transport and the expansion of the cash economy bases which began with the colonial rule, the social and economic modernization of the country was underway. The Anglo-Egyptian occupation led to the creation of new towns and the development of old ones. The building of towns and the provision of urban services did not assume its true dimensions until after the end of the Second World War. In the post-war period considerable progress was made in improving the infrastructure and developing small scale industry. These measures plus the improvement of transportation and communication stimulated rural to urban migration and urban growth.

Table 1.

Changes in Population Size of Greater Khartoum 1905-1973

Year	Khartoum	Khartoum North	Omdurman	Greater Khartoum
1905	14,000	20,600	40,000	74,600
1913	24,900	17,400	54,800	97,100
1925	42,200	25,000	78,900	136,100
1930	50,500	22,100	103,700	176,300
1934	46,700	21,100	111,000	178,800
1943	44,950	15,603	116,196	176,749
1955/56	93,103	39,082	113,551	245,736
1964/65	173,500	80,000	185,400	438,900
1973	349,100	150,200	309,500	808,800
1979	551,100	228,000	414,300	1,193,400

Source: (a) Sudan First Population Census, 1955/56

(b) The Demogratic Republic of The Sudan, Ministry of National Planning, Sudan Second Population Census 1973, Socio-Economic characteristics, Vol.1 June 1973.

Apparently as the above table shows that the beginning of this century and till 1955 the growth of the city was quite modest. The population of Greater Khartoum increased to more than three times in this period (fifty years). However the last three decades have witnessed a considerable increase in the total population of the city. In fact the population increased three times during the intercensal period 1955/56 to 1973 implying an annual growth rate of 6.25%. The population of the city is now estimated to be nearly two million people, i.e. tripled in only ten years.

The rapid growth of population and the continuous large migration inflow suggest that Greater Khartoum qualifies as a primate city. When Zipf rank size rule is applied to the urban centres of the Sudan, Fig. (2). Greater Khartoum is located at the apex far removed from all other urban areas. Moreover the marked deviation from the alignment of a true rank size highlights its primacy. In-migration and the concentration of economic and social facilities has undoubtedly exacerbated the primacy of the Three Towns.

The growth of Khartoum is not only in terms of population size but also in terms of area utilized by urban landuse. As Table (2) shows the city has expanded its built up area about 40 square kilometers in 12 years 1960-1972, to accommodate a population increase of about 350,000 inhabitants. The major part of this expansion was confined to third class housing which accommodated low income groups.

Table 2

Extent of Urban Sprawl in Greater Khartoum 1960-1972

Area Class.	Residential Area in Sq.m.: Khartoum	Khartoum North	Omdurman	Total	Number of Plots.	Maximum Area per Plot.
1st. Class	2.60	--	0.59	3.19	2,339	800 M^2
2nd. "	1.00	0.24	2.40	3.64	4,049	600 M^2
3rd. "	11.20	10.90	11.10	33.20	44,193	400 M^2
Total	14.80	11.14	14.09	40.03	50,581	---

Source: Abdalla, A.H., Planning Problems and Human Environment, Ministry of Housing, Khartoum, 1972.

This is further illustrated by the residential densities (1965) for some selected wards :

A - Khartoum :

Name of Ward	Class	Density per Sq. M.
Khartoum E. (B)	1st.	3,120
Khartoum No.2 (Old)	2nd.	7,550
Eastern Deim (B)	3rd.	30,820
Gabra & Ushara	4th.	1,790
Industrial Area		1,420
B - Khartoum North :		
El Amlak	2nd.	1,250
El Safiya	1&2nd.	2,950
El Amlak	3rd.	11,890.
Khartoum North Deims.	4th.	43,520
Industrial Area		200
C - Omdurman :		
Mulazmeen	2nd.	4,730
Beit El Mal	3rd.	34,070
Umm Badda	3rd.	19,430
El Feteihab	3rd.	12,900
Marzoug	4th.	14,600

Also exhibited by the following distribution, Fig. (1).

A - Khartoum

i) North of the Railway station: mostly first and second classes plus administrative units, constituting 6% of Khartoum population.

ii) The central area south of the railway line: first/second class and Khartoum No.(3) 11%.

iii) The Deims, New Diems, El Goz, Shaggara, Maygoma, Mogran, and Public Housing : making 47% - all of which are third class areas.

iv) East of the railway in Buri Area which is third class : 7%.

v) The rural population of villages linking with Khartoum, constituting 29%.

B - Omdurman

i) South of the town which is a third class area : 25%.

ii) North of the town again a third class area : 29%.

iii) East Central (Mulazmeen) a 2nd. class area : 9%.

iv) West and South of the town made of Umm Bedda/ Feteihab and other small villages at its northern edge, which is a third class area : 23%.

v) The old core of the city : 14%.

C - Khartoum North

i) Most of the town population is concentrated in the old quarters : Khogali, Hamad, Danagla, Khatmiya, which are third class area : 45%.

ii) Low-cost Housing (El Shaabiya) 17%.

iii) Shambat, lying to the north of the town : 23%.

iv) First and second classes areas in El Safiya, Amlak and others : 15%.

The same trend of percentage distribution is evident from 1972/73 Census, for the whole conurbation :

- 1st. and 2nd. classes 5.5%
- 3rd. class 43.1%
- 4th. class 20.6%
- Illegal settlements 30.8%

It is clear from the above figures that there is a direct relationship between the residential class and population density. The lower the class, the higher the population density, and vise versa. This stratification is magnified by the social differential in terms of incomes which decreases from first to second to the third class areas.

The areal growth of the city is certainly under-estimated since it neglects the large areas of shanty towns that have been expanding rapidly in the outskirts of the Three Towns. This horizontal expansion will certainly promote problems connected with services and basic infrastructure.

3.2. Inadequate Housing :

Perhaps the most serious of all problems connected with urbanization and the vulnerability of cities is that of providing adequate housing facilities for the ever increasing population. Housing needs in the capital have increased with time, and the housing problem is exacerbated by a number of interdependant social and economic factors Fig. (3).

Migration from rural as well as urban areas to the Three Towns is probably the greatest single factor creating housing demand. In the period from 1955 to 1973 almost 99 thousand new houses were needed due to population increase alone.(*) During the same

(*) Housing demand is calculated by the following formula:

$$N = \frac{P_{t1} - P_{t2}}{HS}$$ Where: P_{t1} = Population size in time t_1

P_{t2} = " " " " t_2

HS = Household size (5.9).

N = Number of New houses needed.

traditional way of life, favouring aspirations of individuality and independence. The evident change in attitude, though slow, has created new pressures on the housing market.

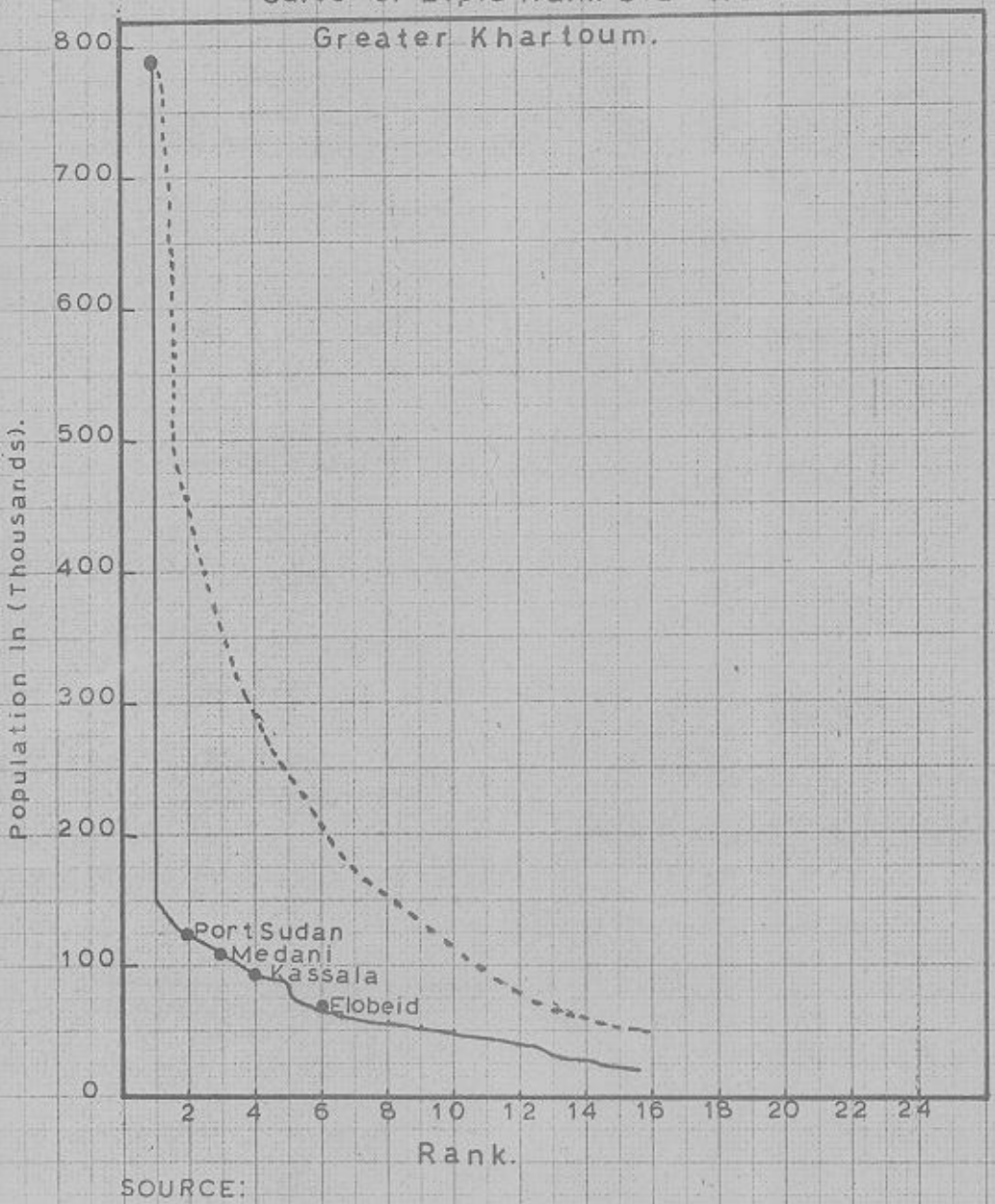
ii) Low Government Investment in Housing :

Low government investment in the housing sector has contributed to the problem. In fact the share of the housing sector in the national development plan was too low. It was 1.5% in the 1961-70 Ten Year Socio-Economic Plan and less than 1.5% in 1971-76 and 1978-83 Five Year Plans. This was by far below the normal percentage suggested by the United Nations - 5% of the Gross Domestic Product.

iii) Rising Costs of Living :

The rising cost of living, soaring inflation in the prices of building materials, and the low income of the vast majority of the city's population have all added new dimensions to the vulnerability of the Three Towns in the area of housing needs and demand. As can be seen from Figure (4) the total cost of construction of a conventional two-room low-income house increased from 460 Sudanese pounds in 1961-62 to 680 pounds in

FIG.2. Rank Size of Urban Areas In 1973 & Curve of Zipfs Rank Size Rule.



SOURCE:

Compiled From The 1973 National Census.

Fig.3. Factors In The Demand for Urban Housing.

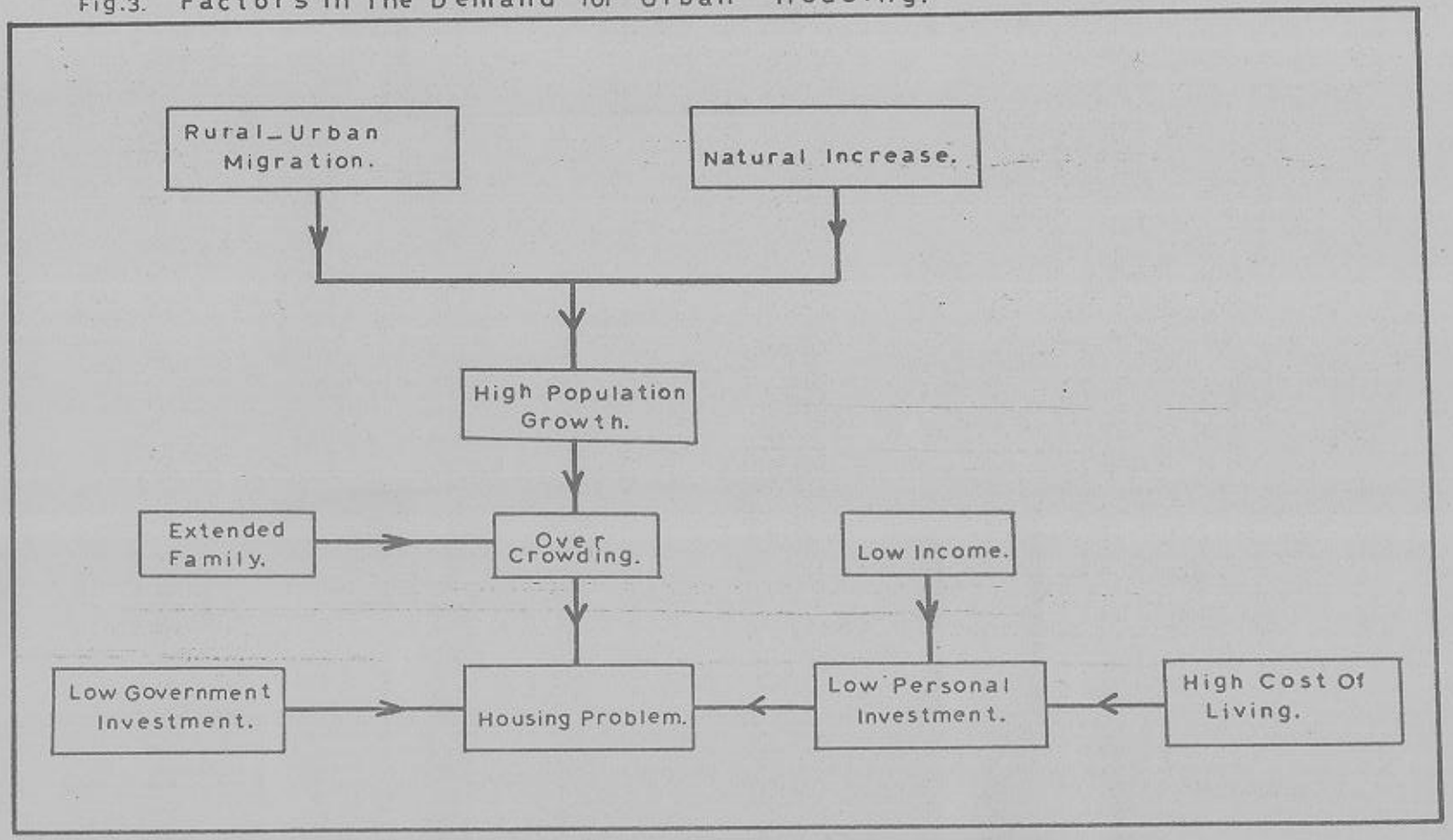
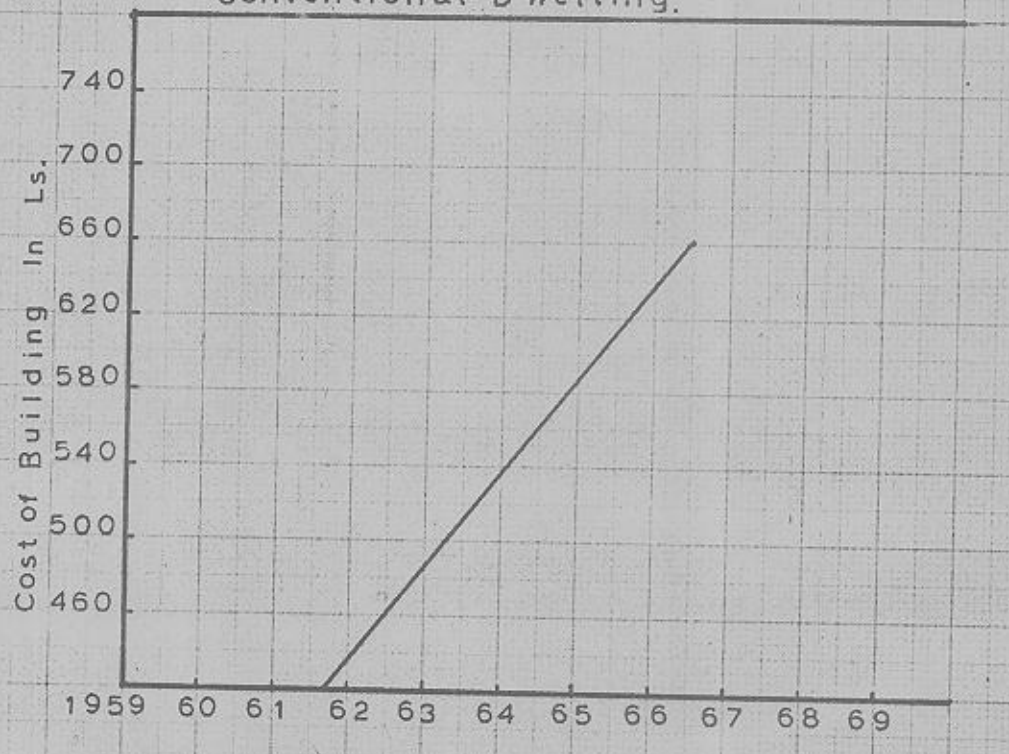


FIG.4. Increase In Cost of Two Room Conventional Dwelling.



SOURCE:

Hamid, A., National Housing & The Expriment of Low Cost Housing.

1966-67; i.e. more than 50% increase in five years. For the same period the average household income increased by about 16%. Since 1967 the rate of inflation in building materials prices has been running at a staggering rate; and at present the construction costs are at least ten to fifteen times of what they were in 1967. Considering cost of construction in relation to income, a typical two-roomed conventional house costs as much as ten times the annual income of the low income group. This one factor is to be singled out as the major cause of the failure of fulfilling minimum housing needs in the city.

iv) Change in Land Use Patterns :

The Three Towns have witnessed in the last decade a distinct change in their land use pattern. The central business district has expanded dramatically into its surrounding residential area. As a result, some dwelling units are directly transformed into commercial offices; and some units which were old and obsolete are demolished and transformed into high rise buildings for commercial and financial use. This transformation has also been accelerated by the sharp

rise in land values in this part of the city. Most house owners are compelled either to sell their houses, if they are decayed or rent them, if they are in an acceptable condition for commercial use. The residential zones bording the city centre have therefore been systematically invaded by the central business district; thus creating new pressures on the housing market.

v) Deterioration of Older Houses :

Deterioration of older houses already in existence added more demand. Many of the houses in the Three Towns specially in Omdurman are constructed of temporary material. It is not uncommon for a large number of houses to collapse during the rainy season. Some of the houses are simply too old and decayed to meet the minimum conditions of a decent house demanded by the sector that owns or rent them. Eventually they are demolished. Moreover the replanning of some of the old residential areas of the city specially in Omdurman has resulted in the demolotion of a large number of houses. The rate of reconstruction is too slow, thus adding to the deficit in houses.

Besides, there are the administrative, legislative, organizational, technical, and implementation problems, summarized as follows :-

vi) Administrative Problems :

- No clear definition or acknowledgement of town and physical planning in settling disputes usually arising between different disciplines enrolled in the physical planning and housing activities.

- Lack of internal organization between the established units within the Housing Department.

vii) Legislations Problems :

- Physical planning, land and building acts and regulations, are merely copied from the colonial time with little amendment or introduction of new acts and regulations to fit the changing political, economic, social and cultural conditions.

- Land legislation, land disposal, land acquisition, land use planning, and development control are open to continuous changes, which are often complicated by association with the political power.

viii) Organizational Problems :

- The different institutions, dealing with planning and housing activities lack the proper channels of communication.

- Rural and regional planners are scattered in many institutions and governmental bodies without any established links.

- The Department of Housing has been drifting since independence between the different ministries, though in 1969 a Ministry of Housing and Public Utilities was established, but for only two years.

iv) Technical Problems :

- Current standards of designs, plot size, infrastructure, services, and building materials according to class segregation into four groups, are only official standards; not in conformity with the informal ones applied by the large low-income groups.

- Methods and techniques of using local building materials are not encouraged and supported so as to substitute the high cost imported materials.

- Planning at district, regional, and national level is not co-ordinated to facilitate decision-making.

V) Implementation Problems :

The implementation of regional and urban development plans needs strong administrative, legal and financial bodies, completely authorized. The existing set-up is not grouped technically under Role Casting, Resource development and Environmental protection and preservation.

Violation and abortion of development plans at the urban or regional scale are usually the result of political decisions and interventions.

3.3. Transportation :

Khartoum rapid growth both in terms of population and area has produced serious defects in the city's transportation network. These are evident in the inadequacy of roads, access problems, and the severe traffic congestion in the central business districts of each of the Three Towns; coupled by the insufficiency and inadequacy of public transport. The vulnerability of the Three Towns in the area of transportation has been a result of a number of interdependent factors.

i) High Increase in Population Mobility :

In the first place the last decade has witnessed a high increase in the mobility of the city's population. This has been brought about by a number of social and economic factors most important of which are :

- expansion of industry and its peripheral location
- expansion of residential areas,
- inbalance in the distribution of social services and market-places,
- concentration of government and major commercial activities in Khartoum town only,
- increase in entertainment facilities, and
- increase in private car ownership.

Higher mobility of the population resulted in demand for better transportation networks, new roads, and an efficient system of public transport. But what is actually happening is a continuous deterioration in all three.

ii) Inadequacies of Infra-structural Network :

The unequal evolution of the infrastructural transportation network of the Three Towns has aggravated the problem. This is a consequence of the form followed by the historical transportation development in the city, oriented towards a few important centres. The transportation infrastructure has generally evolved radially converging towards city centres, industrial areas, and high class residential areas to such an extent that only these zones have benefited. The rest of the city specially the low income group residential areas have remained marginal to transportation evolution.

iii) Low Investment in Public Transport :

Investment in transportation development and improvement by the government was and still low. Even if the government is to grant transportation a high priority only with great difficulty could they have at their disposal enough funds to keep pace with the increasing need for new road construction, maintenance of existing

ones, and improvement in public transport. In fact evidence proves that government participation in public transport has been declining. As Table (3) shows the number of buses owned by the Khartoum Province Public Transport Corporation (KPPTC) has declined from 330 in 1976 to only 136 in 1982. The same trend is also observed in the case of the private sector buses (Ahlya) whose number dropped from 805 in 1976 to 245 in 1982. This is certainly a result of low investment by KPPTC due to lack of funds.

Table 3.

Registered Public Transport Vehicles Khartoum Province.

Year	KPPTC Buses	Anlya Buses	Private owned big buses.	Privately Owned mini buses	Box cars	Taxis	Military Co-Op
1976	330	805				4986	
1977	447	675				5425	
1978	350	427				6413	
1979	110	330				8227	
1980	150	278				9356	
1981	98	278				10371	
1982	36	245		997	2159	11450	250

Source: Khartoum Capital Commission Files.

The decline in the number of buses created acute problems specially for low income groups, the main users of this form of transport. The problem is aggravated by the fact that low income groups live far from the city centre and the industrial areas, and have to undertake a daily journey of anything up to ten miles to their place of work. Moreover, the shortage of public transport related to the increase in population entails that people, in peak hours, have to wait for hours to find transport i.e. time waste.

iv) Shortages in Fuel :

The city is vulnerable in the area of transport due to shortage in fuel, higher fuel consumption, and higher transportation costs due to increases in fuel prices. In fact fuel prices have experienced a sharp increase during the last ten years.

3.4. Food Supply :

Another aspect of rapid population growth is life support vulnerability which includes scarcity or disruption in the supply of food. To examine the vulnerability of the Three Towns in this context, three basic food item will be considered. These are : cereals, vegetables and meat.

3.4.1. Wheat :

The most important cereal produced and consumed in the Sudan at large is dura. However, urban areas have seen significant changes in their cultural preference of cereals. In fact inhabitants of urban area in general, and those of the Three Towns in particular are now predominantly wheat consumers. This change is certainly a result of the adoption of an urban way of life. The increase in female education coupled by a rise in the percentage of employed women have contributed significantly to this change - as the preparation of dura is time consuming -. Even more important, bread is cheaper than dura. Added to this is the fact that the amount of wheat whether locally produced or imported was sufficient in the past to meet the local demand.

However the demand for wheat gradually grew up through the process of diffusion to the other sectors of the population, and eventually led to a sharp rise in the quantities of wheat consumed, as well as in the prices of the commodity, Table (4).

Table 4.

Domestic Wheat Prices 1973/74-1979/80.

Season	Wheat Price (Per Metric Ton)	
	Sudanese Pounds	Dollars Equivalent (*)
1973/74	63.84	159.60
1974/75	65.00	162.50
1975/76	65.00	162.50
1976/77	75.00	187.50
1977/78	75.00	187.50
1978/79	85.00	212.50
1979/80	118.00	236.00

(*) Exchange rate of $ 2.5 to Ls.1, except for 1979/80 when the rate had changed to $.2 = Ls.1.

Source: Terms of reference for the study: Comparative study of cost of growing wheat in Sudan and importing it from abroad, Ministry of Finance and Economic Planning, April, 1982.

3.4.2. Vegetables :

The rapid population growth of the Three Towns is a basic factor exerting pressure upon vegetable supply. The major aspects of the economic distribution and suppl, which tend to make the city vulnerable in this area are summarized in the following :-

- The gap between agricultural and non-agricultural income has continued to widen; thus more and more people leave the land, resulting in decline of agricultural production,
- the prices of farm equipment, fertilizers, seeds and fuel have risen sharply,
- low productivity because of inability of farmers to invest in improved technology,
- intervention of authorities in price fixation,
- the continuous increase in demand for vegetables; and
- the lack of cheap agricultural credit facilities.

3.4.3. Meat :

The larger part of Khartoum meat supply comes from distant livestock producing areas. In the past supplies to the city were adequate as overall country consumption was less than the rate of production.

However during the last few years the city has been subjected to problems of meat supply due to a number of factors. Table 5 showing the supply trend, indicates a continuous decline. This is a result of the fact that the livestock sector specially around the Three Towns has shifted to dairy farming as the latter is more profitable.

Moreover there is a rapid increase in meat prices which cannot be met by the low income groups who represen the vast majority of the Three Towns inhabitants. In addition, as Table 6 indicates, exports of meat to surrounding countries have increased sharply. This trend has certainly exerted an immense pressure on the local market.

Table 5.

Meat Supply in Kgs. (1977 to 1980) for the Three Towns.

	1977	1978	1979	1980
Beef	148,105	99,518	--	29,037
Mutton	293,737	107,464	--	98,376

Table 6.

Number of Live Animals Exported from Sudan 1977-1981.

	1977	1978	1979	1980	1981
Cattle	13,830	10,606	12,637	12,466	22,433
Sheep	167,632	247,587	221,194	416,093	532,994

3.5. Water-Supply :

The first piped water supplies in Khartoum were of this century. At that time the system consisted essentially of two bore-holes in Burri south east of Khartoum. Apparently it was intended to serve the government quarters. However the rapid growth of the city rendered the original system insufficient to meet the city demand. Currently Khartoum is supplied by five water works augmented by 70 bore-holes. Water supply has increased more than hundred-folds during the period 1925-1982, Table (7).

In spite of the massive increase in the volume of water supplied, Table (7), the system is overloaded and operating above design capacity. While the total population of Khartoum has doubled during the last decade and industry significantly expanded, water production has merely increased by 29%. The inadequacy of water supply is evident in the following :-

1. Average per capital consumption of 117 l/cd is significantly low compared to international levels of 400-500 l/cd. Furthermore per capita consumption of low residential class areas (30 l/cd) is by far lower than the national average. Table (8).

2. Serious deterioration in the quality of the water service e.g. low pressure, intermittent supply cuts plus completely unserved areas within the city.

3. Low quality water in terms of colour, taste and ador, specially during the flood season. Moreover, water in some areas is contaminated. This is evident from Table (9), which shows the increase in the number of individuals diagnosed with water related diseases :-

Table 9.

Number of Individuals Diagnosed with Water Related Diseases 1977-81.

Disease	Number of Cases. 1977	1978	1979	1980	1981
Typhoid	954	846	1,230	1,324	3,18
Diarrhoea	224,349	243,268	257,856	371,821	243,28
Infectious Hepatitis	4,630	12,255	7,447	15,057	3,742
Dysentry	139,486	23,600	187,019	155,263	177,19
Total	368,764	279,244	452,327	542,303	424,67

Source: Department of Medical Statistics and Research, Ministry of Health.

Table 7. Sources of Water Supply and Quantities of Water Produced per day in Khartoum, 1924-1981/82.

Source of Water		Date of Commissioning	Original Design Capacity in M3/day	Present Capacity in M3/day.
Burri	Blue Nile	1924	793	19,000
Omdurman	White Nile	1925	793	15,280
Khartoum North(old)	Blue Nile	1954	528	11,000
Mogran	White & Blue Niles	1969	72,000	78,000
Khartoum North (New) Phase I.	Blue Nile	1981/82	36,000	36,000
Public Boreholes	Ground water	---	---	1,440
Private Boreholes	" "			
GRAND TOTAL				169,280

Source: Khartoum Water Corporation.

Table 8.

Water Consumption Per Capita Per day l/cd.
in Different Residential Class Areas - Khartoum.

Class Area.	Percentage of the total population.	Average water consumption per day in l/cd.
1st. & 2nd.	14.0	275.0
3rd.	75.0	100.0
4th.	11.0	30.0

Source: El Hassan, B.M., A Study on Water Quantity Quality and its Health Impact in Khartoum Province, Unpublished Paper Presented to Conference on River Nile Basin Management, Cairo, April, 1983.

3.6. Energy :

3.6.1. Main Source of Energy :

Wood was the main source of energy. Dead wood was collected at no cost. With growth of settlement and population and with improvement in living standards, demand for fuel wood increased. Wood trade flourished and green wood began to be felled. The riverian forests were depleted to give room for agriculture to feed the growing population and the same time wood from this area was brought for the market. Other than the riverian areas fuel wood was brought from semi-desert scrub.

With improved standards of living a better form of fuel was needed. Hence, charcoal production was started using the semi-desert scrub surrounding the three towns, which was heavily cleared by the first decade of this century. Vegetation was completely removed from vast areas. Soon, locally produced charcoal became scarce and expensive.

Khartoum started to depend on other provinces for its needs of firewood and charcoal. But railed charcoal and firewood were too expensive to stop the depletion of the semi-desert areas near-by. In response freight rates were first reduced and then subsidies of 70-75% were made. But total subsidy becoming too high was stopped in 1953.

Later kerosene was encouraged to be used as a substitute for firewood. The per capita consumption of kerosene rose from 2 Kg. in 1950 to 8.5 Kg. in 1957 and to 22.5 Kg. in 1972. 1/ To encourage the use of kerosene its price was put at 30-35 ₰s per Kg. compared to that of firewood at 5 ₰s per Kg. . However kerosene is about 6 times as efficient as firewood regarding calorific value and efficiency of use. 2/

The urban growth of Khartoum and the rise in living standards development of its residents have not only brought in use new sources of energy, e.g. electricity, petroleum, and butagas, but have also introduced the use of the different forms of energy into other sectors of the urban economy, e.g. industry, agriculture and services.

3.6.2. Fuel Wood :

The natural tree cover in the province has been greatly depleted. Estimates of areas depleted are : 75 feddans in 1948, 1658 in 1955, 5255 in 1965, and 5309 in 1980, about 0.079% of the total area of the

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1/ Forests Department Annual Reports and General Petroleum Corporation Records.

2/ Mohamed El-Amin Mukhtar, Trends of Production and Consumption of Wood Fuel in Khartoum Province and Suggested Measures for Satisfying Future Needs, M.Sc. Thesis, Faculty of Agriculture, University of Khartoum, 1983, p.5.

Province. The desert scrub under the control of the Forests Department and bearing some wood accounted for 0,133% of the Province's area in 1980. This source had in 1980 a growing stock of about 3,098,343 tons, allowing an annual production of fuel wood of about 103,280 tons, if produced would satisfy only 5% of Khartoum's requirement. The balance of about 95% has to be imported from other parts of the country, namely Kassala and Blue Nile Provinces, (Fig. (5).

Table (10) shows the locally produced and imported wood fuel (firewood and charcoal). As local production is declining the quantities transported from other parts of the country are increasing.

It is worth mentioning that charocal production in Khartoum has been prohibited since 1947; so, local production is only confined to firewood, and all the requirements of the province from charcoal are met from other areas. The increasing dependency of Khartoum on other areas is evident also in the supply of firewood since the amount transported from other areas constituted in 1971/72 64% of that locally produced, while the ratio increased to 128% in 1979/80.

FIG.5. Fuel Wood & Charcoal Supply Areas To Three Towns.

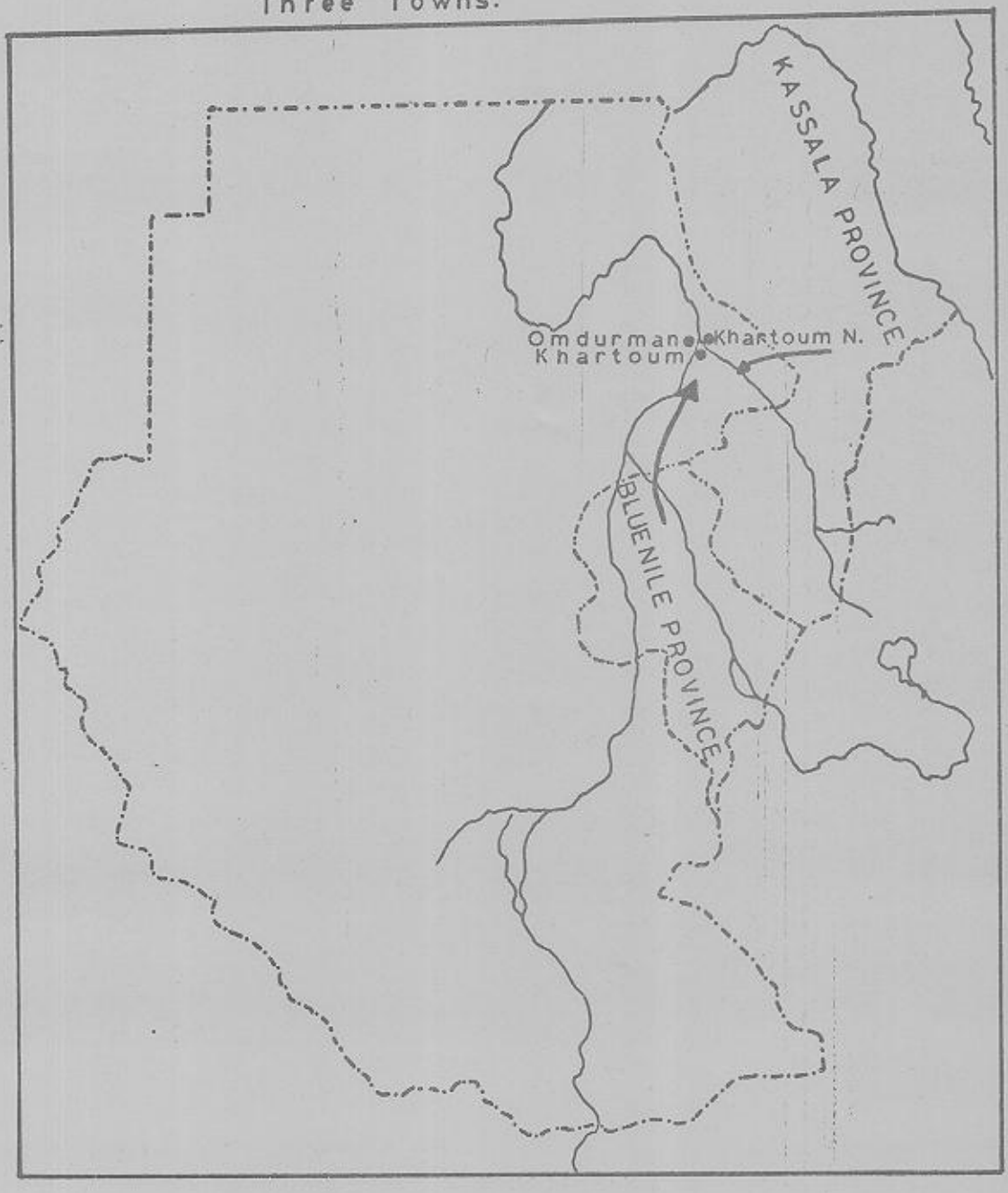

Table 10.

Source of Wood Fuel - Khartoum (in Tons).

Year	Fire Wood			Charcoal
	Locally Produced	From Outside	Total	From Outside.
1971/72	77,219	49,369	126,588	114,541
1972/73	78,540	52,360	130,900	114,847
1973/74	79,002	59,598	138,600	117,205
1974/75	76,260	67,627	143,887	121,004
1975/76	72,303	75,254	147,557	135,093
1976/77	68,738	80,692	149,430	138,945
1977/78	68,717	84,208	152,925	145,530
1978/79	68,673	86,593	155,266	151,475
1979/80	68,667	88,127	156,794	158,323

Source : Forests Department.

N.B. : 6.6 Tons of air-dry wood produce one ton of charcoal.

Regarding the consumption fuel wood has long been the major source of energy. Its consumption is still increasing in absolute terms, but is declining in relative terms, Table (11). The relative decline is due to a number of factors. The cooking stoves in use have a low efficiency ranging between 5 to 17%. Also the prices are sky-rocketing. Prices at Khartoum market increased by 405% between 1973 and 1982 at an average annual increase of about 41%, Table (13). This is mainly due to the rise in fuel wood prices at the producing areas, i.e. the Blue Nile and Kassala Provinces, from Ls. 0.4 per cubic metre in 1971/72 to Ls.3.1 in 1979/80. This increase was mainly caused by an increase in labour wages from Ls.0.75 to Ls.3.5 in the two periods, respectively. Also prices are affected by the change in the means of transport and the rise in transportation cost. Presently, about 67% of fuel wood is transported by road compared to only 20% in the early 1970s. The cost of road transport ranges from 4 to 7 times that of rail freight. Table (12) indicates clearly that the rise in transport cost amounted to 135% in ten years.

Also to improve their revenues the Regional Governments of the producing areas increased the local tax on fuel wood from Ls. 0.05 in 1969, to Ls.0.25 per 45 Kg.-sack in 1981; an increase of 400% in 12 years.

Table 11.

Per Capita Energy Consumption of Household, Khartoum.

Year	Charcoal		Firewood		Agricultural Residues		Kerosene		Butagas		Electricity		Oil Equivalent
Unit:	Kgs.	O.E. Kg.	Kgs.	O.E. Kg.	Kgs.	O.E. Kg.	Kgs.	O.E. Kg.	Kgs.	O.E. Kg.	KWH	O.E. Kg.	TOTAL Kgs.
1972	140.0	14.28	140.0	2.80	19.0	0.17	22.56	11.50	2.13	1.30	110	5.51	35.56
1973	139.5	14.23	137.5	2.75	19.2	0.17	16.14	8.23	2.07	1.24	117	5.85	32.47
1974	139.0	14.18	134.0	2.68	19.4	0.17	8.18	4.17	2.13	1.30	125	6.15	28.66
1975	137.5	14.05	129.0	2.58	19.5	0.17	8.18	4.17	1.15	0.70	141.8	7.09	28.74
1976	135.8	13.85	125.0	2.50	19.6	0.18	5.35	2.73	3.34	2.00	137.8	6.89	28.15
1977	135.0	13.77	121.0	2.45	19.7	0.18	3.30	1.68	2.97	1.67	144.6	7.23	26.95
1978	134.5	13.72	119.0	2.38	19.8	0.18	1.91	0.97	2.72	1.63	168.5	8.43	27.30
1979	134.0	13.67	114.5	2.29	19.9	0.18	4.50	2.30	2.38	1.43	180.9	9.05	28.92
1980	132.0	13.48	110.9	2.22	19.9	0.18	5.00	2.55	2.90	1.53	185.2	9.26	29.22
1985		12.75		2.18		0.22		3.5		3.00		9.9	31.55
1990		12.25		2.00		0.23		4.3		3.85		10.5	33.18
1995		12.00		1.80		0.24		5.2		4.00		11.2	34.45
2000		11.75		1.60		0.25		6.2		4.20		12.0	36.00

Source: Mohamed El Amin Mukhtar, (1983), Op.cit.

Table 12.

Cost of Fuel Wood.

Year	Cost/ton transported to Khartoum: Ls.	Transport cost/ton, Ls.	% of transport cost to total cost.
1973	27.5	5.5	20.0
1976	33.0	11.2	33.9
1979	75.0	27.0	36.0
1982	138.8	65.2	47.0

Source : Forests Department and N.E.A.

Firewood being primarily a household energy source, households consumed in 1979/80 over four-fifth of all firewood consumed in Greater Khartoum, Table (13). Kisra (Local Bread) making is the major household function that uses firewood. In the area of industry bakeries and red brick kilns are the main users of firewood.

Table 13.

Percentage Consumption of Firewood by Sector, Khartoum, 1979/80.

	Sector									
	Household					Services	Industry		Total	
	Kisra	Other	Laundry	Cooking	Laundry	Others	Bakeries	Red Brick	Others	
%	58.7	11.0	11.0	0.4	0.1	--	14.3	3.4	1.1	

3.6.3. Charcoal :

Charcoal is more used than firewood in Greater Khartoum, although its use is declining (Table 11). Greater Khartoum consumed about 37.1% of all charcoal produced in the Sudan in 1971/72, but this figure declined to about 29% in 1980/81. The relative decrease in charcoal consumption is not as sharp as that of firewood consumption. While the per capita consumption in oil equivalence of the of the former decreased by only 5.6% in the period 1972-1980; that of the latter declined by 20.7% during the same period. Decrease in charcoal consumption is due to more conservative use, more use of butages for cooking purposes, its rising prices, and to a higher demand for charcoal at producing areas. The sectoral use of charcoal is not very different from that of firewood. A random sample shows that 99.4% of households use charcoal, and that 87.3% of the charcoal consumed in households is used for cooking purposes while the rest is used for laundry, water heating and ironing. A small quantity of charcoal is used by industries like black and gold smith, copper and brass welding, and mint operations.

3.6.4. Kerosene :

Kerosene was reasonably available and consumption was relatively high up to 1973. A sharp decline, of about 50% of total consumption took place in 1974 Table (14). The major reasons behind this decline were :-

i. the world petroleum crisis that commenced in 1973/74,

ii. general cuts in kerosine imports of the country,

iii. the adoption by the Port Sudan Refinery of a policy favouring maximum production of other fuels at the expense of kerosene, and

iv. the shift in transportation of kerosene from rail to road and hence the great increase in its cost and price.

Table 14

Kerosene Consumption in Greater Khartoum
(Metric Tons)

Year	Tons	Year	Tons
1969/70	14,308	1975/76	4,798
1970/71	17,975	1976/77	3,106
1971/72	17,221	1977/78	1,887
1972/73	12,147	1978/79	4,567
1973/74	6,705	1979/80	6,069
1974/75	7,007		

Source: Ministry of Cooperation, Commerce and Supply.

Consumption started to decline steadily as of 1970/71 to reach a minimum in 1977/78, (only 10.1% of that of 1970/71), after which consumption started

A random sample shows that about 35.9% of all residents of Khartoum use Kerosene, mainly for lighting and cooking.

Regarding the sectoral distribution of consumption, Table (15) shows that Kerosene is used almost exclusively in households.

Table 15
Sectoral Consumption of Kerosene
Khartoum, 1979/80

Sector	Consumption: Tons	Percentage
Households	6,014	99.1
Services	45	0.7
Industry	10	0.2

3.6.5. Butagas :

Butagas is an expensive source of energy because of the initial expenses required for the purchase of the cooking equipment and the empty

cylinder; the costs of which are now in the range LS. 600-1100, and LS. 140-250, respectively. It is therefore expected that as low as 12.4% of the residents of Khartoum used Butagas in 1979/80. In terms of sectors butagas is primarily used in households and services (for cooking and water heating) and for welding in industry. Household consumption accounted for 98.1%, services consumption for 1.5%, and industry for 0.4% of the total butagas consumption in Greater Khartoum in 1979/80, Table (16).

Table 16

Butagas Consumption in Greater Khartoum

Year	Consumption	
	Metric Tons	As % Sudan
1968/69	1,378	93.1
1969/70	1,677	93.0
1970/71	2,142	93.3
1971/72	2,242	93.1
1972/73	2,628	95.0
1973/74	2,468	97.0
1974/75	2,486	87.9
1975/76	3,947	95.1
1976/77	4,043	97.1
1977/78	3,629	94.0
1978/79	4,717	98.0
1979/80	3,880	94.2

Source : General Petroleum Corporation, Khartoum.

3.6.6. Electricity :

The consumption of electricity has been steadily increasing with urban growth such that users of electricity accounted for 93.7% of all Khartoum's residents in 1979/80; but still the per capita consumption of 217.9 K.W.H. is low if compared to the world's average of 380.(*) Sectorally, electricity has been increasingly used in areas other than the household. Table (17) shows that electricity used for industrial and agricultural production accounted for more than half the total consumption in 1979/80.

Table 17

Consumption of Electricity, Greater Khartoum, 1979/80

Sector	Consumption	
	G.W.H.	%
Residential	266.19	43.34
Services	11.13	1.82
Industry & Agriculture	334.00	54.63
Total	611.34	99.99

Source: Central Electricity and Water Corporation, Khartoum.

(*) This is the overall world's average; the world's average for urban centres will this be much higher.

The main problem pertaining to this form of energy is its high unreliability stemming from a severe shortage in total power generated and the frequent interruption of generation. This explains why a surprisingly large and increasing number of private generators is being used in industry, agriculture, household, hotels and restaurants, gas stations, hospitals as well as in government and quasi-government buildings.

3.6.7. Other Fuels :

These include grasses, twigs, leaves, old paper, torn sacks and the like. Of these inferior fuels grass are the most significant, constituting about 87% of all inferior fuels used in Khartoum in 1979/80. These fuels are used almost entirely for cooking, and confined to a small low-income segment of the population, occupying the outer fringes of the town and living in squatter settlements. More quantities of these fuels are used when the supply of other fuels, particularly firewood and charcoal, decreases and/or their prices shoot up.

3.7. Emigration :

3.7.1. Causes :

Emigration, in any identifiable magnitude, is a fairly recent phenomenon, dating back only to the early sixties. The dramatic escalation of emigration started in 1973 when the oil prices skyrocketed, thus creating a huge revenue, part of which was used to expand the economic base of the economies of the petroleum producing countries. Thus great employment opportunities and high wage rates were created, and these acted as a pull factor. On the other hand, the deterioration of the Sudanese economy and of living conditions as a result of the adopted economic policy, e.g. lifting of subsidy on basic foods, devaluation of the Sudanese pound by 100% between September 1982 and March 1983, the frightening rate of inflation and rise in the cost of living index, acted as a push factor.

3.7.2. Size of Emigration :

3.7.2.1. From Sudan :

There are no up-to-data reliable statistics on the number of Sudanese working abroad. Different figures have been estimated. The national workshop on

emigration, (27-30 December, 1978) used the figure of one quarter of a million. Dr. Galal el-Din (Table 18), put the total number of emigrants at a little less than a quarter of a million. On the other hand, El Sharq El-Awsat Newspaper (28.12.1982) estimates the number of emigrants at about one million, of whom about 200,000 work in the Gulf states. One tends to believe that the actual number is higher than what the official statistics say for the following reasons :-

i) A large proportion of the emigrants do not migrate through the Labour Department (the official channel), and are therefore not included in the official statistics. In October 1982 the Labour Department examined a random sample of 300 Sudanese emigrants, and it found that only 10% migrated through the official channel.

ii) There is evidence that a good ratio of emigrants are illegal alients in their host countries, especially Saudi Arabia. For example, in 1977 the number of Sudanese people allowed to go to Saudi Arabia exclusively for pilgrimage and religious visits totalled 35,707, of whom, 12,225, i.e. 34.2% remained in Saudi Arabia.

It is therefore, reasonable to put the total number of emigrants at about one million.

Table 18

Distribution of Sudanese Emigrants in Host Countries, 1978

Saudi Arabia	140,500	60.80	Britain	1,500	0.60
Egypt	55,000	19.50	N. Yemen	800	0.30
Libya	20,000	8.60	Nigeria	300	0.20
U.A.Emirates	12,000	5.20	Lebanon	500	0.10
Kuwait	3,500	1.50	Greece	300	0.10
Oman	1,800	0.80	Jordan	300	0.10
Qatar	2,500	1.10	Bahrain	100	0.04
			Others	2,000	0.90
Total				231,300	99.94

Source: Galal El Din, M.E., Emigration of the Sudanese (In Arabic), Khartoum, (K.U.P.), 1979.

3.7.2.2. From Greater Khartoum :

To estimate the number of emigrants from Greater Khartoum to other countries, three random samples were taken from Sudanese working in Kuwait, U.A. Emirates and Qatar to examine their geographical origin. The results are stated in Table (19).

Table 19

Percentage of Emigrants from Greater Khartoum, 1979

Host Country	Sample Size	Khartoum as place of birth	Khartoum as place of birth
Kuwait	555	21.0	38.7
U.A.Emirates	503	17.9	64.8
Qatar	173	36.4	27.4
Average	---	25.1	41.6

If we assume that these samples are representative of Sudanese emigrants working in all countries, then one-quarter of all Sudanese emigrants come from Greater Khartoom as their place of birth and over two-fifth as their place of residence. The two percentages give an average of 33.4% compared to about 7% of the total population of the Sudan residing in Greater Khartoum.

3.7.3. Occupational Classification of Emigrants :

Emigrants come from the more productive and better qualified section of the Sudanese population. The economically active elements account for about 25% of the sedentary population of the Sudan, whereas they constitute about 91% of the emigrants. Furthermore, it is found that the illiterate segment in the age

group 20-39 years (the more productive group) account for over 51% for the Sudan but for no more than 10% for the emigrants.

The occupational distribution of emigrants shown in Table (20) exhibits the extent to which Khartoum, the main industrial centre and the seat of most of the training institutions, is losing its skilled and treined manpower since most, if not all, of the unskilled workers come from the other parts of the country. One can say that Khartoum receives from other provinces unskilled, and semi-skilled people, trains them and gives them experience, education and expertise, and then loses them to other countries. This is manifested in the severe scarcity and high cost of trained and experienced people which Greater Khartoum is increasingly facing at present.

Table 20

Occupational Classification of Emigrants

Occupation	%
Skilled workers	57.35
Unskilled workers	26.85
Technicians	5.70
Clerks	2.98
Professionals	3.54
Catering	0.98
Others	2.60

Source: Sudan News Agency, Folder of the National Workshop on Emigration, Issue No.59, p.50.

3.7.4. Transfers by Emigrants :

The annual reports of the Bank of Sudan give the following figures for the annual transfers of the Sudanese manpower working abroad :-

	LS
1974	1,300,000
1975	2,100,000
1976	4,300,000
1977	13,000,000
1978	55,000,000
1979	75,000,000
1980	154,000,000
1981	195,000,000

If one conservatively assumes that the total number of emigrants in 1981 was half a million and that each emigrant would make an annual transfer of LS. 195 so only a small proportion is transferred through official channels. Emigrants may be doing one or a combination of the following :-

i) Because of the continuous devaluation of the Sudanese pound, emigrants are keeping their savings abroad in anticipation of further devaluation, and hence a better rate of exchange.

ii) They are selling their hard currency outside the Sudan for those who want to transfer their money outside the country and to those who need hard currency to import goods into the country.

3.8. Crime :

3.8.1. Magnitude :

Table (21) shows the steady increase of major crime excluding traffic offences and offences against other ordinances - incidence in Greater Khartoum. Between 1964 and 1980 crime has increased by 522%, i.e. an average annual increase of 14.19%. The highest of this increase has been in offences against property, followed by offences against persons and then offences against public order; their three respective average annual increases are 20.1%, 12.0% and 11.9%.

Of all crimes committed in the Sudan in 1981, the share of Greater Khartoum was 20.3%. Of the total offences in the country against persons, against property and against public order in 1981, those committed in Greater Khartoum accounted for 13.6%, 23.9%, and 27.5%, respectively. It is worth reckoning that the population of Greater Khartoum constituted less than 7% of the country's total population in 1981.

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Table 21

Crime Incidence in Greater Khartoum

Year	Offences against persons	Offences against property	Offences against Public order	Total
1946	3,598	3,905	3,317	10,820
1948	4,404	4,670	4,157	13,231
1953	5,347	6,219	4,372	15,938
1957	7,280	7,583	5,480	20,323
1958	9,595	8,912	9,291	27,728
1961	10,414	9,727	10,229	30,870
1966	12,804	14,375	11,933	39,314
1967	12,770	16,319	11,143	40,233
1968	13,522	17,617	13,029	44,168
1970	18,253	18,787	15,091	32,131
1971	19,694	19,342	17,163	56,199
1974	16,497	25,005	12,698	54,270
1975	15,107	27,770	13,248	56,123
1979	18,893	30,716	18,478	68,087
1980	18,729	31,374	17,181	67,284
1981	17,352	30,763	15,054	63,169

Source: Khartoum Province, Annual Criminal Report

3.8.2. Classification of Offenders :

Table 22 shows that :-

i) crime is mainly committed by males although the percentage of female offenders has steadily risen since 1978,

ii) the number of youngester male offenders is generally on the rise,

iii) most of offenders fall in the age of 16-30 years, and

iv) that the ratio of female offenders over 30 years of age is generally higher then the corresponding ratio among males.

Table 22

Age and Sex Structure of Offenders

Year	Males (%)			Females (%)			% of Total	
	16 Years	16-30	Over	16 Years	16-30	Over	Males	Females
1975	7.5	54.4	38.1	4.6	59.4	36.0	82.6	17.4
1976	5.7	59.5	34.8	6.1	57.4	36.4	84.6	15.4
1977	8.2	60.8	31.8	5.3	57.9	36.8	84.3	15.7
1978	11.8	64.4	23.8	5.1	50.8	44.1	89.8	10.2
1979	13.8	56.2	30.0	7.1	57.4	35.5	86.8	13.2
1981	10.2	54.8	35.0	3.4	51.8	44.8	84.3	15.7

Source: Khartoum Province, Annual Criminal Reports.

Regarding the geographical origin of offenders we can distinguish between those whose criminal record dates back to before 1960 and those after 1960. A random sample of 204 cases of the former category shows that 53.4% are non-immigrants (i.e. residents of Khartoum) while 46.6% are immigrants coming from the Southern Region (11.1%), Eastern Region (10%), Kordofan (7.3%), Northern Region (6.4%), Central Region (6.9%), and Darfur (4.9%).

For the latter category a random sample of 192 cases shows that non-immigrant offenders constitute 16.7%, while immigrant ones comprise 83.3% of all offenders. The geographical origins of immigrant o offenders are as follows : 28.1% from the South, 15.1 from Darfur, 16.1% from Kordofan, 12.5% from Central Region, 6.8% from Eastern Region and 4.7% from the Northern Region.

Unemployment among immigrants seems to be a prime cause. Table 23 shows the unemployment situation while Table 24 shows that employed immigrants are under-paid. For the period 1970-1981 about 46.1% of offenders against property and persons were unemployed.

Table 23

Unemployment Situation, 1978-80

Years (1)	Registered (2)	Recruited (3)	As % of (2) (4)
1978	75,756	9,705	12.8
1979	76,505	9,948	13.0
1980	81,647	14,084	17.2

Source: Planning and Management Consultancy, Sudan Guide, 1981.

Table 24

Immigrants, Wage as % of Settler's Wage, 1974

Trades-men	Clerical	Service worker	Production worker	Unskilled worker	Unclassified.
47.5	73.9	74.6	64.2	76.8	64.7

Source: ILO, Growth, Employment and Equity: A Comprehensive Strategy for the Sudan, Geneva, ILO, 1976, p.359.

The refugees rate is high among the immigrant offenders. Of all Eritrean, Ethiopian, Ugandan, Chadian and Zairian refugees who totalled 441,000 in 1980, about 12.5% had moved into Greater Khartoum. More and more refugees are committing crime. In 1975 about 4.2% of all offenders were refugees, this percentage rose in 1977 to about 7.8%.

4. ECO-SYSTEM RESILIENCE :

4.1. Control Through Planning :

4.1.1. 1956-1969 :

The government took the initiative to introduce the Town and Village Planning Act, 1956, under the Town and Village Planning Regulations 1957, to face the growing problems of planning and housing, which were dealt with separately without being included in the National Development Plan. The government called for Doxiadis Associates in 1958 to prepare a master plan for Greater Khartoum and Port Sudan. The Ministry of Housing and Public Building was established for the first time in 1969 and continued for 2½ years.

Khartoum new planned areas spread quickly to meet the growing demand for housing. These included first and second class areas (Amarat and Hai El Matar) and third class areas (Sahafa, new additions to Lamab, Shaggara, Ozozab, and Fellata fourth class area. There was also a steady expansion of the new industrial area lying west of the city.

In Khartoum North first and second class areas were also developed in Kober, Safya and Sababi, plus third class areas in Shambat, Kober, and El Mazad;

incorporating as well El Sha'abiya the largest public housing project for low income groups developed in the conurbation.

Also the Industrial Area was expanded tremendously.

The planning of Omdurman continued but very slow in the form of urban renewal projects at the beginning: widening the main road at Murada, replanning of Beit El Maal (free-hold), building of Shambat Bridge (1964) on the Nile, to connect Khartoum North and Omdurman, with Azhari Avenue leading from the bridge into the latter reinnovated. Again the Arbaien asphalt road was built with a bridge on Khor Abu Anga. This was accompanied by residential expansion in Third class areas including : El Thawra and Umm Bedda. The latter is a customary tenure area. Also the town witnessed expansion in light industries.

During this period Khartoum-Wad Medani Highway was constructed to facilitate an easy access to Gezira, the economic heart of the country.

Although the Three Towns are connected to each other by bridges, the old inbalances in functions have continued; with concentration of administrative, economic,

and social functions at Khartoum, and industry at Khartoum North. A limited number of government departments are built in Omdurman and Khartoum North; leading to inadequate spatial relationships within the whole system.

One of the outstanding features of the system that is still noticed is the daily trip to work, oriented towards Khartoum; and the traffic jam which happens during the peak/rush hours. In contrast during the night Khartoum C.B.D. is completely deserted for activities in hotels and night clubs.

The weak relations between housing and employment activities, between commercial and residential uses in the C.B.Ss., and the inadequate means of communication have resulted in low functional standards/relationships between the three entities of the urban system.

4.1.2. 1970-1983 :

At the national level two plans were prepared. The Fifth Year National Plan (1971-1975) amended to 1976, and the Sixth Year National Plan 1977-1983. The share of housing in the plans is far below the standard. Two housing plans for the Three Towns were prepared (1970 and 1977) to cater for the growing population and

the increasing housing demand. The two plans have not materialized due to financial problems. A common factor of the two plans is the lack of coherent relationship and functional linkages between residential use, and provision of technical/social infrastructure and other land uses. Part of the failure can also be attributed to the fact that the housing plans are examined separately from the socio-economic plans, which presents a traditional viewpoint in contrast to integration.

This period experienced political, economic socio/cultural and administrative rapid and acute changes. The Land Registration Act of 1970 changed the whole tenure situation by giving full control to the government over urban land in an attempt to stop illegal development. In the same year the Rent Control Act was also introduced to cut down on rents.

To match the move towards decentralization which is the philosophy adopted by the country to achieve self rule, the physical planning authority was decentralized for the first time in 1976 to the province according to the People's Local Government Act of 1971. In 1980 the Regional Government Act was introduced. The planning authority/power shifted from the commissioner

(P.E.C.) to the Region's Governor, and a new physical Planning Act (1982) was being prepared for approval. For Khartoum Province the physical planning authority shifted from the commissioner to the Minister of Construction and Public Works, according to the Khartoum Province Administrative Act 1981. Linkages between the national level and regional levels are missing although some technical assistance and supervision are provided when wanted.

MEFIT (an Italian firm) was called to prepare a Regional Plan for Khartoum Conurbation and a master plan for each of the Three Towns, which were ready by the year 1976. Up to now these are not approved as legal documents, and of course, they need major updating to fit the new situations.

4.2. Housing Provision :

4.2.1. Government Housing Policy :

In the Sudan the vast majority of houses were and are still constructed by the occupants. The Government role as a constructor of houses is restricted to supplying housing to its employees. During the colonial period, the authorities were faced with the problem of

housing their nationals who worked in Government service. The lack of suitable housing and the lack of a private housing market perhaps made it imperative for them to be involved in building dwellings for the expatriate staff. Moreover, in an attempt to enhance the rapid development of the capital, the authorities began to sell land to Sudanese and foreigners alike.

However, the colonial authorities were faced with the inevitable problem of housing the Sudanese who came to rebuild Khartoum or seek general employment. It was decided to accommodate them in what was known at the time (1912) as native lodging areas or "Deims". Each individual was allowed to build himself a single mud hut in a 50 square meter open plot. None of the basic services were supplied including latrines, and tenure was regulated by an ordinance which provided that the land could be recovered without any compensation even if the plot had been in occupation for ten years or more.

During the immediate years that followed the development of these Deims, no new areas were authorized and the existing ones continued to absorb migrants who were actually encouraged by the authorities to come to

Khartoum. The influx of new migrants, natural population increase, and the lack of alternative accommodation, increased the degree of overcrowding and created an unhealthy living environment. Because of overcrowding and the worsening sanitary and social conditions new Deims were authorized in 1930, but the plots were still 50 square meters in size. The new Deims relieved overcrowding by providing housing for low income groups.

The authorities became aware that a single room without access to a latrine (not even a communal one) though solved the problem of housing demand, provided few opportunities for decent family life, even at the lowest standard. Thus, in 1937 it was decided that a 200 square meters open plot was the minimum area adequate for a single house; and accordingly a layout was drawn up which enabled a pit-latrine to be dug in each compound. Indeed a number of resettlement schemes did take place in this pattern and by 1952 all the old Deims were demolished, and new Deims were built by the people with scarcely any financial help in the form of loans or subsidies from the Government. However the policy of open plots has in the long run led to a partial solution of the housing problem. Even more

important a higher standard of housing is being achieved to meet the housing needs of the lower income group.

After independence in 1956 the national government followed the same policy of open plot housing. As far as the residential classification of land and the minimum standard of building were concerned, the national government devised the following hierarchy of residential communities : First class areas, with a minimum plot size of 800 square meters which should be built of permanent materials; Second class with a minimum area of 400 square meters in which any material could be used, and Third class residential areas with a minimum area of 300 square meters in which again any material except grass could be used.

Following the enactment of the Town and Village Planning Act, the Town and Village Planning Regulations, and the plan prepared by Doxiadis Associates, new planned areas spread quickly in all three classes to meet the demand for housing. In 1966, 22 thousand plots were distributed in the third class areas for the low income groups, defined as those earning at the time below 540 Sudanese pounds annually.

As mentioned the period 1970-83 witnessed the prepration of two housing plans in the Three Towns (1970-1977) to cater for the growing population and increasing housing demand. Also MEFIT, prepared the Regional Plan for Khartoum Conurbation and the Master Plans for the three towns. These plans led to the creation of new residential areas in Khartoum, Khartoum North and Omdurman in all three classes, as more plots were distributed to the ever growing population.

The injection of a large number of subsidized plots into the market proved to be effective in coping with the urban housing needs. But even more important it provided the low income groups with the opportunity of developing their plots with the kind of dwelling they could afford; and which they could expand and improve whenever need arises and their resources permit. It is important to mention that the government does not provide loans for building. However an Estate Bank was established to provide loans for government officials only, a measure that helped accelarating house building for a large number of government employees.

As another measure to ease the problem of housing, the government took the initiative of constructing dwellings for its employees especially for those working which the government undertook the construction of houses for low income groups was that carried in Khartoum North, where 1,000 houses were built between 1961-1967. The houses were essentially built to benefit those working or living in Khartoum North, earning at the time monthly salaries not less than 12 pounds and more than 25 pounds. The plan of 1977 recommended the construction of third class houses in the Three Towns but nothing materialized due to problems of finance.

4.2.2. Squatter Settlements :

Another form of resilience in the area of housing is the appearance of squatter settlements. Inspite of the government's efforts to ease the problem of housing, the expansion in housing has not kept pace with the explosive rate of urban population. Shortage of houses and high rents in the central area prompted the growth of squatter settlements in the periphery of the city in the early 1960s. Since then the number and

size of squatter settlements have increased. In 1973 people living in squatter settlements represented 30.8% of the total population of Greater Khartoum.

Squatter settlements in the Three Towns, similar to settlements elsewhere in Africa are characterized by insanitary conditions, inadequate water supply, overcrowding and absence of communal facilities. Nevertheless in spite of their disturbing conditions they are providing some solution for a growing housing need; since the occupants of such residential areas being from the low income groups are unable to afford better housing standards. The resources necessary for building better housing would have to come either from the government or the private market. In view of the public sector's limited investable resources and the various pressing development needs, it is doubtful whether the government could go as far as building better dwellings for such a large number of people. The private market on the other hand does not support individual housing loans for low income groups because their earnings are not stable, plus the fact that there is no guarantee they shall repay loans.

desire of city dwellers for larger accommodation and better indoor facilities. However, the major reason behind this trend is an economic one. Scarcity of housing and high rents in the city pushed a sizable number of people to the outskirts where houses are available and rents are comparatively low. This trend is further enhanced by the development of asphalted roads (whether by the government or self-help) and better transportation networks. Residential mobility away from the city centre has undoubtedly played a major role in solving the problem of housing for some of the low income groups. It somet..

4.2.4. House Sharing :

To relieve the problem of housing, residents in Khartoum have been forced to adopt house sharing. This kind of resilience is something new and unexpected, keeping in mind that Sudanese families, with their Islamic culture, do not usually approve of sharing housing except with sons or daughters in-law. However, the evident change in attitude is a consequence of economic and social necessity. The rapid rate of migration to the town, shortage of housing, high rents, rising cost of living, low income, and above all the

change in the socio-cultural habits of the population are the main factors that contributed to the encouragement of sharing with both relatives and strangers. House sharing may lead to over-crowding, but it serves in partially solving the problem of housing.

4.2.5. Development of Building Industry :

Expansion in the number of firms producing building material is an indispensable factor in the development of the building industry. According to the survey carried out by the Ministry of Industry and Mining in 1975, 20 of the 21 firms producing building material in the Sudan are located in Khartoum area. The last ten years have witnessed an improvement in the production of cement and cement items both in terms of quality and quantity; and also improvements in the quality of fired bricks. Cement factories were established in Atbara and Rabak. More and more brick factories have developed along the Nile in the vicinity of Khartoum to meet the increasing demand. Besides, there is a marked increase in the production of domestic building materials. Also people are beginning to use more modern construction techniques, specially in the case of high rise buildings which are a form of resilience in themselves.

4.3. Transportation :

Both private and public sectors have carried out various measures for the purpose of responding to the vulnerability of the city in the field of transportation. These can be briefly summarized in the following:-

i) A sharp increase in the number of private cars. In fact the number has increased from 14,740 cars in 1972 to 56,484 in 1982. This is a direct result of higher incomes, higher standards of living and above all the contribution of emigrants to petro-dollar countries as many of them invest part of their savings in private cars.

ii) The appearance of pick-ups and mini-buses, as a new urban transport mode for passengers. They have started to operate over the past few years and their number has increased substantially. In 1982 the numbers of operating mini-buses and pick-ups were 997 and 2,159 respectively.

iii) There is a distinct increase in the number of taxis from 4,922 in 1975 to 11,450 in 1982. This is a result of the relaxation of taxi-licensing regulations. The Open taxi-license has tempted some unprofessional taxi-drivers, mainly government officials, to obtain taxi-licenses for their private cars and drive them in their leisure time to supplement their income.

iv) Efforts by the KPTC to modernize its busses and increase its fleet.

v) Establishment of the Military Transportation Corporation which will use its fleet (150 busses) for official as well as public transport.

and other private agencies, to hire private buses to transport their workers to and from places of work.

vii) Establishment of the Road and Bridges Corporation for the purpose of building new roads and maintaining old ones. The use of river boats as a new mode of transport, is also being attempted on exerimented basis.

4.4. Food Supply :

4.4.1. Wheat :

Realizing the problem of wheat shortage, the authorities responded by introducting various measures to meet the ever increasing demand. First, new land has been developed for wheat production e.g. The current expansion in the Northern Region. Second, a policy of diversification of crop production is introduced to ensure a sizable output of wheat. For example in the Gezira Scheme up to the early 1970s wheat was never cultivated. Now, of the total area of the Gezira Scheme half a million feddans are allocated annually for wheat production; although the yield is very low (0.7 tons per acre, compared to the international average of 4 tons per acre. Wheat is grown basically because of real demand. The area under wheat production in the country as a whole has increased from 39 thousand feddans in 1960 to 253 thousand in 1973, and it is now (1983) estimated at 640,000 feddans. Third, four flour mills are established to ensure immediate supply to the urban population. Fourthly; the government the only importer of the commodity, has increased the amount of imported wheat to the value of 100 million US $ under the US Aid Project PL 480.

Finally a research unit was established in Khartoum North to develop ways of making bread from dura as a substitute to wheat. This is mainly to reduce the amount of imported wheat and to meet the spontaneous demand.

44.2. Vegetables :

A number of solutions to the problem of vegetables production and supply are being adopted. As Table 25 indicates a relatively large amount of new land has been brought under vegetable production. Moreover, the application of fertilizers, pesticides and the introduction of new seed strains have raised levels of productivity. Vegetable supplies to the Three Towns from distant area are made possible as a result of improvement in the regional network of transportation, and the importation of a large number of open pick-ups specially by emigrants to Saudi Arabia.

Table 25.

Increase in Number and Area of Farms allocated to Vegetable Production 1968-69-1973/74 and 1980/81.

Type	1968-69		1973-74		1980-81 (*)	
	No. of Farms	Area in Feddans	No. of Farms	Area in Feddans	No. of Farms	Area in Feddans
Irrigated	543	53,776	813	144,649	1,600	200,500
Open-shaft wells	---	2,175	---	6,149	---	9,500
Tube-wells	---	2,500	---	6,000	---	8,150

Source: Dept. of Horticulture - Khartoum.
(*) Figures for 1980-81 are estimates.

Farmers are investing more money on vegetable production through loans from the Agricultural Bank which allows the producers a grace period before they either pay the whole loan or start to pay the installments.

The large irrigated schemes such as Gezira and Rahad are becoming an important source of vegetable production. Supply from them has increased due to the adoption of an integrated package for vegetable production, including : organization of financing, research input, use of fertilizers and pesticides and better production relations.

4.4.3. Meat :

Resilience in this respect is evident in a number of responses by the public and the private sectors. The government established the Livestock and Meat Marketing Corporation to organize exports and ensure supplies for the local market. Feeding lots around the city are being developed. A new law prohibiting the marketing of meat twice a week has been introduced, and price fixation is being attempted - though not effective. Moreover train carriages are being imported for the transportation of livestock from distant areas in order to ensure continuous supplies.

The private sector has also responded to solving the meat supply problem. Private breeding farms are being established around the city and a large number of modern groceries and butcheries came into being; with storage facilities increasing in the last few years.

Changes in food habits have also occurred, resulting in the adoption of many alternatives to meat. People are now more oriented towards the consumption of legumes, poultry products and fish as substitutes to meat. There are at present (1983) about 160 poultry farms in the vicinity of Khartoum compared to only 10 in 1960. The rise in the number of poultry farms is a result of a rising demand, improved distribution system, introduction of modern technology, growth of fodder industry and investment of foreign capital, e.g. Kuwaiti Poultry Company. Fish production has increased and better systems of distribution and storage have been introduced. More fish is coming to the city from distant areas - as far as Lake Nubia in Northern Sudan. This is facilitated by the organized railway trips, with modern freezed wagons.

4.5. Water Supply :

In response to the acute problem of water supply, several measures are undertaken by the authorities and the inhabitants to meet the demand imposed by the increasing population pressure. These are summarized in :-

i. The National Water Corporation (NWC) is implementing many plans to improve both the quantity and quality of water supply.

ii. Some communities have contributed part of the construction costs in terms of money, labour or both to build piped water connections.

iii. Due to the financial difficulties that prohibited piped water connections to new residential extensions, communal stand posts and water kiosks have been established.

iv. Water vendors have spread in recent years selling water to low class residential areas mostly by means of animal drawn carts.

v. During the summer months when supplies are very low in those communities close to the river, people fetch untreated water directly from the Nile.

4.6. Energy :

4.6.1. Electricity :

The Blue Nile Grid which supplies Greater Khartoum with electricity, has a rated output of 183 MW. However the actual maximum output is 150 MW.

Supply is usually characterized by drops for most of the year, especially during the flood period July-October, when the electricity generated drops to almost half the rated output.

In realization of the gap between supply and demand, and taking in view the future needs of the system, the government is implementing the third Energy Project which is expected to produce an additional 180 MW by the year 1985.

Plans are underway to finance the fourth Energy Project and the Hamadab dam for hydro-electric power.

Because of the shortage in supply, the Three Towns face daily power cuts. As a form of resilience, the cutting is organized so that the different parts of the conurbation get a reasonable share of the power available at the time.

At private and individual level many of the financially able have purchased generators for residential, commercial, and industrial uses. This has increased the consumption of petrol, and has added to noise and odour pollution.

4.6.2. Other Sources of Energy :

Except for shifting use from one source to the other and cutting on consumption, the system seems to have made limited resilience in this area, as all the sources on which it depends, come from outside the system. The limited resilience of the system is reflected by the price behaviour.

Table 26 shows that price control has been very ineffective, giving rise to a high differential between the official and the market prices, except for butagas and electricity which are distributed by gas companies and the government, respectively.

The development of a black market is in itself an indicator of scarcity, and the magnitude of this scarcity is generally proportional to the differential between the official and market prices. This price differential is generally in the range of 26-108% for charcoal and firewood. Kerosene showed the highest differential of 355% in 1975/76.

Table 26.

Prices of Fuels in Khartoum (P/s).

Fuel	Unit	1971/72		1973/74		1975/76		1977/78		1980/81	
		O.P.	M.P.	O.P.	M.P.	O.P.	M.P.	O.P.	M.P.	O.P.	M.P.
Charcoal	45Kg./sack	650	1250	750	1500	1300	2000	1900	3000	2400	5000
Firewood	Kantar	320	450	360	625	850	1750	1125	2000	2375	3000
Grasses	Kg.	---	5	---	7	---	8	---	9	---	10
Kerosene	Gallon	105	105	165	200	165	750	345	1300	860	1900
Butagaz	Kg.	---	---	115	155	189	189	189	189	300	300
Electricity	K.W.H.	20	20	20	20	34	34	34	34	54	54

Source : Mohamed El Amin Mukhtar, Op.cit., p.86.

Note : O.P. : Official Price.

M.P. : Market Price (Black Market).

Price increases have been quite significant. During the ten years between 1971/72 and 1980/81 market prices increased by 309% for charcoal, 367% for firewood, 200% for grasses, and 1709% for kerosene, giving average annual rates of increase of 30%, 57% 20%, and 171% respectively.

Official prices have also gone up. During the same ten years rises in official prices had been 269% for charcoal, 642 for firewood, 719% for kerosene, 170% for electricity, and 161% for butagas. These give average annual rates of increase of 27%, 64%, 72% 17%, and 16% respectively. Thus rises in official prices have been no less significant than rises in market prices. The latter are generally a response to the former.

4.7. Emigration :

The high and increasing rate of emigration is a response to the tight economic situation through which the country lives. Despite the intricate social structure and the very close family relations and the persistence of the family as the production and consumption unit, the deteriorating economic situation has acted as a push factor more powerful than all those cementing ties to

send people abroad. Hence, heads of households either emigrate themselves or encourage other members of the family to do so. This has gone to the extent that some of the young ladies, despite their very sensitive and delicate social position, have opted to emigrate though for shorter periods. When one planning to emigrate does not have the initial money for obtaining a passport, visa, clothing, transport, etc., family members and relatives pool their resources together to enable him to emigrate.

Emigration has affected, to varying degrees, most features of urban life in Khartoum. It is beyond the scope of this study to enumerate these aspects and to discuss the ways people have responded to all pressures created thereby. However, two areas seem to be of special significance, namely scarcity of skilled labour and shortage of professionals specially teachers. In the former area the following adaptations become prominent :-

i) Industrialists are either reverting to more capital-intensive techniques or are employing more unskilled workers and providing more in-service training for them.

ii) More people are depending on themselves by getting to learn basics of mechanics, electric

works, painting, fittings, etc. to deal with the simple problems of maintenance pertaining to their cars, houses or other forms of property.

In the area of education, emigration has resulted in a severe shortage in qualified teachers, specially in English and physical sciences. The situation is aggravated by the very severe competition embodied in the educational system with increasingly lower opportunities at higher levels. The kind of adaptation to this problem depends on the socio-economic status of the family. The main forms of adaptations include :-

i) Sending pupils to study abroad, specially the high school level.

ii) Sending pupils to foreign schools in Khartoum (e.g. International, Comboni, American, etc.) which employ foreign teachers and qualified, well-paid, Sudanese teachers.

iii) Sending pupils to Sudanese private schools of better standars because of well-paid teachers.

iv) Pupils studying in Sudanese schools, mostly public schools, are sent abroad, particularly to Britain to do intensive summer courses.

v) Some do intensive summer courses in Khartoum. In the summer of 1983 the University of Khartoum housed six of these courses.

vi) Some have private tutors for selected subjects.

vii) Others are helped in their studies by their educated parents. More parents are spending more time with their children in this respect. The number of parents able to help decreases as we go down the educational ladder.

Most parents among the low-income and the illiterate, cannot afford most of the foregoing adaptations.

4.8. Crime :

To reduce crime incidence, both the government and Khartoum residents have taken some measures. The government measures include :-

i) Evacuation of those who have no identification cards, the unemployed, and the refugees. These three categories of people are thought of as the primate source of crime, and are therefore, occasionally, sent back to where they come from.

ii) Increasing of security forces, however the expansion of Greater Khartoum is taking place at a rate much higher than can be handled by such improvements.

iii) The use of mass-media (television and radio) in an attempt to create a general awareness among the public about the magnitude of the crime situation, whereby people are advised to take protective measures.

Of more direct significance has been the role of the people in protecting themselves and their properties. The main measures adopted by the people include:-

i) hiring of night guards by those who can afford it,

ii) keeping dogs for guarding property, which is widely spreading, despite the fact that the practice is costly and is a newly developing cultural trait,

iii) more people are owning weapons, specially pistols and guns, to use in case of threat, with some of these being unlicenced, and

iv) the rise of community guards organized by the young in a neighbourhood, usually an unpaid voluntary activity, with young men patrolling the residential area during the night.